

Gambescia, Position of the Feet
Completely revised: Summer 2012-2013, Winter 2013-14
Publication Version

Joseph M. Gambescia, M.D.
and the Position of the Feet on the
Shroud of Turin.
The History of an Investigation.

By

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Part One

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Dedicated to the Memory of
Dr. Joseph Marion Gambescia
10 June, 1919 – 23 September, 1991

Joseph M. Gambescia, M.D., and the Position of the Feet on the Shroud of Turin.

The History of an Investigation. (1)

By

Paul C. Maloney

I'd like to offer a disclaimer right at the beginning. I am not a medical doctor. I am a trained historian offering Sindonologists a fresh viewpoint about the position of the feet on the Shroud, shared with me in March of 1981 by a medical doctor who is now gone from our midst. My challenge to medical professionals and other investigators who are interested in the Shroud is to pick up the mantle left behind by Doctor Gambescia and explore it further.

INTRODUCTION AND BACKGROUND

It was a dreary, rainy afternoon, April 7, 1980. I should have had the light on in my study but I didn't because I was in a melancholy mood. Then the phone rang. I recognized that baritone voice on the other end of the line and knew I was talking to Hershel Shanks, founder and editor of the world's largest circulating biblical archaeology magazine, **The Biblical Archaeology Review**, calling from Washington, D. C.

Hershel wanted me to write an article on the Shroud for the magazine. “But, Hershel, I don’t know *anything* about the Shroud of Turin!” Well, that was not quite true. I had two books about it on my library shelf at the time: Fr. Peter M. Rinaldi’s *WHEN MILLIONS SAW THE SHROUD* and Ian Wilson’s highly readable and now classic 1978 volume, *THE SHROUD OF TURIN: THE BURIAL CLOTH OF JESUS CHRIST?* These were books given to me as gifts from friends who knew that as an archaeologist specializing in biblical topics, I ought, at least, to have them as openers for my knowledge of something that might be of archaeological interest to me. But my definition of “knowing” about things related to the Shroud were a different requirement if I were to take pen to paper about the topic. And, clearly my then current knowledge about this important cloth did not make a safe bet that I could produce a cogent and finely tuned paper for the **Biblical Archaeology Review**.

But after some arm twisting, Hershel convinced me that I could write the paper. Our mutually agreed-upon deadline was December 31, 1980!

Being a trained historian I insist upon primary sources. So, as I began my research, it became clear to me that Dr. Robert H. Dinégar might be an important resource for me to tap. Dr. Dinégar was not only a physicist at Los Alamos National Laboratory, he was also a *bone fide* cleric and thus knew the theological implications of the Shroud should science prove that the cloth came from the first century A.D. Moreover, Dr. Dinégar was the chairman of STURP’s radiocarbon

committee which was then making plans to radiocarbon date the cloth. So I soon called him and learned that the omnibus volume of scientific papers produced by STURP would be published probably by Wiley and Sons sometime in October of 1980. That would be a very important foundation for my own paper.

Nevertheless, I was not one to put “all my eggs in one basket” so I began systematically to collect all of STURP’s research into the Shroud in advance of the publication that I knew would enhance any research I had already done. I traveled to Penn State University, to Drexel University, and to the University of Pennsylvania libraries, among many others, to obtain these critical studies.

But as October came and went I learned from Dr. Dinegar that the publication had been delayed. Although I was glad that I had already pursued collecting the published works, I now worried that I might not be able to meet my December deadline. But as I began to write I knew that I needed someone who had a fine grasp of all the intricate details of Shroud research to read my paper and point me in an accurate direction. I called Shanks in Washington, D. C. and explained my predicament and told him that there would likely be a delay. Meanwhile, I secured the help of Dr. Eric Jumper, one of the co-founders of STURP, to read my paper and give me expert guidance. On a Sunday afternoon—for some three and one half hours—we combed through my paper on the phone when Jumper dropped the bomb on me: “Paul, you don’t have any of the medical data in your paper!!” I responded, “Unfortunately, Dr. Jumper, I have no access to any of

STURP's medical experts." Jumper said, "Well, we'll change that. I'll put you in touch with Dr. Joseph M. Gambescia in Philadelphia."

* * * * *

Dr. Gambescia was one of two medical experts on STURP's team in 1978, having been a student of previous Shroud investigations since 1955. The other was Dr. Robert Bucklin, then deputy medical examiner of Los Angeles County, California.

Gambescia, who had once been a medical examiner for the U. S. Army, was a Professor of Internal Medicine at Hahnemann University Hospital, and Chairman of the Department of Medicine at St. Agnes Medical Center, both in Philadelphia. Using the information Dr. Jumper had kindly provided, I called Dr. Gambescia and made an appointment to see him. My traveling companion was Shroud lecturer and friend, Dr. John A. DeSalvo, a local college professor and biophysicist. I knew he would be a great person to brainstorm with after our visit with Dr. Gambescia.

We met on the appointed day in March, 1981, at Dr. Gambescia's St. Agnes Medical Center office. We poured over photographs of the Shroud and the doctor, good student of the Shroud that he was, gave us an intimate and thorough review of the many markings on the Shroud pointing out where he thought nail wounds were, where blood flows occurred, and other facts, such as evidences for rigor mortis, that only a medical professional might recognize—but generously including

many of the caveats his colleagues both in Shroud research and in the medical profession might offer.

But this was not a “proof of concept” session we were treated to. Dr. Gambescia, was using what he believed would have been good Roman logic following the studies on the wrists that his predecessor, the French physician Dr. Pierre Barbet, had already published in **A Doctor at Calvary**. ([French original, **La Passion de N.-S, Jesus Christ selon le Chirurgien, 1950**]; English Translation, 1963, pp. 121-128). As evidence of this kind of logic Gambescia pointed out that a crucifixion victim found in Israel in 1968 had been nailed through the ankle (albeit in a somewhat different mode than Gambescia was proposing for the Man of the Shroud) in such a permanent manner that when they tried to remove the foot from the cross it had been fixed so tightly that the nail was still in position when the body was taken from the cross. The point of that nail had curved around a knot in the olive wood, holding it securely. (Haas, 1970; Tsaferis, 1970; Zias & Sekeles, 1985). Simply stated, Dr. Gambescia believed that to anchor the person properly on the cross—and making sure that the victim would last as long as possible for his punishment—the soldiers would have driven a first nail through the front of the solid ankle (just as they had driven their nails through the carpal bones of the wrist) and then followed it with a “tacking mode” by placing the left foot atop the right foot with a nail driven down through the center of the left, through the center of the right and on into the stipes of the cross. Thus, Gambescia was proposing that there were two wounds in the right foot, and one

wound in the left. While no clear image of two nail wounds were immediately obvious, Gambescia was troubled that one nail alone would not support a body too heavy for any significant length of time—especially when the Man of the Shroud had to push up to breathe.

He admitted that his colleague on the STURP team, Dr. Robert Bucklin, a forensic pathologist, did not agree with him, but followed the classical interpretation already set forth by Pierre Barbet, that the only wound in the right foot was that shown on the Shroud to be in the center of the right foot. Gambescia didn't try to prove this to Dr. DeSalvo and me. He just stated that that was his medical opinion about the markings. And later, in my discussions with Dr. Bucklin, I confirmed that the latter still held to the classical medical interpretation. And still later during another discussion with Dr. Gambescia, he told me that he himself had had further extensive personal discussions with Dr. Bucklin but had failed to change Bucklin's mind about it. Here were two highly trained medical professionals with differing opinions. At least they did agree on one thing: the left foot was nailed atop the right foot. So what was I—a simple “reporter”—to do to decide who was right when I turned in my paper to the **Biblical Archaeology Review** for publication. If I was faced with such a conundrum then, things were about to get more complicated!!

It is important here to insert here that Dr. Gambescia was not rejecting the work of the French physician, Dr. Pierre Barbet; he was actually building upon Barbet's work. Neither was Dr. Gambescia rejecting the special interpretation of the arms and their attendant blood flows

proposed by the late Mons. Giulio Ricci. His proposal, however, does suggest an interpretation different from that proposed for the blood flows for the feet than that offered by Mons. Giulio Ricci. It is this new interpretation that we are introducing for further research by the medical profession to be discussed alongside the earlier discussions for the feet. But more about this shortly.

Meanwhile, I learned of another view of the position of the feet after my first session with Dr. Gambescia. Presented in the first edition of **THE CROSS AND THE SHROUD** (1981 & 1982, pp. 79-88; 2005, pp. 71-77), this was the belief that the feet were nailed side-by-side and it was a view held by none other than the late Dr. Frederick T. Zugibe, then Chief Medical Examiner of Rockland County, New York!! Here again was another truly expert witness trained in medicine—a medical examiner, no less!!—who held a view different from both Dr. Gambescia and Dr. Bucklin!! It was enough to make one throw his hands up in despair. My paper for the **Biblical Archaeology Review** was now already much too long! Hershel had cautioned me that, at most, they might publish 18 pages!! How could I lengthen my report further by extending the details and dragging the general reader into what almost surely would have been a boring recount of all the minutiae of each of the differing medical views? There *must* be a way out!

Dr. Gambescia, himself, though involved in other medical publications, had not had the time to truly pursue the serious research into the Shroud required to put his idea into print. He was busy in his professorial position at Hahnemann University Hospital, and as full time

director of the Department of Medicine at St. Agnes Medical Center. He was also the father of 16 children.

This paper does not attempt to recapitulate all of the different published discussions about the stance of the feet on the Shroud. It is dedicated to presenting the view of Dr. Joseph M. Gambescia which needs to enter the stream of discussion about this important topic. There will be occasional references made to other views in the endnotes but no effort to explicate all the pros and cons of these views as against the view of Dr. Gambescia. An extended discussion based upon all the views available and their supporting arguments is well worth a future paper. For now, however, the scope of presentation is limited.

EARLY EXPERIMENTS

Dr. Gambescia had explained to Dr. DeSalvo and me in our March, 1981 meeting, that he had gotten his son, Joseph, Jr., (Fig. 1, a. & b.) involved in helping him visually to set forth the stance of the feet that he believed was exhibited on the Turin Shroud.



Fig. 1. a and b: Joseph Gambescia, Jr. shown illustrating Dr. Gambescia's approach to the stance of the feet on the Turin Shroud. Photos provided through the kind courtesy of Stephen F. Gambescia, Ph.D., Assistant Dean of Academic and Student Affairs, Health Administration Dept., Professor, College of Nursing and Health Professions, Drexel University, Philadelphia, PA. Photo date: Summer, 1978.

Photos taken by Joseph M. Gambescia, M.D.

After our meeting I maintained my own interest in discovering just how to approach this challenging problem. One day not long after the frustrating revelations that there were three *different* views of the feet, I was looking at Vern Miller's truly great photos of the Shroud. Among many other photos, he had kindly sent me an 8 and ½ by 11, high resolution, full length photo presentation of the Shroud (the basis of the one published in the **National Geographic Magazine** (Vol. 157, no. 6, June 1980), I studied this intensely trying to formulate my questions hoping the photographs would “respond” with an answer.

I took notice that there was a large blood stain in the “terminus region” of the frontal leg image area on the Shroud. And out, nearby from this stain, there was another set of what I came to call the “islets of blood.”

(See Fig. 7.1.b. below [p. 34]). Frustratingly, sometimes publications will crop this absolutely crucial portion of the image; I've even found that some issues of **National Geographic** published them without these blood markings!!. They were there, seemingly, out from nowhere and could not be understood by me at this early date.

Then I noticed that at the other end of the Shroud there was a rivulet flow out from the "heel" area into the cloth region beside the right foot creating a kind of "pool" of blood, but separated by what I supposed must have been a wrinkle in the cloth. I asked myself, "I wonder if the 'islets of blood' on the frontal end of the cloth could be matched up with the rivulet flow from the heel that appeared on the dorsal end?"

Well, there was one thing I could do to find out! So I went to my nearest window glass repair shop and purchased two plates of clear glass. Superimposing the first pieces of glass, this on a color photograph of the Shroud published in **National Geographic** for June 1980, I daubed special colored transparent paints on the plates—I didn't even bother to create a head! I was just "in a hurry" to find out the results. When dry, I turned the frontal end of the glass over and placed it atop the dorsal view. Then came my first shock: When I aligned the "islets of blood" with the split rivulet out on the cloth at the dorsal end near the heel, ***the large isolated blood stain at the "terminus" of the frontal shin, aligned perfectly with the heel!!!*** (Endnote 2, endnote 21, and Fig. 2, a. & b.) Could this be right? I was filled with all kinds of doubts.



a.

b.

Fig. 2 a and b. Headless version (version I) of my glass plates beginning my investigation into the stance of the feet. (Created by author, copyright, 1981)

So I went back to the glass company and purchased a second set of plates, a bit larger, and created one with a head for each end and duplicated my experiment. (fig. 3, a. b. & c.). All along I had assumed that the large blood stain on the frontal end of the Shroud had probably aligned with the top center of the right foot. But it didn't!!! ***This is the first, of several further observations, of which I have been unable to discover having been published previously or extensively in the literature about the feet.***



a. **b.**



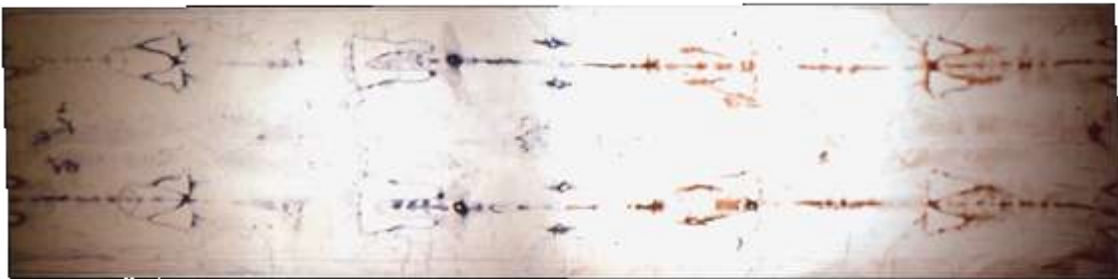
c.

Fig. 3 a, b. and c. Version II of the glass plates showing the frontal and dorsal views as they were painted on the glass, and in view c. showing the frontal glass plate mounted atop the dorsal view showing the matching of the “islets of blood” and main frontal blood stain aligned with the heel. (Glass paintings created by author, copyright, 1981).

In one fell swoop I had ceased to be a reporter and had become an investigator! It appeared that Dr. Gambescia could be right! My paper for the **Biblical Archaeology Review** was now 63 pages long—but it no longer mattered. I was, as I’ve heard from many others, “hooked.” Curiosity had gotten the better of me and I was now on the trail of what the Shroud was trying to tell me about the position of the feet. Applying Ockham’s Razor, the simplest explanation for the “islets of blood” was that they had been picked up from the split blood flow out away from the heel on the dorsal end of the cloth when the frontal end of the cloth was laid over the corpse.

I went back to the “drawing board”—so to speak--and made a color coded image of the full length of the Shroud on a translucent plastic

sheet, but in miniature—so that I could create decent looking photos of the superimposition of the two ends. (Fig. 4, a. b. c. d. e. & f.) Blue would be the dorsal end and sepia would be the frontal end.



a.



b.

c.

d.

e.

f.

Fig. 4, a. showing the full plastic transparency with the frontal end (right) coded in sepia and the dorsal (left) coded in blue. This is followed by five views, b., c., d., e., and f. showing the sequence of folding them over until the final view (f) presents the finished alignment showing the frontal end (sepia) superimposed atop the dorsal stains (blue

end) illustrating how the finished presentation looked. (Plastic overlay created by author, copyright, 1981). (3).

I superimposed the frontal end over the dorsal, aligning the split flow with the “islets of blood” and, again, it showed that the large blood stain matched the heel—not the center of the right foot. But this answer deeply disturbed me! How then do we explain the wonderful classical interpretation explicated by Dr. Pierre Barbet??? If the large frontal stain was NOT related to the central stain of the right foot preserved for us on the dorsal end, then where was the evidence of the wound for the top center of the right foot? And did this mean that—proof positive—there was a perforation in the ankle/heel of the right foot and another in the center of the right foot? And where did the rivulet of blood out near the heel area on the dorsal end come from? Did it drain down from the central wound of the foot with the corpse in supine position and then flow out into a “pool” on the cloth? Or did it come from the heel itself?

My mind was awl with questions and it seemed as if these only created further problems with medical interpretations already well established! Dr. Gambescia had proposed that the dark marking on the heel area of the dorsal end was evidence for the exit wound of the first nail. How could I, an abject novice, go up against long-time researchers such as Mons. Giulio Ricci in Rome, who actually illustrated this central wound by superimposing the frontal end large stain atop a perforation in one of the feet. (See his book, **THE HOLY SHROUD** (1981, p. 269) for

details). (4) Moreover, Dr. Bucklin interpreted that as a dark clot that had settled there which ultimately had come from the central portion of the bottom of the right foot. To me, that had seemed to be to be a reasonable approach.

In turn, Dr. Gambescia had observed that the right foot was fairly parallel with the assumed stipes of the cross—diverging somewhat, but not by very much to the right or the left in what he insisted would have been the “push-up” point for the Man of the Shroud to lift his body periodically to take the tension off his diaphragm enabling him to get a full breath each time. Otherwise, Gambescia had pointed out, he would have suffered asphyxia and died rather quickly. If there was only a single anchor point in the right foot, why then did the right foot not twist as it seemed evident to me that the left foot did? Later, as I studied the swivel pattern preserved for the left foot, I realized Dr. Gambescia’s observation about the right foot, would become an even more powerful argument for the authenticity of the Shroud as a burial cloth!

Since this early meeting with Dr. Gambescia I have confirmed the following variant views then available of the position about the feet along with their published sources as follows:

1. That the feet were nailed side-by-side on the stipes of the cross. (Zugibe, 1988, p. 77). Two nails used for the feet.
2. That the feet were nailed on a suppedaneum or platform which was itself nailed to the cross. (Bulst, 1957, pp. 47ff). Two nails

used for the feet. (A variation of the view in number 1 in the list above).

3. That the feet were nailed one atop the other, the nail going down through the center, on the stipes of the cross. (Barbet, 1963, pp. 121-128). One single nail used.

Most medical observers have interpreted the data on the cloth as pointing either to two nails in the feet (for example, if the feet were nailed side-by-side [Items 1 and 2 above] or one nail (for example, a single nail driven down through the center of the left foot and then on down through the center of the right [Item 3 above]. In the latter view the “rosette” pattern in the center of the right foot is plausibly set forth as proof that a nail penetrated the sole of the foot at that point.

THE OBSERVATIONS: WHAT WE SEE ON THE SHROUD

The Dorsal End of the Shroud (Fig. 5, below)

(The following illustration figures in Fig. 6.0 tie in to the listing here provided).



Fig. 5. a.

Figure 5. a.: Dorsal calves and feet (General View). Enrie (1931) Dutton Bros. lifesize copy, Notice that the puzzling pattern of blood flows on the left foot can be seen at the “terminus” of the left anatomical leg on the Shroud. Life size photo courtesy of the late Fr. Peter M. Rinaldi, S.D.B., Port Chester, NY.



Fig. 5. b.

Fig. 5. b. Backlit dorsal end of Shroud showing the right and left feet. The right foot is seen on the viewer’s left; the left foot is seen on the

viewer's right. (Ultra-high resolution photo of the Shroud and the cropped portion above by the kind courtesy of Barrie Schwartz; Copyright, Barrie Schwartz, 1978). (For further discussion see the Appendix, pp. 104-105).

Dorsal Details (Specific)

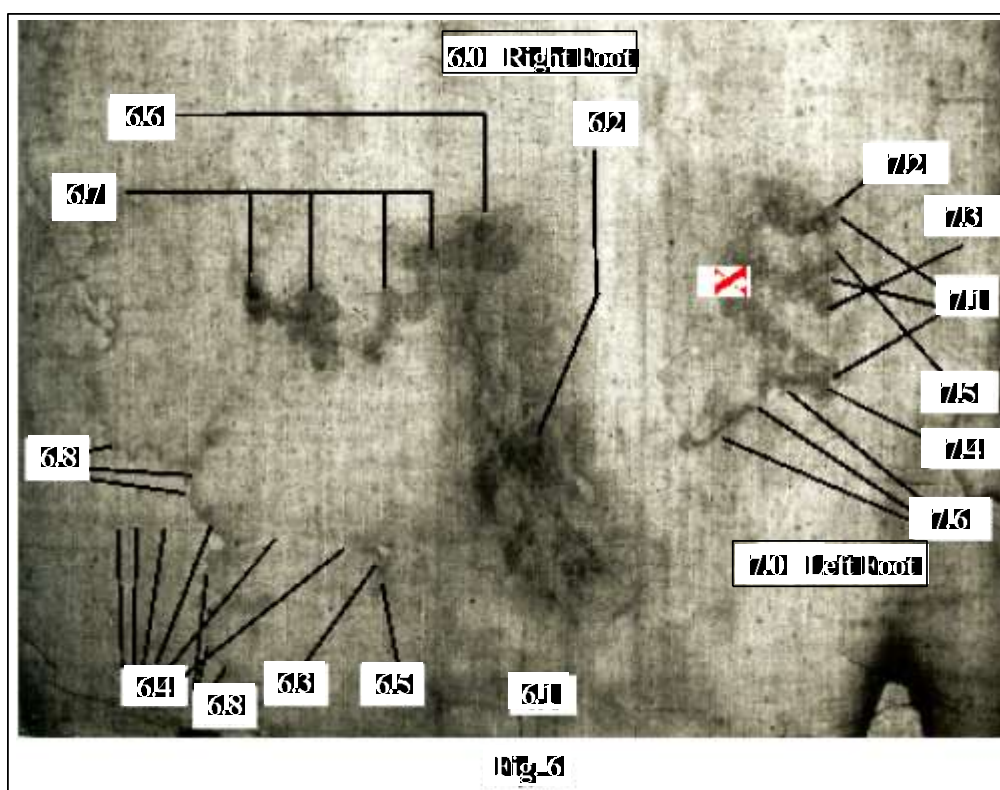


Fig. 6.0 Adapted from V. Miller (1978) high resolution photo. The red “**X**” is the proposed emergent point for the blood flow on the left foot. For a fuller discussion of the left foot, please see the Appendix.

(Original photo through the kind courtesy of Vernon Miller, STURP). (See Appendix for a more detailed discussion of Left foot)

Before we can evaluate Dr. Gambescia's views about the position of the feet we first need to set forth the observations of what can actually be seen on the Shroud. (Fig. 6 above). It must be noted here that at least four of these observed features do not seem to have been discussed in the literature heretofore. (They are indicated by bold italic print in the list below):

Section IV.--The anatomical right foot (See fig. 6 above):

6.1 A full imprint of the right foot was preserved on the cloth. Obviously, there was blood completely covering the entire bottom of the foot. (Fig. 6.1. a & b. immediately below).

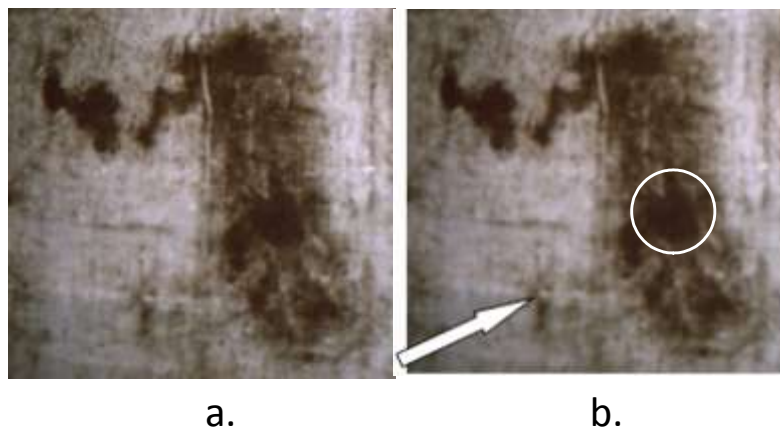


Fig. 6.1.a. and b. Enrie (1931) close-up photos of dorsal feet [right foot only] taken by the author at Corpus Christi Church in Port Chester, NY, from a life-size Shroud photo made by the Dutto Brothers (courtesy of the late Fr. Peter M. Rinaldi, S.D.B.). The white arrow in 6.1.b. points to the area where the small “semi-triangular” mark occurs on the Shroud. (See Fig.

- 6.3.c. below). All views provided here (photos and drawings) are taken as if the viewer is standing at the dorsal end of the Shroud with the right foot positioned at the left of the viewer. Photo b. adapted to left photo-image (in point 6.1.a. by author. (P.C.M.)
- 6.2. [Feature 6.2 in Fig. 6] There is a “rosette” imprint in the center of the right foot that is darker than the surrounding area. (See above white circle in Fig. 6.1.b. and the drawing on sheer cloth of 6.2.c. below representing, in line drawing, fig. 6 above).



c.

Fig. 6.2.c. Life-size line drawing on cloth [based upon ¼ size tack sharp STURP photos made by Vernon Miller], Oct. 1978 and then blown up to life size by the author]. (Drawing on sheer cloth by the author; copyright 1981; this is the cloth I used in a demonstration wrapping my feet for Dr. Gambescia).

6.3. There is a small “semi-triangular” shaped stain adjacent to the “rosette” shaped stain above and unrelated to the flow from the heel (6.3. in Fig. 6 and see white arrow in Fig. 6.1.b. above). This “semi-triangular” marking is associated with the outermost margin of coloration that is directly attached to the main imprint of the right foot. But this “semi-triangular” area is clearly lighter in color than the main imprint or even the surrounding area adjacent to the actual the margins of the “semi-triangular” marking. It is a kind of “stencil” due to the surrounding coloration which is presumed to have been caused by blood material. See the enhanced photo detail in Fig. 6. 3. below. ***This is the first item that does not seem to have been discussed by previous medical observers probably because its relationship to any wound in the foot is not immediately obvious.***

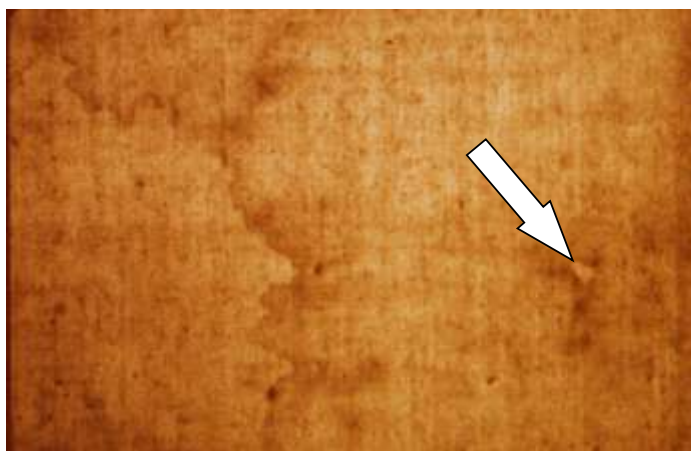


Fig. 6.3. Photo enhancement of “semi-triangular” area
courtesy of Tony Mercadel, Eastman Kodak, Rochester, NY

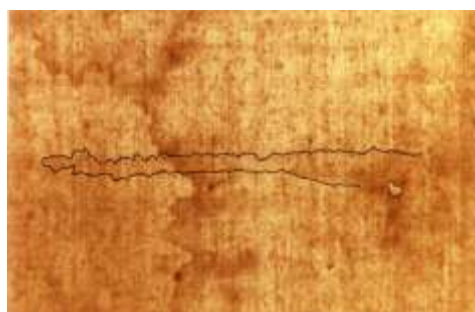
using Kodak's Premier System. White arrow points to the "semi-triangular" mark, appearing as a kind of "stencil" on the Shroud. We can see it only because presumed blood material surrounds it. (Photo based upon the STURP photographs taken in 1978 by the late Vernon Miller of Brooks Institute). (5).

6.4. (a. b. c. below) Flowing straight out away from the "semi-triangular" marking is a narrow clear fluid stain so subtle that the observer, using magnification, must look closely at an enlarged original photograph to see it. *This is possibly the reason this feature is the second item which, it seems, has never been noted in previous literature.* The stain margins for this flow are delineated by a darker line which has visual similarities to the lines at the periphery of the water stain margins. Caution must be exercised, however, not to conclude that since the water stain margins contain iron oxide, the same must be true of this particular stain. Note that the pattern in this flow here is quite different from those seen in the water stain margins.

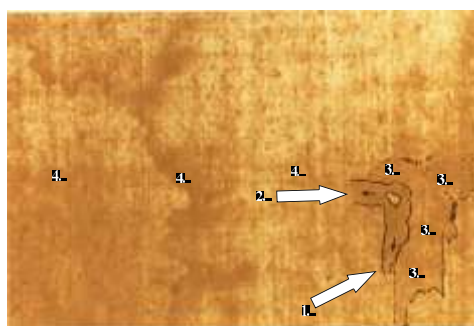
a.



Unmarked/enhanced
 photograph showing all
 the features to the
 "left" of the original.



b. Blood pen marking showing the location of the narrow rivulet out away from the "semi-triangular" area.



c. Blood pen marking showing the location of the "semi-triangular" area and, apparently, two blood flows from it.

Fig. 6.4. a., b., and c. (Kodak [Tony Mercadel transparency enhancement]) Line drawings added by author as additional enhancements to show locations of important landmarks. (4 - 4 - 4 in 6.4.c. above) = the clear rivulet out away from the semi-triangular spot. (See line drawing in b. above). No. 2 = STAGE ONE blood flow from the crucifixion stance-apparent blood flows away from the "semi-triangular" spot. 1. STAGE TWO = the removal phase of the body from the cross when it was carried somewhat sideways to the tomb. No. 3 = a darker but diffused area of blood stain also created during the STAGE ONE phase when the Man of the Shroud was still alive but the

left foot continued to swivel as the Man of the Shroud raised his body to be able to breathe. See text below for discussion. (P. C. M.)

6.4—6.5. I propose the following interpretation of a more complex pattern which seems to represent three different stages in the position of the body. Gravity is the main indicator of each position.

- a. **Stage One:** The upright crucifixion stance. 6.5 represents, in this interpretation, (flow number 2 in **6.4.c.** above) a blood flow running downward controlled by gravity toward the ground. Most of the flows on the arms, the chest, the wrists, the head, and some on the feet were moving in this upright stance.
- b. **Stage Two:** Removal from the cross and being carried side-ways. This is represented, in reverse, by 6.4 (flow number 1 in **6.4.c.** above). However, this flow mark was picked up when the Shroud cloth was tucked around the right foot when it was in the supine position very shortly after the corpse was laid in the tomb and while the blood was still damp. Therefore, as we currently see it on the Shroud, it is in reverse of how it actually flowed from the perforation on the top center of the right foot. This flow moved in the same direction as the fluid flow across the

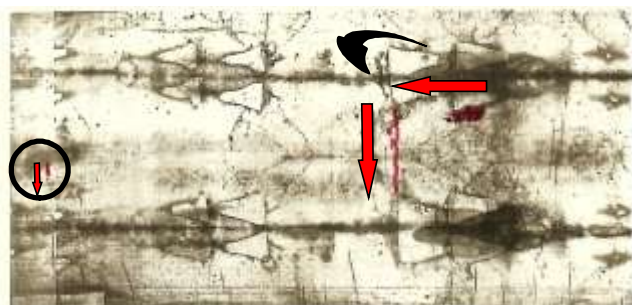
back did when it exited the wound in the right side as the body was carried to the tomb.

- c. **Stage Three:** Laid in the tomb in the **supine position**. This is a post-mortem flow seen at 4-4-4- in **Fig. 6.4.c.** above. **6.7** also represents a post-mortem flow but earlier in time than this one. (See **6.7** below)

(STAGE THREE) is a **deposition flow where the body is supine** the flow running nearly straight down a furrow in the cloth adhering to the right foot (4-4-4 in Fig. 6. 4. c. above). This serum flow is proposed to have occurred on the cloth with a more complex pattern already on it. (see **Fig. 6.0** above [see further below for the distinction between 2 and 4]) **(STAGE ONE, no. 1 above)** the **crucifixion stance solid blood flow** emanating from the vertical position of the Man of the Shroud while still alive on the stipes (upright) of the cross and was still damp blood just after the Man of the Shroud was removed from the cross) having been smeared by the left foot as it swiveled.

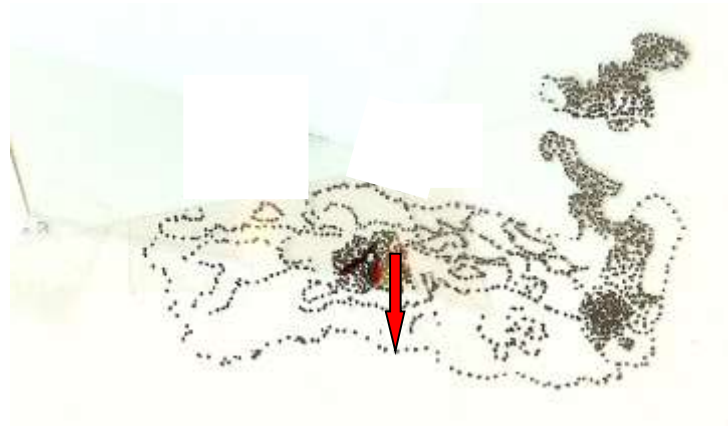
Meanwhile, it is proposed that an **“intermediate” pattern of flow (STAGE TWO) occurs when the body is removed from the cross and carried to the tomb**—no. 2 above. It looks “reversed” on the Shroud, but if we visualized it with the cloth folded over the right foot in death, the cloth has picked up a

pattern that flowed in the opposite direction. In other words, this particular flow ran off of the foot in the **same direction as the flow across the small of the back from the wound in the side when the body was taken down from the cross**. Thus, part of the complexity of the flows is explained by three separate events imposed one atop the other.



a.

Fig. 6.5.a. The author created this to illustrate the source and flow of blood from the wound in the side and to demonstrate the matching direction of flow from the top-center wound in the right foot. Both flows are consistent with the idea that the body was taken down from the cross wherein the blood flowed downward then turned at right angles and flowed across the small of the back in the direction of gravity. The same direction is followed by the flow of blood from the top center wound of the right foot. For the detail of the circled area please see stippled drawing in Fig. 6.5.b. below. (Transparency adapted by author from a full length photograph by Vernon Miller (1978)). (Adaptation copyright 2013).



b.

Fig. 6.5.b. Author's stippled-effect drawing with the transparent direction of blood flow at the "semi-triangular" area overlaid on top of the "rosette" shape to show the alignment of the blood and direction during removal from the cross. The clear rivulet has been removed from the above drawing since that rivulet flowed during the supine position when the corpse was laid in the tomb for burial. (Drawing copyright: 2013).

This complexity: ***the superimposition of pre-deposition and post-deposition serum flows (in various aspects of its forms) atop the crucifixion flow and the "removal from the cross" position, is the third item that does not appear to have been discussed extensively in the literature if at all.***

6.6. There is a dark stain at the heel.

6.7. Flowing out away from the heel area is a rivulet of blood, the flow having been separated at a point out in the cloth perhaps by a wrinkle in the cloth. Solids from the end of this flow have seeped through the cloth and now exist as a dried droplet on the non-image side of the Shroud. (8)

The water stain margin (point 6.8 in fig. 6.0 above) from the fire of 1532 *transverses* the flow from the “semi-triangular” marking noted at 6.4 Neither stain has apparently been affected by the other. The two must therefore be consequences of separate events.

Section V --The Anatomical Left Foot:

7.0. The left foot on the dorsal end (See right hand portion of Fig. 6.0 above; the following items are labeled on the above dorsal photo. For further discussion of the left anatomical foot please see the appendix) The right foot imprint has been fully described in section IV. There is no full imprint for the bottom of the left foot as there is for the right. We can only assume that the “surface” on which the blood flows is the bottom of the left foot. (For discussion of the only discovered and scientifically

proven crucifixion please see endnote 20). This flow is composed of two main patterns:

7.1. Three larger streams of blood appear to flow “sideways” out toward what should logically be the outside edge of the left foot. Each can be interpreted as radiating out from a single point. (See the red “X” in the photograph in fig. 6.0, referencing the numbers in 7.0, the left foot and in the Appendix of this paper).

7.4. The first stream angles out toward the edge of the foot toward a point that would appear to correspond to a place near the front-side of the foot, but forward of the arch.

7.3. The second stream angles out toward the edge of the foot at a point relatively adjacent to where the center of the arch of the foot would be.

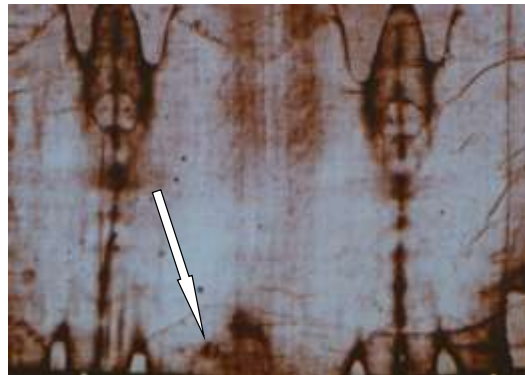
7.2. The third stream angles out toward the edge of the foot in the direction of the heel.

7.4. The first stream is connected to stream 7.6 which appears to double back to aim toward the front of the left foot generally in the direction of the big toe (see 7.6 below).

7.5. This stream is connected to the main streams which I have labeled 7.3. and 7.4. in fig. 6.

7.6. This stream is connected to the first (larger main stream) labeled 7.4 in Fig. 6. above. It angles in a direction which might be interpreted as toward the big toe on the left foot. It is narrower and, hence, should be interpreted as carrying less blood fluid at the time of the run. That is, the foot did not stay in a position long enough for it to widen from the flow as is apparent for other flows on the left foot.

The Frontal End of the Cloth

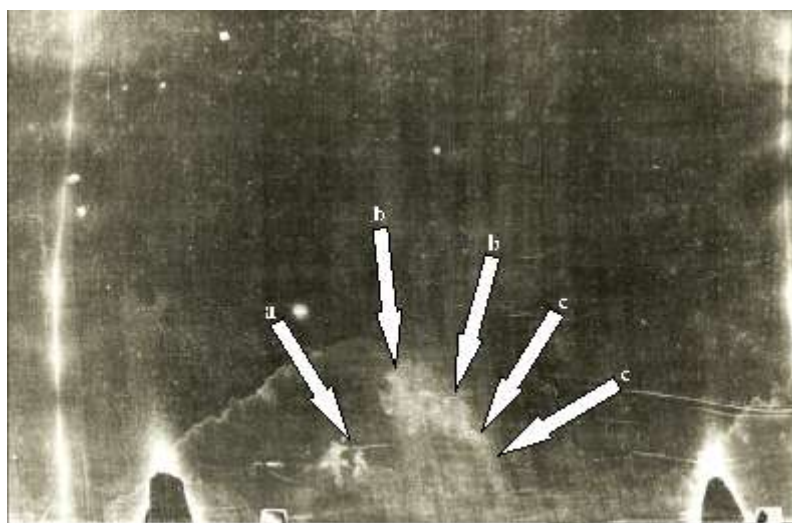


a.

Fig. 7.1.a. Shroud Frontal view close-up of legs and feet area. White arrow points to the split “islets of blood”. The above photo was taken by the author at Corpus Christi Church, in Port Chester, NY. Courtesy of the late Fr. Peter M. Rinaldi. The original life size photo of the entire Shroud was made by the Dutto Brothers. See further below.

Regarding 7.0. in fig. 6 above: It must be observed here that there is no visual evidence for foot image imprints (neither left nor right) on the frontal end of the cloth. The following are the markings for this end of the Shroud.

Frontal end right foot area:



b.

Fig. 7.1.b. Adapted by the author from a black and white close-up of the Shroud frontal feet by Vernon Miller. Original glossy photo courtesy of STURP scientific photographer, Vernon Miller (taken Oct. 1978). Arrows have been added by author. (See details below).

7.1.a. There are two relatively small and isolated red stains located out in the cloth near the outer side of the right foot area (on the non-“side-strip” side of the cloth). These have no

apparent connection to the larger blood stain at the end of the frontal calves. I have called these the “islets of blood.” (see a closer view at a. in the photograph, Fig. 7.1.b. immediately above). These split “islets” on the **frontal** end of the cloth appear to match up (i.e., align) to the split blood flow emanating from the heel area on the **dorsal** end of the Shroud and may be related to the more general topic of tucking and folding. (7). ***This is the fourth item that does not appear to have been discussed extensively in the literature (if at all) to which I have had access.***

7.1.b-b. There is a relatively large blood stain at the end of the right shin area. (b-b. in the photograph immediately above).

7.1.c-c. There is a blood flow appended to one side of this larger flow (in fig. 7.b. immediately above) that appears to run around toward the ankle/heel area from the blood source in the front. The fact that this is aligned with the “islets of blood” and that there appears to be a run of blood from this area, suggests that Dr. Gambescia may be right about a wound in the front of the ankle. This would be strong evidence that the dark spot on the heel is **not** a clot, but rather is an exit point for the first nail.

7.2. The left foot on the frontal end: There is no visible stain (i.e., no image coloration) that can be clearly interpreted as associated with the left foot on the frontal end of the cloth. That is, there is no imprint that unarguably **looks** like a foot. This may be due to a slightly twisted foot (as envisaged in Fig. 8 below [p. 45]) and to further distortions from the

tucking of the dorsal cloth around the feet that prevented the left foot from being near the cloth to provide an imprint.

We shall discuss the items listed above, but not necessarily in the sequence given. And the discussion of the left foot will be reserved for the second part of this paper.

THE RECONSTRUCTION EXPLORED: INTRODUCTION

In attempting to reconstruct the scene that I believe emanates from the above observations, and to test the viability of Dr. Gambescia's interpretation, the following assumptions are made:

1. That the law of gravity is in operation on the Man of the Shroud.
2. That there is a three-dimensional object wrapped in the cloth.
3. That this three-dimensional object is most likely a corpse.
4. That the corpse was not washed before burial.
5. That the corpse was probably very bloodied but that only moist blood stains on the body were transferred to the Shroud cloth. Dried blood on the body would only have been transferred to the cloth as reddish-orange agglomerate particles. (6).

6. That isolated non-image related blood stains in off-image areas of the cloth, that is, those not directly connected or superimposed on the body image, (i. e. the two “islets of blood” (point 7.1.a. in Fig. 7.1.b. above) have been transferred from another area on the same cloth which is related to a blood flow. (See 6.7 above in Fig. 6.0)

7. That the image becomes out of focus and image traces vanish when the cloth is more than 3 or 4 cm. distant from the body. (Jackson, *et al.*, 1977).

8. That this mode of the nailing of the feet on the Shroud represents a mode different from the format used by those who crucified the only scientifically proven victim of crucifixion found in Israel. (See endnote 20 for further discussion).

Right Foot: Investigating the proposed Heel Wound

As noted earlier in this paper, the first problem I tackled to investigate Dr. Gambescia’s proposal was the origin of the two very small isolated stains found at the frontal end of the cloth (point a. in Fig. 7.1.b. above as previously noted [p. 34]). It seemed reasonable to assume that they must match the separated flow (split flow] which came from the heel area on the dorsal end of the Shroud (point 6.7 in fig. 6 above [p. 21]).

As described earlier I worked with several versions of two small plates of glass, each roughly the same size. One was superimposed atop the dorsal end photograph of the foldout image in the **National Geographic Magazine** (June, 1980) to enable me to create a transparent image on the glass. The same was done for the frontal end with the second piece of glass.

When the paint had dried the frontal plate was laid over the dorsal plate and the two isolated stains (“islets of blood”, point a. in Fig. 7.1. b. above and the drawing in Fig. 7.c., points 3-3 in the line drawing below [p. 39]) were aligned with the split flow from the heel (point 6.7 listed in the text above and see 6.7 in Fig. 6 above). As noted, this alignment produced the first surprise. When thus aligned, the large blood stain at the frontal right foot area located at the end of the frontal shin (In the line drawing below it is point 1.) was itself positioned automatically over the heel (point 6.6 in fig. 6 above) of the right foot on the dorsal end, directly above the dark stain in that area. This fact suggested to me that Dr. Gambescia might be right—that there was probably a wound in the ankle/heel area as generally supported by the singular archaeological evidence found in 1968 and published in the **Israel Exploration Journal** in 1970. (See endnote 20)

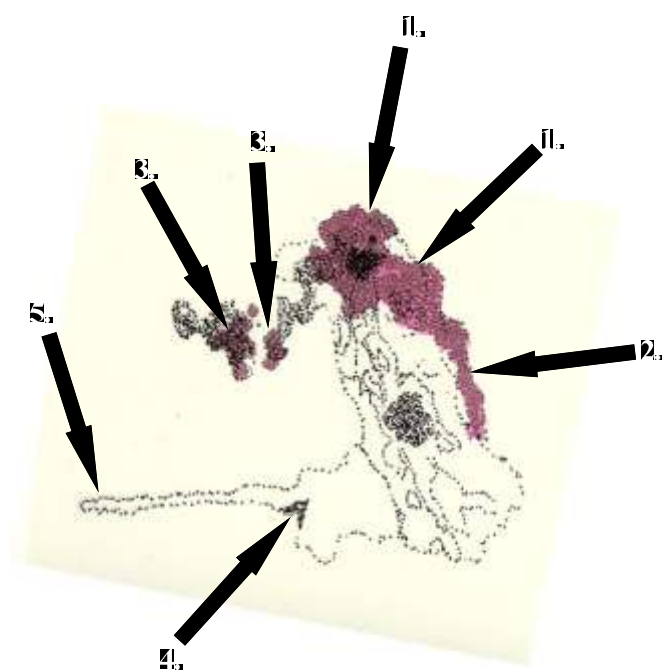


Fig. 7.c. Black and white line drawing of dorsal right foot with a colored line drawing of the frontal end superimposed atop the dorsal drawing showing the alignment of the frontal foot stains as follows: 1-1. The main blood stain from the frontal end (color coded red here). 2. The “trail” of blood emanating from the main stain implying a direction flowing on a surface downward toward the center of the foot. With

gravity as guide, this stain must have been created during the Man of the Shroud's upright position on the stipes. 3-3 = The blood flow across the horizontal plane of the Shroud in deposition mode, emanating from the heel area and showing the split in the flow probably due to wrinkles in the Shroud. 4. Arrow pointing to the "semi-triangular" perforation. 5. Rivulet emanating from that "semi-triangular" mark implying near-clear serum. (Drawing by the author based on Vernon Miller's (1978) close-up photographs of the dorsal and frontal feet areas; drawing copyright, 2013).

Right Foot: Investigating the Center Wound

The classical view of the Shroud has always assumed a wound in the center of the right foot. Indeed, evidence does show that a dark "rosette" shaped stain is clearly visible (point 4.2 in the listing above). Most interpreters have therefore taken the large frontal foot blood stain (point 6.1 in the text listing above) to be the blood from the top center of the right foot. But if the alignment of this large stain (point 6.1) with the heel (point 6.b. & b. in Fig. 7.1.b. [p. 34]) is correct, this would indicate that this blood emanated from the **front** of the ankle, not from the center of the foot. But then where is the stain from the top center of the right foot? Is there any trace of it on the Shroud?

To grasp a better understanding of the blood patterns on the dorsal foot end of the cloth, I enlarged by four times, a one quarter life-size black and white photograph of the dorsal end of the Shroud (kindly provided to me by the late Vernon Miller of STURP) and superimposed

this on a panel of sheer cloth. When this painted-in pattern was dry, I set my own right foot down on the right foot imprint and wrapped the sheer cloth around my foot to determine the position and orientation of the entire pattern to an actual 3-dimensional situation. (See photograph of the cloth in Fig. 6.2.c. [p. 23])



Fig. 7.d.

The “semi-triangular” spot (point 6.3 in Fig. 6.0) located to the side of the main foot imprint is on the same side as the dark flow of blood from the heel, but roughly adjacent to the center of the right foot. When the sheer cloth was wrapped around my right foot, the “semi-triangular” stain aligned exactly with the top center of my foot and, consequently, with the “rosette” pattern found on the bottom of the right foot imprint. (Line drawing by author based on Vernon Miller’s B/W photographs of the dorsal and frontal foot areas of the Shroud; drawing copyright, 2013).

When I first encountered the narrow fluid flow near the “semi-triangular” stain, while examining the original Vernon Miller photographs with a jeweler’s loupe, my first thought was that it might be related to the water stain produced during the dousing of the fire of Dec. 4, 1532. However, there are four reasons why this argument is unsupportable:

1. The width of the 1532 water stain border is perhaps some twenty-five times greater than the width of the narrow fluid stain associated with the “semi-triangular” mark. This suggests that there was a greater amount of fluid in the 1532 fire dousing, with a greater amount of solids in suspension that flowed to the water stain border than there was in the fluid flow associated with the “semi-triangular” mark.
2. The narrow fluid stain actually *transverses* the 1532 water stain border at right angles and exhibits no altering of either flow.
3. The small fluid flow stain is wider near the “semi-triangular” mark and gradually narrows during its length until it ends on the other side of the 1532 stain border. This suggests that its source, with a greater amount of fluid, is at the “semi-triangular” mark and is therefore associated with the bloodstain/imprinting process of the blood-images on the Shroud.

4. The small fluid flow stain is relatively long and narrow indicating a steep incline of plane and a narrow furrow in the cloth down which it presumably quickly ran. (See the “Physics of fluid flow” on p. 48-51 below).

These four reasons argue that the two different stain borders, the 1532 water stains on the one hand and the clear fluid flow stain from the “semi-triangular” mark on the other, were deposited on the Shroud during two distinctly different and time-separated events.

Therefore, the “semi-triangular” mark more likely represents a ***perforation in the skin on the top center of the right foot*** and the fluid flow may represent nearly pure serum coming from that perforation, with the fluid flow stain demarcation line having been caused by the few blood solids remaining in suspension in the serum, being deposited at that stain margin area. But this was clearly a post-mortem flow because the heart was no longer pumping to keep the solids mixed.

Although there is more to this portion of the story, I shall delay discussion of it until the second part of this paper.

Meanwhile, what about the long nearly-transparent rivulet emanating from the region of the “semi-triangular” mark? The position of the rivulet and the direction of it suggests that it emanated from this proposed perforation in the skin of the top center of the right foot. The length of this rivulet has been determined as a minimum of 131 mm and a maximum of 133 mm. Rounded off, it would be approximately 5 and $\frac{1}{4}$ inches long. (9) In the second part of this paper I shall return to

examine this “semi-triangular” mark and its surrounding rivulet pattern in much greater detail.

Interpreting the left foot in the light of the right center wound

By the above proposal we may then understand the peculiar flow pattern of blood on the left foot as representing this swiveling action with the flow of blood running at times off the forward (side) portion of the foot, then off the blade of the foot adjacent to the arch, and finally off the heel. That this swiveling took place is demonstrated by the evidence for a flow running along the blade between the heel flow and the blade flow connecting points 7.2. and 7.3. in Fig. 6 above [p. 21]. We will examine this again in part two of this paper.

If the suggested reason for the swiveling pattern of the left foot is accepted as viable, then there is a further question: If one nail were used for the feet, as is commonly accepted in the “classic” discussion of the imprints of the feet on the Shroud, and the left foot has moved up and down creating the pattern we now see for the left foot, what would prevent the right foot from also swiveling on that single nail? Gambescia’s view—two nail wounds in the right foot—offers the best explanation. With two nail wounds the right foot could not move at all. The evidence on the Shroud shows that the right foot is slightly bent inward. This may be because when the left foot was pulled down on

top of the right, the right foot, still only on one nail, rotated inward a bit as the left foot was being nailed into place on top of it.



Fig. 8. Side view of the feet showing their position on the cross in relation to each other and to the ground. (Drawing by author, copyright 1989).

The composite of the left foot pattern with plantar/dorsiflexion data and the clear rivulet and top right foot markings on the feet as wrapped in the cloth may be illustrated as follows:

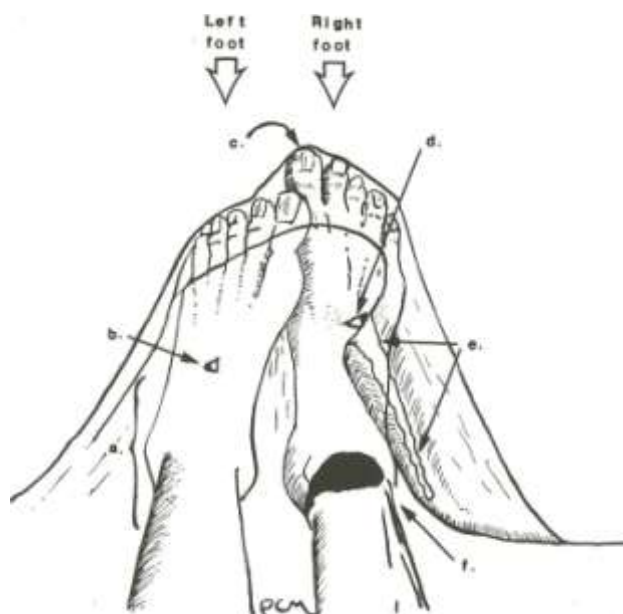


Fig. 9. Deposition of the body with the feet now in the supine position. The left and right foot in relation to the cloth. (a. Hypothesized ankle area of left foot (not registered clearly on Shroud). b. Hypothesized top center mark of nail in left foot (not registered on Shroud). c. Big toe of right foot (not definitively registered on Shroud). d. Top center “semi-triangular” mark of nail on right foot (registered on the Shroud to one side of right foot out on cloth adjacent to the right center of dorsal end). e. Fluid flow from nail wound in top center of right foot (registered as such on Shroud but “appearing” to emanate perpendicular to axis of right foot on Shroud). f. Large blood stain from front of ankle preserved on the frontal end of Shroud showing “trail” of blood going around the ankle toward the heel. Note: As noted above, it is important to realize that the center mark of the top left foot is hypothesized; it does *not* show up anywhere on the Shroud—either dorsal or frontal. This may be explained by assuming that the cloth did not touch that particular area of the Shroud during wrapping in the tomb. The left foot itself may have

had an angular twist to it due to rigor mortis from the stance portrayed in the drawing of Fig. 8 above. (Drawing by author; copyright 1989).

Because of the complexity of patterns on the dorsal end of the Shroud, and because of the subtle interrelationship between the dorsal and frontal draping over still-moist blood, and because the particularly important insight gained by the two-nails-in-right-foot proposal assumed by Dr. Gambesica's particular view of the position of the feet and, most especially, the need to investigate further the nature of the "semi-triangular" mark adjacent to the right foot, we shall now return, in part two of this presentation, to the details surrounding the markings associated with the intricate patterning found associated with the right foot on the dorsal end of the Shroud.

END PART ONE

**Joseph M. Gambescia , M. D., and the Position of the
Feet on the Shroud of Turin.**

The History of an Investigation.

With some added observations made by Dr. Gambescia.

Part Two.

PREAMBLE TO PART TWO: Brief Summary of part one and introduction to Part Two

In part one we have set forth the observations that seem to support Dr. Joseph M. Gambescia's view of the position of the feet on the Shroud. But there were some complexities we needed to examine more closely, particularly in the region of the dorsal feet.

PHYSICS OF FLUID FLOW

There are some basic rules that govern fluid flow. I will not explore them in great depth—that would require a separate dedicated paper on the topic. Please treat them as the general statements they are. I will summarize them as follows:

1. **The viscosity of the fluid.** The thicker the fluid, the slower it will move. On the Shroud clotting blood is thicker than clear serum which has lost most of its solids. We may deduce that thick blood is more likely blood exuded while the Man of the Shroud was still alive and is therefore darker because the pumping heart has maintained a mix of solids and serum.
2. **The incline of the plane.** The steeper the plane (i.e. the inclination of the surface across which or down which the liquid flows) the faster the liquid tends to flow. On the Shroud an area of cloth that is relatively steep—such as

cloth that is draped over the feet—will be conducive to a faster flow of liquid (eg. The flow of serum down a “trough” in the cloth). The clear fluid that runs in the “trough” is most likely understood as serum which has lost most of its solids, and is therefore exuded from the “semi-triangular” perforation in the top center of the right foot of the Man of the Shroud after he died.

3. **The width of the channel.** The wider the channel the slower the fluid will move while in a narrower channel the fluid will tend to flow faster. For example, perhaps the “trough” angling downward from the toes on the right foot toward the horizontal plane contributed greatly to the “straight” pathway seen in the flow of fluid away from the center perforation in the right foot from the “semi-triangular” mark in the top center of the right foot, whereas the meandering flow out away from the heel on the dorsal end on a more-or-less horizontal surface was a slower moving liquid.
4. **The path of least resistance.** Fluid prefers to move in wet channels as the path of least resistance. (eg. Blood that has already flowed down a certain pathway, a path which is still wet, creates its own “preference” for future flows). And even the incline of the plane will not cause this flow to diverge until the incline reaches a certain angular degree that will allow gravity to take over to alter and modify or create an entirely new direction of the flow. We will explore

the patterns on the left foot below as an illustration of the above factors in fluid flow. Dried blood will create an impedance that can influence the pathway blood takes if the angle of the pathway changes.

5. **The morphology of the “terrain.”** Channels in the “terrain”—i.e. furrows in the cloth will guide flows. An example of this is the proposed “channel” down which the nearly clear fluid flowed mostly in a straight direction. The mini-meanderings of the stain margin (i.e. the stain border itself) may have been caused by capillary action due to the weave. Changes in the terrain—such as impedances—wrinkles in the cloth, for example—will change the direction of fluid flow. A good example of this can be found in the fluid that flows off of the heel out into the cloth on the dorsal end of the Shroud. It is clear that this fluid was guided by channels in the cloth to create a kind of general meandering pattern—those channels being wrinkles in the horizontally placed Shroud.
6. **The material on which the fluid flows.** Although many of my experiments were done on dust laden glass where micro-capillary action was less obvious to the naked eye, experiments on cloth illustrated the more obvious effects of capillary action due to the weave which amplified the pattern. This can be seen with a jeweler’s loop on the tack sharp photographs of the “straight” fluid flow out from the

“semi-triangular” mark on the top of the right foot on the dorsal end of the Shroud.

7. **The amount of liquid in the channel.** Liquid has a weight to it but it varies depending on the density of that liquid, which in turn varies with the temperature of the liquid. But at 70 degrees Fahrenheit a gallon of water weighs approximately 8.34 pounds. Coagulated blood may differ from this somewhat (being greater in weight) I, therefore, did not explore that factor because I did not have access to the kind of equipment nor the amount of blood I would have needed to do so. But, the greater the weight, presumably the faster the flow in a channel of the same width and same incline. If we use water as the “standard” we can get what is called “laminar” flow (slow), “turbulent” (fast) flow, and “jet” flow. This standard does not apply easily to our situation on the Shroud because of the material (weave of the cloth) and draping (over a corpse) which make it difficult to apply experimentally and I will therefore not explore it further here. But I would assume that the type of flow we see in the “clear fluid” emanating from the “semi-triangular” mark would be closer to the weight of water and would match the “fast” flow indicated here. (See L. Don Leet, et al, pp. 255-285). (10)

These, then, are the general components of fluid flow. It must not be thought, however, that only one or two of these factors in fluid flow listed above is/are involved as an “overriding” component of the movement of the fluid. They all act upon each other, intimately, so that it is difficult to point to any one or two factors as that which “controlled” the direction, speed, and shape of the flow.

DORSAL LEFT FOOT FLOW: A Closer Look at the Details

One sees on the Shroud an “imprint” or “pattern” for the left foot that has been difficult to interpret. But, based upon the initial observations by Dr. Joseph Gambescia, I shall offer a reconstruction as a “primer” to those who may wish to find inspiration to improve upon it. Here is my thinking: If the first nail went through the right foot at the ankle, as proposed earlier, then it becomes clearer that if the left foot were attached by a single nail in the center of the right foot, as Dr. Gambescia believed it was, the left foot would therefore have been free to move but that this second nail would firmly anchor the right foot so that it did not. If the Man of the Shroud changed his position on the cross, pushing down on the nails using his feet, then that movement would change the orientation of the pelvis relative to the ground and, therefore, also the position of the left foot (and other appendages above the pelvis as illustrated by the crucifix created by the late Mon. Giulio Ricci of Rome). When the Man of the Shroud pushed up to get a full breath, the toes of the left foot would be oriented toward the ground. When he sagged, the lateral blade

(outside edge) of the foot was more parallel to the ground surface. When he became utterly exhausted, the heel would be pointed in a downward position and the Man of the Shroud would likely have been in highly excruciating pain. But keep in mind that the Man of the Shroud would have done this repeatedly in order to take a more potent breath periodically and to ease the tensions on his joints and muscles. Early on he would have had some strength to push further up to breathe, but as time passed and his strength began to fail, his ability to push up became gradually diminished. In the drawing below I have tried to condense into a small set of graphics, running from left to right, five snapshots, as it were, to try and depict what might have happened over a period of time. The red arrows are an attempt to visualize the blood flows during those snapshots in time.

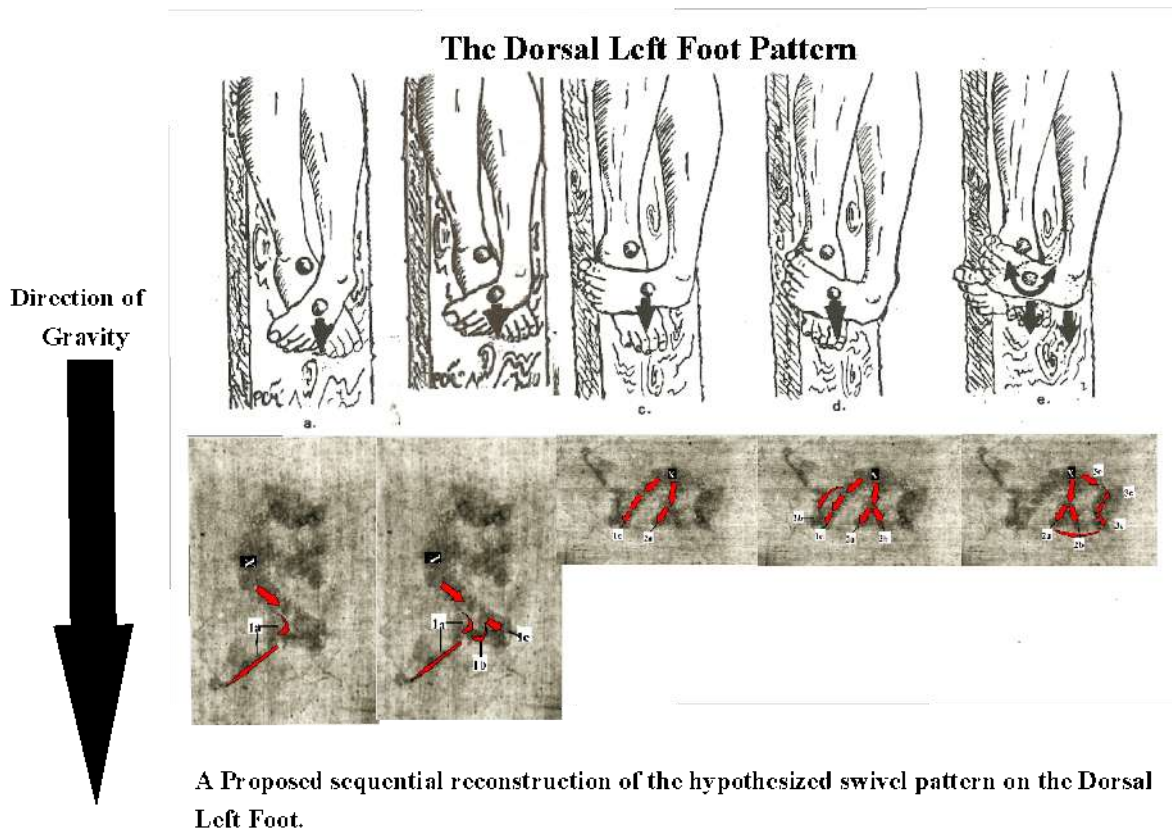


Fig. 10. The swivel pattern of the dorsal left foot. (Drawing by author; copyright, 2013).

By this proposal we may then understand the peculiar flow pattern of blood on the left foot as representing this swiveling action with the flow of blood running at times off the forward portion of the foot, then off the lateral blade of the foot, and finally off the heel. That this swiveling took place is demonstrated by the evidence for a flow running along the lateral blade between the heel flow and the lateral blade flow connecting the (designated in Fig. 6 as the flow (7.5.) running between points 7.2. and 7.3.; in Appendix see 7.5.6. a. and 7.5.6.b.)

Dr. Gambescia's approach allows us to suggest an interpretation different from that proposed by the late Mons. Giulio Ricci. (11). It may be seen as a pattern of blood flows following gravity which happened not in the tomb due to tucking of the cloth around the foot but rather in the living stance while the victim was still on the cross—a stance (and the resulting flows) that must have been accompanied by excruciating pain with every movement up to gain a breath. (12).

If the suggested reason for the swiveling pattern of the left foot is accepted as viable, then there is a further question: If one nail were used for the feet, as is commonly accepted in the "classic" discussion of the imprints of the feet on the Shroud, and the left foot has moved up and down creating the pattern we now see for the left foot, what would prevent the right foot from also swiveling on that single nail? Gambescia's view—two nail wounds in the right foot—offers the best explanation. With two nail wounds the right foot could not move at all. The evidence on the Shroud shows that the right foot is slightly bent inward. This may be because when the left foot was pulled down on top of the right, the right foot, still only on one nail, rotated inward a bit as the left foot was being nailed into place on top of it.

Although I had been using Vernon Miller's high resolution photographs taken in 1978 for my study (and these, I received directly from Vern Miller, himself)—not the orthochromatic photos taken by Enrie in 1931—there was a nagging question in the back of my mind: What if!? What if the "semi-triangular" mark and the attendant fluid flow so subtly present on the dorsal end of the Shroud were ONLY an artifact

of the photography and not truly represented on the Shroud itself. This was no idle worry. Barrie Schwartz and I had talked in times past about how second, third, and fourth generation photographs taken by Enrie could build up false subtle artifactual “information” that did not represent the original. I did not believe the photos I received from Vern Miller were second generation. But I needed to be assured that what I was seeing in the photographs was indeed on the Shroud itself.

Thus, I believe, it was in the early Spring of 1997 that I learned of a planned trip by the late Dr. Alan Adler to attend a private meeting of the Shroud of Turin Conservation Commission held in Turin in June of that year. (13) Adler was the only American on that commission. So I put together a short document, replete with the appropriate textual and photographic material, to guide Dr. Adler on my requested examination of the Shroud. I wanted to know if he could verify, first hand, that the semi-triangular mark and the rivulet that seemed to emanate from it could actually be seen with the naked eye on the original, not digitally enhanced, Shroud. When Dr. Adler returned to the United States after his meeting he called me confirming the observations I had made using Vernon Miller’s high resolution photographs. He also told me that when he was there at the meeting, he was convinced that this matter ought to be seriously investigated with chemical analysis, and had requested a sample to be removed from the stain margin for analysis at his lab at Western Connecticut State University. Sadly, he was denied that request.

The fluid flow and the “semi-triangular” mark can be seen with the naked eye so further investigation of this remains a desideratum for future research. As of this point in time we cannot yet say, from a strictly analytical chemistry standpoint, that the fluid flow associated with the “semi-triangular” mark is actually a blood product. But it does not, as stated earlier, seem to be associated with the dousing of the 1532 fire.

EXCURSUS: THE “EXPECTED” SHAPE OF WOUNDS

However, before we further examine the “semi-triangular” mark and fluid flow area on the Shroud, I should like to include in this part of the paper an excursus.

In **Gray’s Anatomy** (1977, p. 1136) there is discussion of a feature of skin called cleavage lines, linear furrows, or sometimes known as “Langer’s lines.” These are microscopic lines of tension that transverse the skin. When an incision is made parallel to these lines, the incision tends to come together; but when an incision is made across Langer’s lines, the incision tends to gap open. Long ago, Baron Guillaume Dupuytren saw that when a sharp conical instrument perforated the skin, the incision resembled an ellipsoidal slit such as might have been made by a flat blade, not a conical hole as one might otherwise expect. (14).

A search in medical literature for what might happen with a Roman square nail failed to turn up anything that could guide me. Shouldn’t a

square Roman nail produce a square entry and exit wound? To answer my question experimentally I turned to Dr. Isidore Mihalikis and his associate, Dr. Malcolm Cowen, prominent Eastern Pennsylvania forensic pathologists. Although we cannot experiment with human cadavers we can probe the question, following the lead of Dr. Pierre Barbet (**A Doctor at Calvary**).

The questions raised by this “semi-triangular” perforation, shortly to be discussed, necessitated an experiment using an amputated appendage. This time I simulated a “Roman nail” for use with this test. But my nail was designed for “handling” in the experiment, it was not an attempt to actually reduplicate the exact nature of Roman nails themselves. (See the photos below of the nails provided here for the actual ancient nail type) Thus, in this case, only the point of the nail for a distance of about 1 and ½ inches, would be valid in the testing since the shanks of such Roman nails, about an inch and a half beyond the point, usually have very roughly the same girth all the way up to the head.

A close look at the “semi-triangular” mark on the Shroud shows a ragged point at one end and two right angles at the other end to complete the “semi-triangular” shape of the mark. Note also that this mark is very highly defined—to the point of being of very high resolution! Logic suggests that the reddish material surrounding the hole was transferred from the foot to the cloth. The mark exists simply because the bloody area of the foot surrounding it provided what may be called a “stenciled” imprint. If one begins a triangle at the apex of this mark and radiates two lines out toward the widest portion of the

mark and measures the resultant triangle, it would be approximately 6.5 mm on the longest sides and about 3.5 mm at the end.

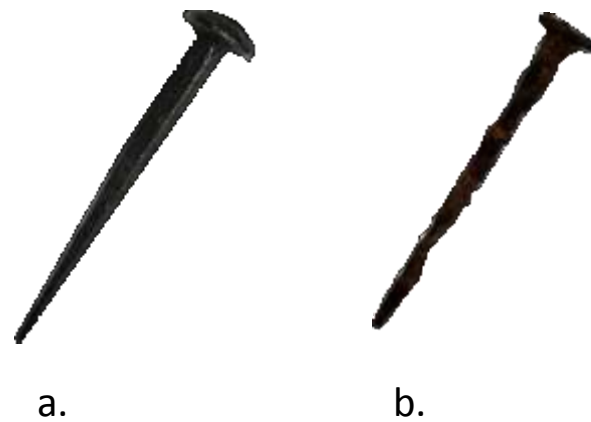


Fig. 11, a. and b. Roman square nail: a. modern replica. b. Ancient Roman square nail. (Both in the author's collection.)



a.

b.

c.

Fig. 12. a., b. and c. a. Amputated appendage before nail. a. Amputated appendage with nail in it. c. Amputated appendage after nail is removed.

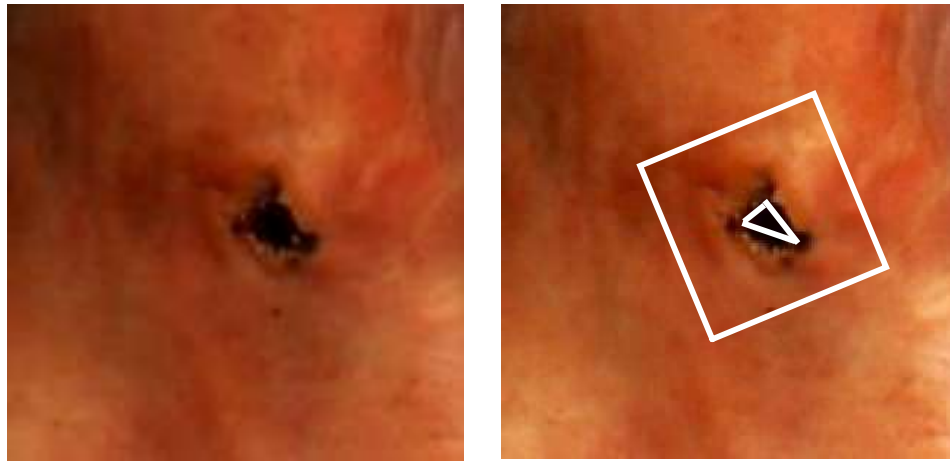


Fig. 13. Close-up of nail wound. Notice the superficial (very very subtle) “mound” preserving the squareness of the nail. But note especially the roughly “triangular” skin shape of the declivity in the wound itself, the actual cut made by the square nail. The reader may compare the right photo depicting the geometric shapes with the left, unretouched photo.

I believe that the “semi-triangular” marking and its surrounding associated features (including the clear fluid flow from the “semi-

triangular” marking, has **three components** in this analysis. I will state them in my analysis as follows:

I may summarize my **first** observation of the “semi-triangular” mark as a **“Static mark” on the cloth adjacent to the right foot. That is, it represents a “non-moving” point on the cloth.**

THE AREA SURROUNDING THE “SEMI-TRIANGULAR” MARK

If the “semi-triangular” mark were all that there was to that region of the blood imprint we would not need to examine the matter any further. However, as I scrutinized Vernon Miller’s photograph of this area of the Shroud I noticed that the rivulet that led away from the “semi-triangular” mark seemed to have multiple stain margins. It was almost as if the fluid flow had stopped for a while as the solids in suspension in the fluid gathered at the stain margin—only to begin again to move on to the next stain margin. Although the rivulet extending from the “semi-triangular” mark is remarkably similar to the experimental blood stains from which most of the organic debris has moved to the stain margins, the structure surrounding this mark is somewhat more complicated than one border only. There actually appear to be a series of such irregularly shaped borders—not concentric rings—moving out away from the “semi-triangular” mark toward the long clear rivulet. Earlier I had showed that a contrast existed between the border of the fluid flow stain emanating from the

“semi-triangular” mark and the water stain borders from the fire of 1532.

Dr. Walter McCrone (1987/88, p. 56; see also there Plate 2, figs. 10 & 11) noted, in experiments comparing blood stains with those of iron oxide, that blood debris tends to migrate to the border of the stain while iron oxide tends to settle straight down on the cloth. Taking an idea from this experiment I repeated it, adding one additional factor. Through the kind help of Dr. Malcolm Cowen, I obtained two types of blood: regular coagulating blood and non-coagulating blood. I placed blood on the cloth at prescribed times spaced out at 5, 10, 20 minutes, and 1, 2, 3 and 4 hours apart. With the coagulating blood sample (coagulating sample 1) I could obtain a good simulation of the “clear serum” stain pattern within 1 and ½ hours of permitting the blood solids to settle out. With the second sample (non-coagulating sample 2), I was able to get a good simulation of the clear stain in 3 and ½ hours. Further testing, however, is needed including the use of just saline solution and other variations, to determine just how much information can be deduced. (15)

Earlier I had showed that a **contrast** existed between the border of the fluid flow stain emanating from the “semi-triangular” mark and that of the water stain borders from the fire of Dec. 4, 1532. Can we show any **similarity** between this proposed wound mark and its irregular borders by comparison with any other wound mark on the corpse? I have already demonstrated previously that the large frontal stain at the base of the frontal shin aligns with the heel and that therefore there must be

a wound in the front of the ankle (the entry point) and in the heel (the exit point). Using a jeweler's loupe, I examined Vernon Miller's original photograph in the heel wound area. Here, also, were displayed evidences of an irregular border, although darker than the borders around the "semi-triangular" area.

Is there any discernible "chronology" of events at the "semi-triangular" mark that might attest to a changing relationship between a corpse and the cloth that enwrapped it? We assume, of course, that the corpse would be in the supine position on the burial bench with the right foot angling upwards toward the ceiling of the burial locus—in first century A.D. Jerusalem this would have been in a rock-cut tomb. The multiple borders of the stains suggest that the cloth was originally a cover, "glued" to the top of the foot by blood, preventing any issue of fluid from the center perforation of the right foot except through capillarity. As the cloth became wetter with the fluid the weight of the fabric gradually peeled the cloth away in stages from the top of the foot and was eventually freed entirely from the nail hole to create a kind of furrow or trough in the cloth, down which the nearly clear fluid, unleashed from the hole, could run.

I may therefore summarize my second observation of the "semi-triangular" area as ***being composed of a fluid flow emanating away from the STATIC POINT, and running down what I propose to have been a narrow furrow in the cloth. The "semi-triangular" mark is static—a fixed point on the cloth, whereas the fluid flow records a moving fluid away from that fixed point.***

But the “semi-triangular” marking has a **third** component, an observation which I may **summarize as being consistent with the physiognomy of the foot and the tucking/folding of the cloth over it.**

One night, at Dr. Gambescia’s home, I demonstrated the relationship between my feet and the cloth with the Shroud blood flow patterns drawn on it. (For which see Fig. 6.2.c. on p. 23). I showed Dr. Gambescia how the “semi-triangular” mark came exactly to the center of my right foot when I pulled the cloth over my right foot. Thus, I argued, it was this “semi-triangular” mark and its emanating fluid flow that represented the wound in the top center area and that it was pressed directly against the top of the right foot, acting as a dam during burial, preserving the stencil-like demarcation of the break where the second nail penetrated the skin after passing through the left foot.

Interrelationships between the Blood Flows on the Body

It was very late this same night when I shared these observations with Dr. Gambescia. To appreciate the setting one would have to understand that, normally, Dr. Gambescia tended to be a quiet, contemplative man. But this made me nervous because my only “medical” training was confined to the knowledge of anatomy an archaeologist might use on the bones he dug up. Nevertheless, I wrapped my feet in the life size sheer cloth I had made of the dorsal end and verbally described the pivotal flow on the left foot while he

quietly and thoughtfully watched. Dr. Gambescia suddenly jumped up. “The arms, the arms, the arms!!” I was startled! But he quickly made an interesting connection between this pivotal flow and the two differing blood flow patterns on the right and left forearms. Referring to an observation made originally by the late Mons. Giulio Ricci, he noted that when the left foot was nailed to the right, the left hip was pulled downward, thus creating a very different angle for the left side of the body. The right forearm, at times, would descend from the patibulum at about a ninety degree angle to the ground; the left arm, pulled more taut due to the lower inclination of the left hip, would have caused the left arm to be at approximately a 45 degree angle. (Ricci, 1981, p. 163). Moreover, Barbet (1963, p. 108) had noted a bifurcation of a blood flow from the wound in the left wrist. This, too, would have been caused by a periodic changing of positions in body stance on the cross from a pivoting of the left foot.

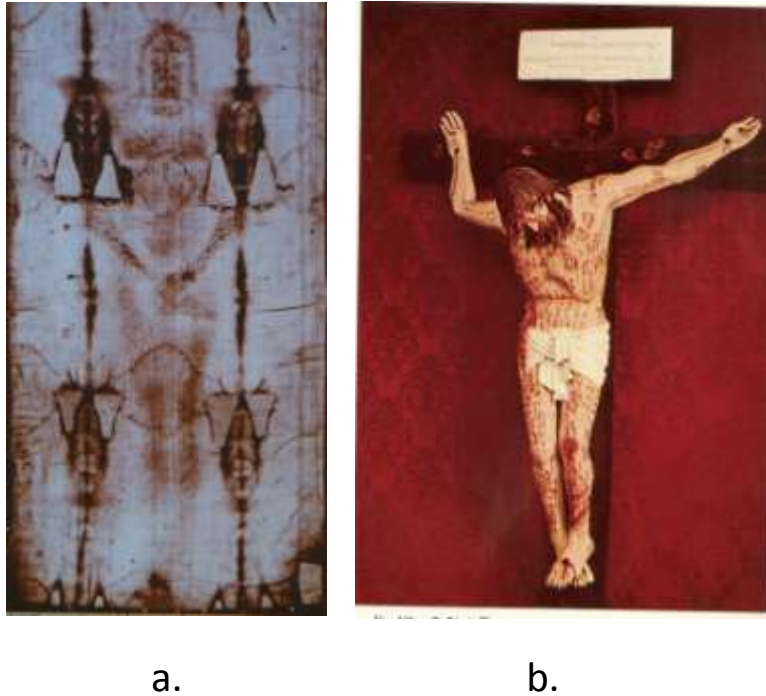


Fig. 14 a. & b. a. Frontal figure of the Shroud deliberately “flipped” so that true anatomical right matches the anatomical right in Mons. Giulio Ricci’s crucifix based closely on the Shroud. b. Crucifix designed by Mons. Giulio Ricci. (See The Holy Shroud, See p. 184, Centro Romano Di Sindonologia, s.r.l., 1981)

THE CRUCIFIXION SIMULATION (16)

The following reconstruction of the events is suggested by the foregoing discussions: After the Man of the Shroud was nailed to the patibulum, this beam was raised up and set onto the top of the stipes.



Fig. 15 a. and b.

Fig. 15. Placement of the first nail to go through the front of the ankle of the right foot (a.) and the result following that first nailing (b.). I call this the “anchor nail” because it goes through the ankle, out through the heel and directly into the stipes of the cross.

The right foot was firmly grasped and the first nail was pounded into the front of the ankle, down through the heel and into the upright of the cross. Then the left foot was placed on top of the right foot and a second nail was driven, this time through the center of the left foot, down into the center of the right foot and into the upright of the cross. Thus, the right foot was firmly anchored to the upright and could not

move, but the left foot, nailed with only one nail, could pivot up and down around this nail. At first the blood oozing from the nail wound on the bottom of the victim's left foot flowed in a long narrow flow toward the toes. Some of the blood dripped to the ground and some, following the shank of the nail, onto the top of the right foot. But clearly, at first, the victim could maintain his position, albeit briefly, with the left foot pointing in a generally downward direction.



Fig. 16. Completed nailing showing the first nail through the front of the ankle and the second nail penetrating the center of the left foot and down through the center of the right foot. Thus, there are two nail wounds in the right foot, but only one wound in the left. The right foot could not move. But the left foot could swivel up and down depending upon the movement of the crucified each time he pushed up to breathe or sagged from exhaustion.

During his time on the cross, as the victim raised himself, then sagged from exhaustion, the movement of the left foot would have smeared the blood from the wounds on the top of the right foot. But much of the blood from the left foot would have dripped off from the edge of that foot onto the ground rather than directly onto the top of the right foot.



a.

b.

Fig. 17. a. and b.

- a. The underside view of the feet following their nailing.**
- b. The negative view of G. Enrie (1931) showing the bottom of the feet as imprinted on the Shroud.**

When the Man of the Shroud was removed from the cross and laid on one end of the Shroud cloth, the various preparations for quick burial having been made, the end of the dorsal cloth was first tucked over the right foot, then the frontal end of the Shroud was pulled over the

body. The inward tilt of the left foot combined with the tucking of the cloth around the right foot prevented any stain from the top left foot wound from leaving any mark on the Shroud cloth. The dorsal end of the cloth was tucked just enough to cover the feet including the top center wound area of the right foot without touching the ankle. Thus the dorsal end of the cloth prevented any other markings or imprints, except for the frontal ankle wound and the islets of blood, from being transferred to the frontal end of the Shroud.

THE WOUND IN THE SIDE

Early in my investigations of the Shroud, I was curious about the wound in the side which any observer can see exhibits a flow of blood straight down toward the ground. Mons. Ricci has studied this perforation in the side fairly well. (Ricci, **The Holy Shroud**, pp. 186-193) (17). Ricci has argued that the elliptical shape of the wound matches well the shape of a Roman spear. But Dr. Isidore Mihalakis and I performed some experiments on amputated appendages and it is probably not so much the *shape* of the blade as it is perhaps to be attributed to the *effect of the bone structure* beneath the skin. (18) Be that as it may, it was from this perforation that ample fluid flowed out—a mix of blood and serum—in St. John’s words “blood and water” (Gospel of John 19:34).

Dr. Gambescia, during our visit in March of 1981, asked Dr. DeSalvo and me to “keep our eye” on a large bag of mixed blood he had shaken at the beginning of our session. By the end of our discussion the blood and serum had separated enough that the darker liquid with the solids

had settled to the bottom leaving a golden fluid on the top. It was this type of blood, illustrative of blood in a system where the heart was no longer pumping to keep it mixed, that Dr. Gambescia wanted to bring to our attention.

Following his commentary on the “blood and water” Dr. Gambescia remarked in an off-hand way —toward the end of our session—that he suspected that a rope might have tied the torso of the Man of the Shroud to the stipes of the cross. He based this on a rather “whitish” area running across the image on the lower part of the chest beneath the pectorals. But he was quick to comment that this might be the result of well developed pectorals. And there he rested his observation.

We moderns often view crucifixion as a “sentence of death.” True, crucifixion nearly always resulted in death but the Romans’ primary goal was in employing crucifixion as a means of torture to deter the kind of behavior they wished to prohibit. Thus, using a rope would have prolonged that torture.

Meanwhile, it is most unfortunate that we cannot more fully explore the path the blood took from the perforation in the side all the way to the rivulet that runs across the back. This is because a patch used to repair one of the burn holes from the fire of Dec. 4, 1532, impedes our ability to see the course of the flow in photographs before the Summer of 2002. However, even with the patches removed (which was done during the Intervention of 2002) we are no better off because the fire has destroyed any evidence on which we might base such a study. We

only know that it went down for a distance to reach the point where the corpse had been turned on its side so that the direction of serum and blood could flow across the back (preserved for us on the dorsal end of the Shroud. (19).

Some years later, I was giving a talk on the Shroud to a group of nurses at Sacred Heart Hospital in Allentown, PA. I showed a slide illustrating the crucified stance common in Dr. Zugibe's studies—but which was not a common one for nearly all crucifixes one sees. The drawing on the front of Dr. Frederick T. Zugibe's earliest book was adapted from the physical stance borne by the more than 400 volunteers whom Dr. Zugibe mounted on his cross to learn something about the physiology of crucifixion. As I was discussing Dr. Zugibe's studies, I was suddenly struck—in mid-sentence—by Dr. Gambescia's remark and I commented immediately to the nurses that if the blood from the wound in the side were to have issued forth with the body in that stance, the blood would have run down the side, not down the front of his torso as we see on the Shroud. Suddenly, this insight suggested to me that perhaps Dr. Gambescia was right about the rope tying the torso up against the stipes of the cross.

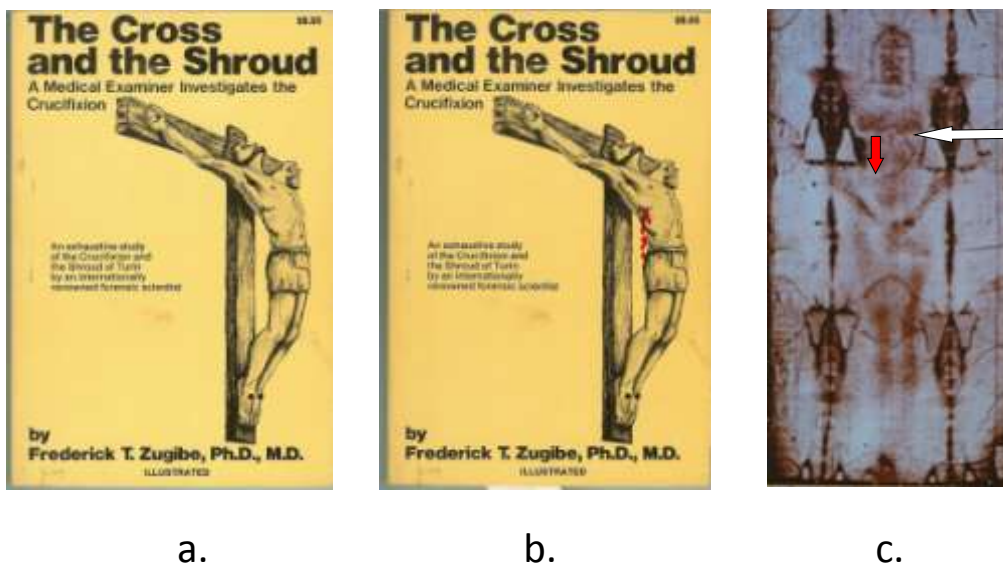


Fig. 18, a. b., and c. a. The original drawing on Dr. Zugibe's book. This drawing was based upon more than 400 volunteers who mounted Dr. Zugibe's cross during his studies of the physiology of crucifixion. b. Slight alteration by this author (P. C. M.) showing how gravity should have governed the blood flow if the body were in the stance shown on the cover of the book. (See blood [designated in red] dripping from wound in the side). c. The Turin Shroud showing the flow of blood straight down with no provable misalignment of the blood if the cloth had enwrapped the body which would have showed the perforation and blood flow along the side, rather than, as it does, down the front from the perforation (see red arrow on frontal Shroud image). White arrow points to "whitish" area on chest where Dr. Gambescia had suggested the possibility of a rope. (Modification to Dr. Zugibe's book and to Enrie frontal view created by this author (P. C. M.)).

SUMMARY: SOME RESULTANT OBSERVATIONS

First, we note here that conclusions based on Dr. Gambescia's hypothesis provide a more satisfying explanation for why the bottom of the right foot was so covered with blood containing solids. The nail in the center of the right foot "erased" the arch of that foot and pressed the full right foot up against the stipes of the cross. Blood emanated from the victim while he was still in the hanging position not only from the exit wound in the heel but also flowed down around the front of the ankle as well as from the left foot following the shank of the nail from the exit wound in the bottom center of the right foot. And the Man of the Shroud was still alive with his heart pumping—not dead when the solids would begin to settle inside the body.

It must be noted here that there is an important comparative distinction between the imprint of the right foot and that of the left. The question here is: Why is the right foot preserved as a "full" imprint whereas the left only preserves the rivulets—but no convincing "full" imprint of the foot itself? The right foot blood flows may be illustrated as follows:

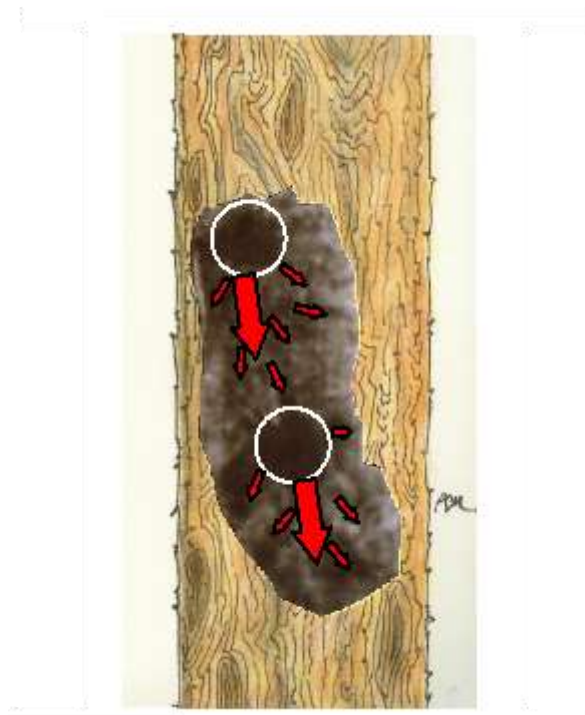


Fig. 19. Top circle represents the proposed wound in the heel. The bottom circle represents the wound in the center of the right foot discussed by Barbet. The large red arrows indicate the general movement of blood by gravity. The smaller arrows represent the movement of blood by capillary action. (Drawing by author and superimposed right foot adapted from the Dutto Brothers imprint (by G. Enrie) courtesy of the late Fr. Peter M. Rinaldi). (Adaptation copyright Jan. 2014). (20)

My conclusion therefore is this: First, two nails in the right foot flattened the foot against the stipes of the cross creating the downward flow of blood and the capillaric spread of blood throughout the bottom of the foot. But the left foot, nailed with only one nail, retained the

arch of the foot with little chance for any capillary action to spread the blood.

Second, we must note that these findings support STURP's conclusions, made public at New London, Connecticut in 1981, that the Shroud of Turin must once have wrapped a corpse. Although scientists around the world have not yet been able to suggest a completely satisfying mechanism by which the image was put onto the Shroud, the radiocarbon date, placing the Shroud in the 1260-1390 time frame, takes us nearly one thousand years past the time when crucifixion was practiced under Roman rule. This creates a singular problem, still scientifically unresolved. If the Shroud wrapped a corpse, as John Cornwell notes in the British journal **The Tablet** (1989), someone in the fourteenth century must have obtained a living person willing to be crucified. But I would add that even if someone were crucified in the fourteenth century, how would an artist know exactly how to set it up properly or represent Roman crucifixion as practiced in the first century C. E. Where would he have gained his knowledge about the various methods of crucifixion and the intimate medical details of it all? How would he have obtained his intimate familiarity with the way blood behaves at different stages between a living person on a cross and a corpse in a tomb? He would have had to practice and practice with many victims before he refined his technique to give us the details we now see. Moreover, why would he even need to depict such details for a fourteenth century audience not learned in such matters?

Third, if the Shroud is in fact fourteenth century, then, as the late Dr. McCrone has insisted since 1979, we would expect it to be a painting. But we have only to compare the Shroud with the artistry of that particular time frame to see that the Shroud represents a crucifixion unlike any known to artists who painted the topic during that time. Why does it not conform to the details of other paintings of crucifixions and depositions rendered by artists in the thirteenth-fourteenth centuries? We have only to study comparative art history to realize that, especially in a field connected with ecclesiastical topics, such images tend to take on a life of their own and begin to influence each other. Instead, in numerous aspects, the feet being but one example, it diverges radically from traditional renditions not only in its presentation of the crucifixion but also in its interweaving of the minutest of details, all in an oblique and subtle manner, testifying to a very advanced medical knowledge of blood flows and anatomical integrity. But, by applying Dr. Gambescia's interpretation of the feet to the Shroud, there is revealed a level of detail that no artist of the time ever tried to portray! Nor did he have the medical knowledge to do so.

But crucifixion, as noted above, had not been practiced for nearly one thousand years since it was outlawed in the fourth century of the Eastern Roman empire. This raises questions about the radiocarbon testing results placing the Shroud in the fourteenth century and the nature of the image itself. That issue has already been tackled by the late Ray Rogers. (Rogers 2005) Thus, if anything at all is achieved by this examination of Dr. Gambescia's proposal, it is hoped that science

will continue to investigate the Shroud to resolve these remaining perplexing questions.

How Old is the Ankle Wound Interpretation?

Since the sub-title of this paper is “The History of an Investigation” we must ask “How old is the ankle wound interpretation?” Well, it is difficult to say. But it is possible—yet also debatable—that an artist in 1624 tried to interpret the nails as possibly perforating both the ankle and the center of the feet as proposed by Dr. Gambescia. The True Copy of 1624 is kept in the Dominican Monastery of Our Lady of the Rosary in Summit, New Jersey. When I first read Carlos Evaristo’s **THE UNTOLD STORY OF THE HOLY SHROUD** it suddenly occurred to me that he had independently taken note of the antiquity of the ankle nail perception so I explored the idea further, consulting my collection of color transparencies of the 1624 True Copy. Until I had read this in Evaristo’s book, it had not occurred to me to think that perhaps past artists might have interpreted the Shroud markings in the manner proposed by Dr. Gambescia. (21)

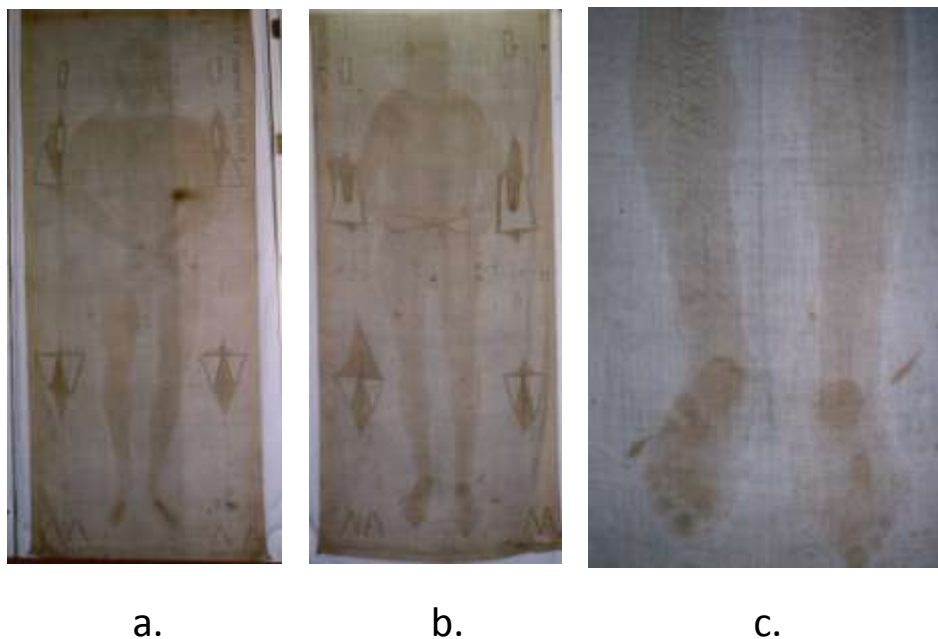


Fig. 20. Frontal, Dorsal and close-up of dorsal feet of the 1624 True Copy in the Monastery of Our Lady of the Rosary, Summit, New Jersey. Notice the apparent two wounds in the foot (one at the ankle and one in the center of the foot) on the right hand side of the photo in c. above.
 (Photos by the author) (22)



Fig. 21. Inscription: “CAVATO DAL ORIGINALE IN TAVRINO L ANNO 1624” (Photo by author).

A List of the Shroud's Anomalies: Problems with the Painting Hypothesis

Finally, if it is argued that an artist did paint the *original* Shroud—as this view has most forcefully been argued by the late Dr. Walter C. McCrone in so many of his publications—the Shroud now becomes most unique. We may therefore conclude this paper with a convenient list of anomalies, as they would become if a singular artist painted the original:

1. Artists down through the ages have presented the Crucified wearing a crown of thorns. The Shroud shows the Man of the Shroud with a “cap” of thorns.
2. Artists have always depicted the Man of the Shroud with no rope holding the torso against the stipes of the Cross. The Shroud appears to support the view that a rope pulled the torso back to hold it against the upright (stipes) of the cross.
3. Artists have traditionally rendered the Crucified with nails through the palms of the hands. The Shroud shows them to be through the wrists.
4. Artists have long painted the Crucified showing the arms in a “Y” type of stance. But Mons. Giulio Ricci, who studied this in detail, shows that the right arm was likely bent at a right angle, whereas the left was in the “Y” position.

5. Artists have followed several different paths in rendering the feet. Sometimes they show the feet (especially in crucifixes) with the right foot up against the stipes of the cross, and the left nailed atop the right—all with one nail. At other times they have depicted the left against the stipes with the right atop the left foot—again, all with one nail. And sometimes the two feet are nailed side-by-side on a slanted platform (suppedaneum). This latter view is common in Eastern Byzantine, Greek, and Russian Orthodox crucifixes. Gambescia's view would require two nails, one going through front of the ankle of the right foot to anchor it directly to the stipes, with the left foot nailed atop the center of the right using a single nail leaving the left foot free to swivel.

This list, then, and the complexity it represents, itself becomes a powerful argument ***against*** the position that the Shroud was a painting. No artist ***ever*** painted such a complex depiction of the Crucified. Yet, students of the history of art—interested especially in cladistics—can now actually see the Shroud as the ***beginning*** of a “tree of descent” where one can study just how the many painted views of the Crucified diverged over the centuries, influenced by various translations of the New Testament in conjunction with markings on the Shroud itself and the heavy pressure of tradition in numerous different geographical locales. But that would be the subject of another paper.

END OF PART TWO

“Joseph M. Gambescia, M.D., and the Position of the Feet on the Shroud of Turin. The History of an Investigation.” Endnotes for Parts One and Two

ENDNOTES

NOTE: Numbers in parentheses at the ends of sentences or paragraphs in the body of the paper, and occasionally in the captions to the figures, refer to entries here in the endnotes.

1. ACKNOWLEDGEMENTS: I am indebted to a host of people who helped make this research and the photographs and drawings in it possible. I have consulted with a number of experts during the research beginning in March of 1981. First and foremost, I discussed this paper at numerous stages with the late Dr. Joseph M. Gambescia. He has not only been my guiding light on the study of the feet but an inspiration and challenge to move forward and investigate many aspects of the concept as they came to light. It is most unfortunate that he did not have the opportunity to review the final version of this paper because his lamented death intervened; but I had his valued advice for a period of 10 years. His son, Stephan, kindly stepped in to read one of the more recent iterations (see below).

I have also profited immensely from my discussions and technical probes offered me by Isidore Mihalakis, M.D. and Malcolm Cowen, M.D., forensic pathologists in Eastern Pennsylvania.

The late Fr. Adam J. Otterbein, C. SS. R., President of the Holy Shroud Guild provided continuing inspiration, and discussion; also, the late Fr. Peter M. Rinaldi, S.D.B. made his Dutto Brothers life-size copy available and also discussion; the late Vernon Miller of Brooks Institute in Santa Barbara, California provided superb original glossy photographs of the Shroud from his portfolio of scientific photographs he took of the Shroud in 1978.

I am also grateful to Tony Mercadel of Eastman-Kodak in Rochester, NY, for his work in digitizing the special transparency of the area of the right foot on the dorsal end of the Shroud (see fig. 6.3) and kindly providing a very important computer enhanced photo of the critical area discussed in this paper.

Additionally, I thank Kevin E. Moran for making a specific measurement of the rivulet on his life-size backlit transparency of the Shroud.

I am also immensely grateful to the late Dr. Alan D. Adler for his kindness in carefully double checking on the Shroud itself in a private meeting of the Shroud Conservation Commission in June of 1997 regarding the details given in this paper treating the fluid flow from the “semi-triangular” mark on the Shroud. Dr. Adler requested permission from authorities at that time to take a sample from this fluid flow to

determine chemically whether it was blood or not. He was, however, denied that request. Thus, such a test remains a desideratum for future research.

I also extend a special thanks to Dr. Malcolm Cowen who helped me with the research project in understanding the wound in the top center of the right foot. I am further grateful to David E. Johnson who photographed the entire foot research session. (See Fig. 12, a. b. and c. and Fig. 13).

The crucifixion simulation photographs were done in four separate stages (See figures 15-17). I wish to thank my former pastor, The Rev. D. Craig Landis, for being the model for this project and, quite literally, suffering through uncommon agonies on those four different occasions in a most uncomfortable (often quite painful) position while the photography took place. Thanks are also due to my sons, Mark C. Maloney, and Edwin J. Maloney, and to Dr. Barry L. Ross, formerly a professorial colleague of mine at United Wesleyan College, and former Director of the Wesleyan Mission, Yokohama, Japan, for their generous help in setting up and carrying out the simulation events.

I am also very deeply indebted to two gentlemen who have reviewed this paper. I wish to express my appreciation to Dr. Malcolm Cowen, forensic pathologist in Eastern Pennsylvania, who kindly read an earlier iteration of this paper and suggested a number of important corrections all now included. And a major thanks to Dr. Stephen F. Gambescia, Assistant Dean of Nursing at Drexel University in Philadelphia, son of Dr. Joseph Gambescia, who very generously took time to read a more recent version and suggested numerous changes which I have also incorporated. Any errors which remain are mine alone.

See, additionally, the special thanks to the Dominican Nuns of the Monastery of Our Lady of the Rosary in Summit, New Jersey, in endnote 21.

My profoundest thanks to Barrie Schwartz of STERA who founded and has built the website, shroud.com over many years, with whom I have had many an illuminating conversation but who also generously provided me with ultra-high resolution photographs of the back lit Shroud for research purposes. A portion of that backlit image (the left foot) is to be found in the discussion in the Appendix; see also my discussion in endnote 24.

I also owe a debt of gratitude to Carolyn Scavone for her kindness in taking the time to put a black and white version of selected photographs into Power Point for the conference (shortened [i.e. 47 pages]) version of this paper presented in St. Louis, on Saturday, October 11, 2014 at the Drury Plaza Hotel in Chesterfield, Missouri.

Not least I owe an important debt to my anonymous reviewers who made extraordinarily valuable suggestions in their comments on the abstract. Where possible in the endnotes, I have tried to

incorporate their observations in one form or another. (For this please see the extensive endnote [endnote 13] on pareidolia.)

2. Much of the basic research for this paper was conducted in the Spring and Summer of 1981 and later throughout the ten years before Dr. Gambescia's lamented death in 1991. Dr. Gambescia kindly critiqued its medical implications. After his death I continued to consult the medical profession on all matters medical regarding the problems discussed in this paper. But, it must be emphasized, I am not a trained medical doctor. Much of my medical knowledge comes from my studies in anthropology and, later, as I studied the Shroud extensively and discussed matters with other medical sindonological professionals such as the late Dr. Robert Bucklin, former assistant medical examiner of Los Angeles County, California, Dr. Frans J. M. Weijffels of Maastricht, the Netherlands, and the late Dr. Frederick T. Zugibe, former Chief Medical Examiner of Rockland County, N.Y. I soon learned that even medical professionals could have divergent views on the interpretation of what we can see on the Shroud. However, it was reported to me by Carlos Evaristo that Dr. Zugibe acknowledged Dr. Gambescia's views and seemed, at least a few years before Dr. Zugibe's death, to have leaned more favorably toward Dr. Gambescia's views. Unfortunately, I am unable to state with confidence that Dr. Zugibe did, in fact, modify his stance about the feet being nailed parallel to each other. This two-part paper, then, must be seen largely as a "history" of this current medical investigation. As stated in my opening disclaimer, I leave it to the medical professionals to pick up the story to research, experiment and extensively investigate the matters I bring to their attention here.

3. I am fully aware of the many technical problems faced by Sindonologists with photo-lithography in publications on the Shroud. The important concern about pareidolia was made by one of my anonymous reviewers. I have not discussed it in the body of the text because everything here can be seen with the naked eye, without the extra benefit of digital enhancement. Nevertheless, I have used digital enhancement where I thought it would be a useful tool—particularly on one feature that was important for public viewing. Please see footnote 13 below for extended details on pareidolia and other problematic issues.

4. Mons. Giulio Ricci has published a treatment of this feature. See **The Holy Shroud**, p. 269. Curiously, the problem with Mons. Ricci's presentation is that he made no visual correlation with the flow from the heel out across the Shroud with the "islets of blood". More puzzling still, he appears to correlate the large blood stain on the dorsal end of the Shroud with the top wound in the center of the left foot! His presentation still leaves us with the question: "How did the two isolated islets of blood on the frontal end of the Shroud get there?" Dr. Gambescia's view beautifully explains this. The evidence for the blood solids penetrating the cloth appears on an unpublished slide in the possession of Dr. Eric Jumper. The matter has been verbally confirmed on a number of occasions by Dr. John Jackson.

5. A particularly vivid photo of this area (based, of course, on the 1931 Enrie photographs) was published in Werner Bulst, S.J., **The Shroud of Turin**, (1957), The Bruce Publishing Company, photo no. 12, caption 12, p. 164, and see the text discussion on pp. 62-65. Bulst proposes that the stance of the feet are best explained by the feet having been mounted on a suppedaneum—a “footrest”. But studies by Gino Zaninotto indicate that the suppedaneum was not developed for Roman crucifixion in the first century C.E. , that it was later (source: unpublished manuscript in this author’s possession (P.C.M.)). See the inclusion of Dr. Zaninotto’s unpublished manuscript in the references . If the suppedaneum was not used in the first century C.E. then the feet must have been nailed directly to the stipes of the cross. This concept is supported by the first century burial of the crucified Yehohanan ben Hagkol found at Giv’at ha-Mivtar where the nailing through the calcaneum was through the side, not through the top. See endnote 20 for references to this discovery.

6. Dr. John Jackson has confirmed the presence of these reddish-orange agglomerate particles, especially associated with the image area of the Shroud. However, he believes the greater proportion of this material is probably abraded from the defined blood areas already present on the cloth and that this probably occurred as a result of the folding and unfolding, and/or rolling and unrolling of the Shroud over the centuries.

7. For a general discussion of the tucking and folding concept see Barbara M. Sullivan, “The Shroud of Turin: A problem in spatial perception, historical perception, and art perception.” In Fr. Aram Berard, S. J. (Ed.). **History, Science, Theology, and the Shroud**. n. d. [1991], pp. 25-71. See also her earlier article “How, in fact, was Jesus Christ laid in his tomb?” which was published in the popular journal **National Review**, (1973, 20 July, pp. 785-789), the reviews in the same journal by R. Bolt (1973, 26 Oct., p. 1146) and J. F. Kayser (1973, 26 Oct., p. 1146-1152), and her responses (1973, 26 Oct., pp. 1152-1153). Mons. Giulio Ricci has also discussed the tucking issue. (See **The Holy Shroud** pp. 256-261).

8. As per discussions with Dr. John Jackson. The evidence for the droplet on the non-image side of the cloth is preserved in a photographic transparency in the possession of Dr. Eric Jumper.

9. My thanks to Kevin E. Moran who measured this fluid flow for me on his life-size Kodak Duratrans copy of the Shroud. However, we must keep in mind that since cloth is a flexible and “plastic” material which has been stretched many times for examinations and held up for ostensions this measurement (taken from the 1978 STURP photographs) may not necessarily be “hard and fast”. It is therefore preferable to say that the measurement is an **approximate** one.

10. See, basically, L. Don Leet, et al. regarding the list of the geophysics of fluids. The list, as such, does not exist in Leet’s book. And not everything in Leet’s chapter on “Running Water” will apply. I have extracted, distilled and adapted the items in the list from the larger context of the discussion there. Scientists and other investigators may well find their curiosity piqued, and questions may be raised with the listing of these geophysical features about fluid flows. Indeed, I truly hope that this paper may be

the beginning of numerous spin-offs by investigators who have access to more appropriate equipment who can test some of these factors and relate them to the fluid flows on the Shroud.

11. See Mons. G. Ricci, **The Holy Shroud**, p. 249 where he proposes that the imprint was caused by three fingers grasping the sole of the left foot creating the “blank” between the blood traces. However, one problem not addressed by Mons. Ricci is that by placing the three fingers on the bottom of what one might assume to be a blood coated sole (in the same manner as the right foot?) the blood would have left smearing but it would also, since it was still wet, would have left traces in the interstices of that weave. We would expect that such blood would not only show up on the frontal view of the Shroud, but also in the backlit copy of the Shroud photographed by Barrie Schwartz literally in the waning moments of the STURP investigation in 1978. Where I could examine published photographs of this backlit view, it appeared to me that the frame of the table on which the Shroud was mounted, may interfere with viewing the crucial aspects of the left foot to “test” whether or not the above observation can be borne out. However, spectral examination and chemical analysis might be able to test his hypothesis. However, what we see on the “left foot” image is a “shortened” version when placed alongside the right foot. The “heel” portion of the blood flow can, roughly, be placed at the same level as the “heel” of the right foot.

Yet, the long narrow rivulet that runs toward what we presume might have been toward the area of the big toe on the left foot, (perhaps ending on the “ball” of the left foot) indicates a fast flow of blood while the Man of the Shroud was still in the upright position on the cross, (the blood is still mixed, therefore the heart was still pumping) as opposed to the position he would have been in while being carried to the tomb. See my discussion of this on pp. 31-33, 44-47, 52-55, and in the Appendix on pp. 101-106.

The alternative approach in this paper is to see these as flows on the bottom of the left foot caused during the swiveling of the foot while the Man of the Shroud was still alive moving up and down in his attempt to breathe. This is presented to Shroud researchers for their consideration and future additional research. Mons. Ricci’s highly detailed crucifix showing the various stances of the right and left arms would seem to imply that swiveling of the feet did, in fact, occur. However, Mons. Ricci does not seem to carry forward with this idea to explain the “pattern” on the sole of the left foot. See the crucifix on p. 184 of his book **The Holy Shroud** and his drawings of the arms on p. 160 along with his discussion on pp. 160-164. How many times did the Man of the Shroud raise and lower himself? Ricci suggests that this “happened only a few times.” (Ibid, p. 162). However, if the flows on the bottom of the sole of the left foot are used to answer the same question, then maybe the Man of the Shroud raised and lowered himself many more times than just a “few” (See the discussion in part two of this paper above).

There is one other observation about the left foot I did not explore in this paper. From some experiments I have conducted there appear to be “droplets” of blood (many of them!) hanging in

suspension on the bottom of the left foot where the blood seems to have coagulated, creating exudates where darker material of the exudates congregate to the periphery of the droplet to leave serum in the center of each coagulating droplet. This pattern appears to be “undisturbed” on the left foot but no such similar pattern occurs on the right foot. This is a pattern that needs to be explored further by medical professionals. My present assumption is that when the Man of the Shroud was carried to the tomb he was not carried with portions of the body covered with blood—because in Jewish view “The blood is the life” (Leviticus 17:14) and would not have been disturbed by touching or smearing it. More likely, the body of the Man of the Shroud was carried by two persons, one holding the torso under the arms but pivoting the body with the left side facing in the down position, and the other person carrying the legs, perhaps by the shins or behind the knees. Sadly, because Dr. Gambescia had already passed away, I did not have the opportunity to discuss this facet with him. I leave it to modern medically trained persons to explore it further.

12. On the other hand the “rosette” area at the bottom of the center of the right foot exhibits a different pattern. It varied in gradations from very dark at the presumed exit areas, to a bit lighter in the border surrounding the exit area, to highlighted haloes with what UV photography and lab experiments would suggest is serum at the outermost border of the wound. (Miller & Pellicori, 1981, p. 85).

13. Technically speaking, the markings on the Shroud, which I consider in this paper to be supportive of Dr. Gambescia’s approach, cannot be classed under any sort of pareidolia. This is because the definition of “pareidolia” has parameters that contain cultural components—i.e., what we “expect” to see due to our eye-brain connection, often influenced by our own cultural background. So, for example, Americans tend to see the “man in the moon” in the night sky whereas in Japan people may see a “rabbit eating rice.” More recently space craft pictures sent back to earth have been variously interpreted by humans as showing a man’s face on comet 67P (Rosetta space craft), or a man’s face on Mars seen in the Cydonia region, or an elongated “human skull,” also on Mars, or even a “traffic light” (!) lying on the ground as photographed by the Curiosity Rover.

Nevertheless, my request to Dr. Adler was precisely because of my concern regarding pareidolia. In my case, I wanted to be absolutely certain that the features discussed in this paper could be seen easily by the human eye. This problem is well illustrated in Ray Rogers review of Mark Antonacci’s book, **Resurrection of the Shroud** wherein he states:

With regard to other images on the Shroud, few of us can see them. "I think I can see" is not a substitute for an observation, and observations must be confirmed. When Fr. Francis Filas (deceased) claimed he saw the coins, lituus and all, he was looking at specific photographic prints. He had many prints produced at increasing contrast. Finally, all that was left was strings of dots. It took a numismatist who was familiar with ancient Roman coins weeks to "see" the lituus in those photographs. Your mind tries to make sense out of any "patterns" your eye can see. Psychologists have a lot of effort

invested in studying such phenomena... It is dangerous to build a scientific theory on such shaky foundations. Your mind tends to see what it expects and/or wants to see. (Rogers' review, p. 15, available at: <http://www.shroud.com/pdfs/rogers.pdf>).

The ever present danger of pareidolia and other related issues covered in this extensive endnote (including such problems associated with photo-lithography in the publication process; photo flip-flopping [see 13.a below]; cropping, [see 13.a below] etc.) promoted my extreme caution when I asked of Dr. Adler this special favor to examine the Shroud in person in June 1997 to verify whether or not the markings that had been digitally enhanced were there and could be seen without digital enhancement. This footnote, then, not only covers pareidolia, but also other problems that are not technically defined as pareidolia.

But first, see the important cautionary article by Dr. Danielle Murra and Dr. Paolo Di Lazzaro in **THE INTERNATIONAL WORKSHOP ON THE SCIENTIFIC APPROACH TO THE ACHEIROPOIETOS IMAGES** (edited by Dr. Paolo Di Lazzaro). (Conference organized at ENEA, Frascati, Italy) entitled "Sight and Brain: an introduction to the visually misleading images." Pp. 31-34. [NOTE: See now the more recent online publication entitled "Perception of Patterns after digital processing of low-contrast images" authored by Dr. Paolo Di Lazzaro, Dr. Daniele Murra and Barrie Schwartz. This can be found at the following link: http://www.frascati.enea.it/fis/lac/excimer/sindone/2012_12_ENEA.pdf] (I thank my anonymous reviewer for this information).] (Although I do not use the term "pareidolia" anywhere in the body of the paper, I had already incorporated my concern about the topic when I discussed G. Enrie's use of orthochromatic film in his photography of 1931.

Sadly, there has never been published an "atlas" of the Turin Shroud that might have presented definitively important tools to aid the sindonologist. A few examples are the STURP generated scientific tools such as the UV photographs taken in 1978 (published in the **Journal of Biological Photography** but woefully lacking in resolution due to the lithographic technique employed and, therefore, virtually not usable!), full X-ray frames taken in 1978 by Bill Mottern and his colleagues but only briefly published in the scientific journal **Materials Evaluation**, the (back-lit taken by Barrie Schwartz in 1978) of the weave of the cloth; and the "quad mosaic" produced and developed by the late Don Lynn and Jean Lorre of Jet Propulsion Laboratory, in Pasadena, CA. To try and achieve this "atlas" goal, Kevin E. Moran (an optical engineer with Estek (a spin-off of Kodak), The late Rev. Albert R. "Kim" Dreisbach, the late Dr. Alan D. Adler, blood chemist with Connecticut State University, Tony Mercadel, , Gus Kahwati (both then affiliated with Kodak), the late Don Lynn (of Jet Propulsion Laboratory in Pasadena, California, the late Fr. Adam J. Otterbein, C. SS. R., president of the Holy Shroud Guild, myself and several others went as a delegation to Kodak in Rochester, NY to see if we could enlist their help in producing such a tool. Lamentably, Kodak was in the throes of their own budgetary problems and could not offer a solid plan to make it happen. So far as I know, no one has "picked up the mantle" to carry forward with the concept. It is still badly needed. Perhaps it might be achieved in an on-line version.

How do we safeguard against pareidolia and other features that may distract us from the true science of the Shroud? My effort over the years was to be certain that what I could “see” on the Shroud was a real feature embedded in or on the original cloth, instead of some pattern that my eye-brain connection insinuated upon me, and this led me to the sequence of events recorded in this paper that I followed in attempting to certify this as a real, genuine product of a cloth-body contact. This entire paper in fact, may be seen as a collection of such observations and experiments emanating from my intense concern to safeguard against pareidolia. Extensive experimentation, repeated discussion of the feature with others who have dealt with optical phenomena (and specific measurements by them), and finally, asking: “Does this proposed feature fit logically and comprehensively into the global scheme of—in this case—a bio-physical phenomenon recorded on the Shroud?” Some may suggest that my effort to demonstrate this was “extreme.” Personally, I do not think so. The eye-brain interconnection is very real. This is all the more true when it comes to the Shroud because many suggestions have been made over the years from those who found “inscriptions” “images” “implements of crucifixion” even “Roman armor” and other things in photographs of the Shroud. It is not my purpose in this paper or even in this footnote to explore in detail what components on the Shroud may cause this but, in passing, one may suggest the following: the tightness/looseness of the weave caused by production of the cloth on an ancient loom, variations in the TEX of the threads, variations in hank bleaching, etc. [regarding the tightness/looseness of the weave in the Shroud, Jean Brabbinger, a textile specialist with the Scottish Woolen Centre in Stirling, Scotland, explained to me in Sept., 2001 that an experienced weaver would often have a young apprentice who was not as experienced or as strong as the older, more mature weaver. Hence, the experienced weaver would be able to draw the weft yarns tighter on the loom, whereas the inexperienced apprentice would not be able to produce as tight a weave. This feature stands out clearly in the remarkable backlit photographs taken by Barrie Schwartz in 1978]. Additionally, the herringbone pattern itself, the variations of lignin in each individual fiber, and other anomalies in the weave may need to be considered as contributors to what we see on the Shroud.

That having been said, we must nevertheless be cognizant of the dangers of pareidolia when studying the Shroud. We can easily apply the discussion presented in Dr. Murra’s and Dr. Di Lazzaro’s Frascati paper to create a list of applicable observations as general rules to follow in order to maintain objectivity regarding the possibility of pareidolia. Indeed, this effort to apply the Frascati paper to the topic at hand could be made into a separate paper for the future guidance of Shroud researchers by incorporating their observations with what I offer below. But, for the present, I will have to limit my comments. Throughout the following list there is a basic assumption emanating from my discussions with Dr. Gambescia. He firmly believed that his medical observations related to the Shroud and its image convinced him that this cloth had once wrapped a genuine corpse. For him it could not be a painting, nor could it have wrapped a hot statue. Based upon this founding assumption, therefore, my research over the years (1981 to the present) into Dr. Gambescia’s proposal has encompassed the following 15 questions:

a. Are the tools Shroud researchers use accurate? I would suppose that 99.9 percent of all Shroud researchers use photographs for their study of the Shroud. It is a very rare researcher that can have an emissary visit the original Shroud (as Dr. Alan Adler did for me) to verify the realities compared between the photographs and the real thing. It is also wise to be aware that sometimes publishers will unknowingly “flip flop” photographs of the Shroud making a feature that is known to be on one side, to appear (mistakenly) on the other side.

For example, sometimes important facets of the Shroud have been cropped out of publications. The “fold-out” Shroud published in **National Geographic** (June, 1980) had the “islets of blood” completely or partially cropped off the frontal end of the photograph!

The image on the Shroud is vague at best. But if publishers print a lighter ink than is appropriate, some important features (which show up in other photos) will occasionally not show up at all! The semi-triangular marking can actually be seen on the **National Geographic** fold-out. But if the original Shroud is vague to begin with, how can this be?! Vern Miller told me that the photograph he sent **National Geographic** was a black and white high definition version; I have, in fact, one of these given to me by Vern, in my own collection. So how is it that the Shroud has a sepia color in the **National Geographic** June 1980 issue? Vern explained that it was published as a “false color” rendition to emulate more closely the color of the original Shroud. By using a black and white high definition photograph and false color printing, publishers can circumvent the problem of lack of detail in color photographs. Nevertheless, there is danger that such publications can introduce false “information” into the very tools we depend upon. It was precisely this caution that impelled me to request of Dr. Adler a check of the original Shroud to verify that the “semi-triangular” marking and the emanating rivulet were actually on the cloth.

It might be relevant to ask: do publishers “control” for their color photos? What “pixilation” do they use in the lithographic printing (i.e. dots per square inch?). Color photos do not show detail as well as black and white photos. I prefer to use high definition (i.e. high resolution) first generation photos to ensure that I am seeing the details that are truly there; and I prefer to supplement all my studies with both color and black and white. Close-up photos of areas I’m studying are also a preference. But sometimes there is an advantage to seeing the “global” picture in “small”—a phenomenon Dr. Gambescia called “mini-fication.”

Some photo-tools have never been adequately published. For example, although ultraviolet photographs were published by V. Miller and S. F. Pellicori in the **Journal of Biological Photography** (see the end references), the actual photographs published are virtually useless to the investigator simply because of their low “pixilation”. Only original glossy UV photos (to which I did not have access) or high quality adequately color controlled lithographic publication would be of use to the investigator.

Other photo-tools have never been published in a technical journal at all. For example, the so-called “blue quad mosaic” (but extremely valuable photos) taken by the late Don Lynn and Jean Lorre of the Jet Propulsion Laboratory in Pasadena, CA have never appeared in a peer reviewed publication to my knowledge. They may, however, be available by going to Shroud.com.

b. How does the entire cloth with its visible stains relate to the texture of the whole cloth and to every other individual stain? I first tried to investigate this by using multiple glass overlays and, finally, a plastic sheet with the image imposed on the transparency. These are illustrated in the paper. In particular, I used this method to study the “islets of blood” but that overall relationship can be shown to have consistent interrelationships with other stains on the body.

c. How does this rivulet relate to other apparent liquid flows and/or patterns on the Shroud? In this case we examined the crossover of the rivulet from the “semi-triangular” mark as it passed over the stain margin from the fire of 1532. They do not appear to be at all related and I have concluded in the body of the paper that they are separate events.

d. Is the proposed feature larger than the substrate weave pattern? When I was first in Shroud research this was my earliest rule to develop a way to guard against pareidolia. It came about from an observation made by Samuel Pellicori when he critiqued an article appearing in **Current Anthropology** written by Bill Meacham (I quote Pellicori as follows: “Much heat and emotion have been generated over the “findings” of inscriptions, coins, etc., by some people. The methodologies of these people are in themselves suspect, a problem often encountered when nonscientists attempt to apply scientific techniques. Regardless of that observation, examination of high-quality STURP photos failed to reveal unambiguous letter forms [on the coins, (P.C.M.)]. The technique of pre-exposing a pattern to the retina (Whanger) assists the eye in seeing this Pattern in a subsequent field of dots which are unrelated (except for a preferred linear trend due to the weave structure). STURP scientists issued a statement to the effect that letters could not be identified from examination of the photos. This was more than one year ago. Until objective (and reproducible) methodologies are devised and applied to the problem, the coin-letter data point is insubstantial.” See his fuller comments now conveniently available at <http://www.shroud.com/meacham2.htm> .)

I had numerous phone conversations with the late Fr. Francis Filas of Loyola University in Chicago regarding the problems the inscription on the coins made and cautioned him that we may never be able to scientifically resolve the matter. But he did try. (His basic problem, however, was that he was depending on Giuseppe Enrie’s orthochromatic photos of the Shroud). This rule, however, does not apply to anything that appears in this paper because I have ignored all features which are the same size or smaller than the weave of the cloth.

e. If it can be seen on the 1931 orthochromatic photographs taken by G. Enrie, can it also be seen on later photographs where a different film type was used? In this case, I first used the high

definition glossy black and white original photographs kindly provided to me by the late STURP member, Vernon Miller of Brooks Institute, who did the scientific photography of the Shroud in 1978. Later, I examined the “fold-out” version of the photograph taken by Gian Carlo Durante published in **Sindone immagini 2000** by ODPF (2002) and those by Gian Carlo Durante published in G. **Ghiberti’s Sindone: le immagini, 2002, Shroud Images** also published by ODPF. See the fig. 9 fold-out in this publication where the “semi-triangular” marking and the lead portion of the fluid flow from it can be seen without the use of digital enhancement. The detailed close-up can be seen there in figure 6. In all such cases I was able to discern the semi-triangular marking and the lead fluid flow proposed to emanate from a wound in the top center portion of the right foot.

I could not, however, clearly discern (in figure 14) this fluid flow on the backside of the Shroud in this same publication (taken during the intervention of 2002). Perhaps it would show up in a closer view. But, if not, it is likely that neither the fluid nor the “stencil” record of the “semi-triangular” marking penetrated the cloth. It is probably true that there was not enough blood surrounding the “semi-triangular” marking to seep through the cloth. The fluid flow probably evaporated shortly after it was emitted from what Dr. Gambescia and I believe was the top center wound of the right foot where the cloth was positioned over the foot during the burial.

f. Can it be measured? In this case Kevin E. Moran was able to make such a measurement of the rivulet on his lifesize Duratrans. But we need to keep in mind that the cloth of the Shroud is a flexible, stretchable fabric which has been held up for display many times over the century. No measurement can be trusted to be a hard and fast rule. Thus, any such measurements can only be approximations.

g. What caused the stain margin? There is an apparent series of stain margins that may, reasonably, be explained as “the slow seeping of blood serum, in its final stages after the heart stopped pumping, from a wound in the top center of the foot that was drawn by capillary action from that perforation to gradually wet the cloth and cause a ‘series’ of loosening of the cloth in stages away from the perforation until it created the furrow down which the fluid flowed rather rapidly on the cloth.” It is this stain margin that Dr. Alan Adler had requested samples from to be tested to ascertain the presence of blood solids—i.e. the hypothesis that the stain margin is, itself, composed of blood solids that have gravitated through the fluid to the stain edge. His request was unfortunately denied. But this still remains a goal for future testing. I have not tried to explore this series of stain border markings in this paper. I simply take note that they can be seen in the high definition photographs taken by Vern Miller.

h. Does the proposed “semi-triangular” wound/rivulet fit into the more general “global” proposal of the stance of the feet in Roman crucifixion and, in particular, in the global scheme as it has been reconstructed on the Turin Shroud? In this regard, we must consider all the other blood flows one can see on the Shroud and ask: “How do their flows show relationship with the specific focus on this

study of the “semi-triangular” mark and rivulet?” Some, patently, will not simply because they were issued from wounds that took place in a different setting and position: There are three such settings which are proposed in the body of this paper and which Dr. Gambescia had assumed: 1). CRUCIFIXION: When the body was on the upright (stipes) of the cross in the vertical position; 2). REMOVAL: When the body was removed from the cross and carried to the tomb in the “sideways” position. 3). DEPOSITION: When the body was laid in the horizontal (supine) position on the burial bench.

i. Can further experimentation elucidate the features we seem to “see” on the Shroud? In this regard I obtained the help of two forensic pathologists to conduct such experiments with amputated appendages to test what such para-sindonic investigations can reveal. One project was to explore the wound in the side (with the aid of Dr. Isidore Mihalikis) but not topically relevant to this paper. The second project, with the aid of Dr. Malcolm Cowen, was to explore the nail wound in the top right foot. That research is incorporated as an excursus in this paper. (See pp. 57-64 above).

j. Can the feature we are studying be shown to fit into the laws of geophysics? I have explored this with my inclusion of such “laws” here in this paper as drawn from the study of fluid flows found in the sixth edition of L. Don Leet, Sheldon Judson, and Marvin E. Kaufman’s **Physical Geology**. (See endnote 11 above).

k. Can simulations recreate situations that help us to expand our perceptions and provide an aid to the overall comprehension of our goal of study? The re-creation of the proposed stance of the feet which are illustrated in this paper, the re-creation of the actual life-size burial cloth that wrapped the feet, all are attempts at broadening our perception so that we safeguard against “seeing” on the cloth what we think we want to see.

l. Can the feature under study be explained by the substrate weave or anomalies therein? In actual fact, when one studies the very narrow stain margin and its “meanderings” one suspects that there is a capillary interaction between the weave and the movement of the fluid down the hypothesized trough. But I did not have access to the necessary equipment to demonstrate this possibility and so it remains as a research goal for the future and an off-shoot paper exploring it.

m. Can we show that the proposed stance of the feet do fit into Roman crucifixion? In this regard we will need to spend more time combing through the literature and, in particular, further studying the singular discovery of the bones of Jehohanan found at Giv’at Ha-Mivtar. Unfortunately, archaeology provides only that one piece of evidence so we cannot reconstruct a pattern. However, if one studies the literary remnants of Roman crucifixion—for example, in Josephus—we may come up with a broader context within which we can set the suggested stance found on the Shroud of Turin. (See further on this my discussion in endnote 20, below. That literature implies that the Romans were quite creative when they crucified the more than 2000 Jews mentioned by that late first century writer. A convenient gathering of material on the subject of Jewish burials can be found in Joseph Marino, **THE**

BURIAL OF JESUS OF NAZARETH AND THE SHROUD OF TURIN, 1999, published by Jeff Richards, SFO, 1241 N. East St., Suite 38, Anaheim CA 92805. For reference to the discovery at Giv'at Ha-Mivtar see p. 17.

n. Can chemical and/or spectral analysis for blood at the stain margins confirm the hypothesis presented above? This is a desirable goal to request for the future on the areas under study in this paper. Controls should be conducted on areas of the cloth where it is already known that blood is not likely to be present. But it is also prudent to be cognizant that flakes of blood are known to have broken away from original blood areas and to have been transposed to other areas of the Shroud.

o. Finally, does the proposed feature on the image fit into the historical time frame or cultural context thought to be representative of the Shroud? Does it mesh with the other global features, biologically, found on the Shroud for which there is no controversy? An example of this is Dr. Alan Whanger's suggestion that the Man of the Shroud was wearing a phylactery (Heb. teflin) on his forehead when he was buried. He obtained photographs of a phylactery; but the type he used (i.e. a box-like shape) was common to the 14th century C.E. This could, therefore, be used as "evidence" that the carbon 14 dating of the cloth was, after all, "accurate." But the phylacteries found at Qumran, representing first century forms, are quite different in shape (they are "pouch-like") than like the 14th century teflin. Moreover, the proposed "band" holding the phylactery to the forehead, is more likely to be a feature of the weave rather than true evidence for a band holding a phylactery in place. Additionally, there is a clear reverse "3" in the blood flow and if a phylactery were to be on the forehead it would have prevented the cloth from picking up this distinctive rivulet. I have respectfully submitted in discussions of this feature that archaeology argues against the presence of the proposed phylactery.

14. Actually, although Dupuytren is acknowledged as having been the first to notice this feature, it was the Austrian anatomist, Karl Langer—hence the feature is often known as "Langer's Lines"—who studied it intensely.

15. I wish to thank Dr. Cowen for his generosity and kindness in providing me the blood for my experimentation. In my judgment much more work needs to be done on this matter with tests of both coagulated and un-coagulated blood as well as water with iron and saline solutions. The viscosity of the blood is a factor as is the "drag" of the texture of the cloth on the speed of flow. My goal in testing this was to study the creation of the serum stain border. My purpose was not to study transference of blood from skin to cloth as was done by Dr. Gilbert R. Lavoie, et al in their work (for which see [Shroud Spectrum International](#), nos. 7 (June, 1983, pp. 15-19), 8 (Sept., 1983, pp. 2-10) and 20 (Sept., 1986, pp. 3-6). Therefore, I only used eyedroppers to put drops of blood and serum on cloth and studied the timing. In other experiments, I studied fluid flow using only water.

16. See the acknowledgement regarding my former pastor in footnote 1. I must emphasize here that this was, of course, not a true crucifixion. It was a simulation of the stance of the feet in a

crucifixion as proposed by the late Dr. Joseph M. Gambescia as presented in this paper. The set up was accomplished by placing a hand-hewn barn beam across two saw horses beneath which I placed a large sheet of chalk paper on which I had drawn clouds. My pastor then laid down horizontally on the barn beam. While the nail used in the photograph showing the beginning of the nailing was a genuine iron nail, it was only manufactured by me and used in that photo to show the first position of the nailing at the front of the ankle. The heads of the nails in the other photos are made of balsa wood and painted to mimic iron and they were “stuck” to the foot by Halloween blood. The photos were accomplished with Kodak transparency film by placing a tall step ladder near the layout of the total assemblage of saw horses, chalk paper and “body” and photographing downward from an overhead position. My sons, who assisted me, had to bend the left foot into the proper position and the photo quickly taken because of the considerable pain caused by the simulation itself. My colleague, Dr. Barry L. Ross, held the iron nail in place for the photograph seen in Fig. 15.a. Sometimes the hot sun melted the Halloween blood and the balsa wood slid to a position not acceptable for the finished illustration. That was why we restaged the photographic work on some four different occasions before “getting it right.” When properly cropped and presented here, the photos only give the illusion of a crucified person in an upright position. I am most grateful to my pastor for his considerable patience and long-suffering in this effort.

17. In actual fact, the photographs presented by Ricci on p. 193 are not Roman spears, but are rather Canaanite in origin, roughly some 1300 hundred years earlier than the Roman era, coming from a Middle Bronze cemetery in Upper Tiberius in Israel. These photos may be seen in their original publication by consulting Israel Exploration Journal (IEJ) Vol. 18, no. 1, (1968) in plate I A. The three larger points are actually daggers while the smallest one at the far right in the photo is an arrow head. The photo Ricci presents has been flip-flopped from the original in the IEJ photograph.

18. I wish to extend my thanks to Dr. Isidore Mihalikis for his very kind help in performing the experiments that elucidated the structure of the wound in the side of the Man of the Shroud. Discussion of that important experiment will have to await another paper in which I discuss the wound in the side. We used amputated appendages in all of our work.

19. The photographs of the burn holes after the patches were removed may be seen in the publication of the Shroud released after the “intervention” of 2002 in Mechthild Flury-Lemburg, Sindone 2002, L'intervento conservativo Preservation Konservierung. Editrice ODPF, Torino 2003, (see the “global “ view of the Shroud on p. 88, and on p. 90 regarding the flow across the back, in the right hand photo).

20. The yellowish tint of the wood in the drawing is deliberate. It is meant to emulate olive wood. In 1968 archaeologists discovered the ankle bone of the only scientifically proven crucified man found by archaeologists in Israel. It was discovered in a tomb from the first century AD, inside a bone box

(ossuary) with the name scratched on it: "Yehohanan ben Hagkol". The nail had penetrated through the side of the ankle and into an olive wood stipes (upright of the cross). When the nail hit a knot in the wood, the iron point curled around a portion of the olive fibers in the stipes. When it was removed from the stipes for burial those fibers were what proved what the original stipes was made of. (See Nicu Haas, "Anthropological Observations on the Skeletal Remains from Giv'at ha-Mivtar" published in the **Israel Exploration Journal** (IEJ) in 1970 (vol. 20, pp. 18-32). Haas was with the Department of Anatomy at the Hebrew University of Jerusalem.

This discovery has been discussed in many publications dealing with the Shroud. See, for a few examples, Mons. Giulio Ricci's treatment in **The Holy Shroud**, pp. 177-182; F. T. Zugibe in **The Cross and the Shroud** (1st edition, (1981), pp. 79-87; 2nd edition (1988), pp. 71-75; Zugibe, **The Crucifixion of Jesus: A Forensic Inquiry**, (2005), pp. 90-95. A more recent discussion of this crucifixion has been issued by Joe Zias and Eleazar Sekeles in **IEJ**, 35 (1), "The Crucified Man from Giv'at ha-Mivtar." pp. 22-27.

We must be careful, though, not to take this singular example of crucifixion as the "gospel" for how Romans actually practiced all crucifixions in the first century. Josephus tells us that thousands of his countrymen were crucified. And the modes of their crucifixions were quite varied!

Varus then sent part of his army through the country to search for those who were responsible for the revolt, and when they were discovered he punished those who were most guilty but some he released. The number of those who were crucified on this charge was two thousand. (Josephus, **Jewish Antiquities**, Book XVII, 295).

The soldiers out of rage and hatred amused themselves by nailing their prisoners in different postures; and so great was their number, that space could not be found for the crosses nor crosses for the bodies. (Josephus, **Jewish War**, V, 451).

Yet the Yehonanan ben Hagkol crucifixion is the only archaeologically proven example of a crucifixion found in the Holy Land. One example does not a pattern make. Tradition has it that St. Peter was crucified up-side-down. Dr. Gambescia's proposal illustrates another mode of crucifixion for the feet different from that of Yehonanan ben Hagkol.

21. I led a team of ASSIST specialists to Summit, New Jersey, to the Benedictine Monastery of our Lady of the Rosary. All of us owe a special debt of gratitude to these wonderful and dedicated nuns, led at the time by Prioress Mother Mary Albert. They graciously hosted our team, or various members of it, during four different occasions of our investigations and photography between May and November of 1987.

Carlos Evaristo, in his book **The Untold Story of the Holy Shroud**, p. 258, bottom photos, brought to my attention the possibility that the 1624 True Copy might be an early interpretation of the wound in the

front of the ankle. But I was not certain that the translation made by the late Antonio de Matos actually said what I thought it did.

I contacted the author to verify the view I believed he meant. In an e-mail to me dated to June 11, 2014 he said, **“Yes, what I was pointing out in that talk as briefly and badly detailed on page 258 was precisely that the artist of this True Copy had interpreted the Turin Shroud dorsal feet as you said, representing nail wounds in the FRONT of the ankles of the dorsal feet. ...I had first pointed this out to Fred Zugibe in a letter I sent to him in 1996 and he agreed with me and later shared that indeed Dr. Gambescia had proposed that the markings on the Turin Shroud represent a nail wound securing the right foot to the stipes of the cross in a similar manner.”**

I think, however, it would require a separate paper to adequately probe the artistic interpretation of the 1624 True Copy (or other True Copies that may also be candidates for it, as both Carlos Evaristo and I believe is true).

22. The True Copy in this photo is temporarily mounted on a special table created by Kevin E. Moran of Charlotte, North Carolina. The table was built with a second round of research on the Turin Shroud in mind. Mr. Moran, who was part of our 1987 team, was very kind in making this available to our research team for the study of the 1624 True Copy at the Monastery of Our Lady of the Rosary in Summit, New Jersey in May of 1987. I owe Mr. Moran a profound debt of gratitude for this act of generosity.

23. The Appendix is a later iteration of the photo-chart on p. 21. The numbers will not always match and the investigator who uses this photo-chart should treat everything in the Appendix as self-dependent.

24. The photo and drawing are intended to be used as illustrative only. Because the cloth is flexible and because there is no image of the left foot on the Shroud this leaves matters open for considerable subjectivity. I make the following assumptions:

- a. That the cloth wrapped the left foot on a corpse.
- b. That all flows follow the law of gravity (see p. 54) and of geophysics (see pp. 48-52)
- b. That the blood flow is recorded not on the side of the left foot as the position of the nail would indicate on the only crucifixion victim found in archaeological context (see endnote 20 above) but on the **bottom surface** of the left foot as seems to be clear from the markings on the Shroud.
- c. That blood dripped off the outer edge (blade) of the left foot as illustrated below in the drawing. This view is fully supported by evidence seen in the backlit photo of the left foot which

shows intensely dark, opaque, blood spots (nearly “black”) which appear the heaviest on the “blade” of the left foot. These spots mean that the blood is so pronounced, i.e. so impregnating the cloth here that no light can pass through to the camera at those spots! (I am profoundly indebted to Barrie Schwartz for providing me with ultra-high resolution photographs of the backlit Shroud which shows this information).

d. That the small “pool” of blood at the end of the long narrow flow ended on the “ball of the foot.” (See Fig. 24 below).

Dr. Joseph M. Gambescia and the Position of the Feet on the Shroud of Turin. The History of an Investigation.

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LEFT DORSAL FOOT BLOOD FLOW SEQUENCE

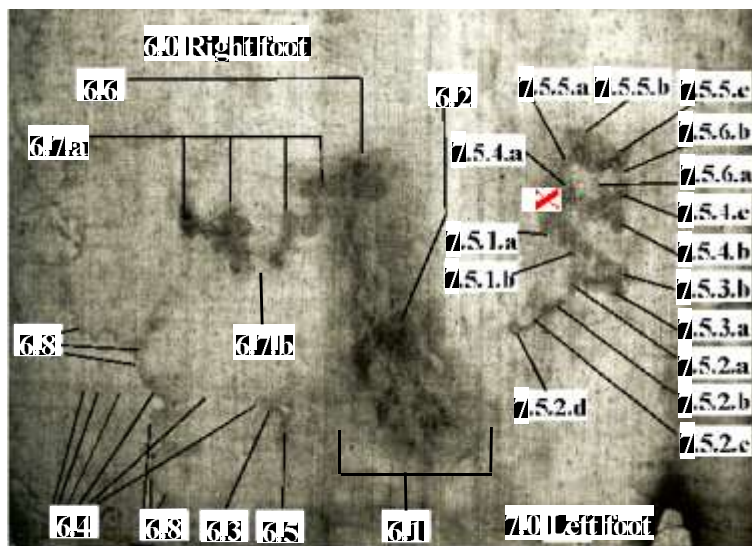


Fig. 21. Left Dorsal Foot Blood Flow Sequence

6.0 (See pp. 21-31 above for discussion of Right foot). (23)

6.1 Full blood imprint of right foot.

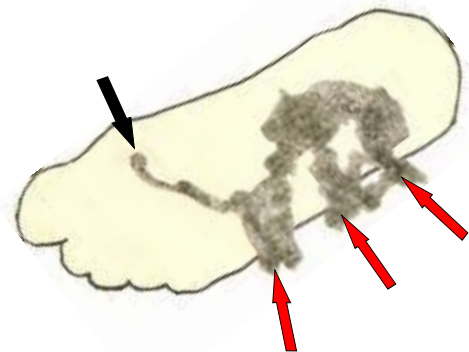
6.7.b. The split in blood flow off from the heel area of the right foot. This is probably due to a wrinkle in the cloth.

7.0 Full Left foot blood flow sequence.

The numbering sequence for the feet (the right foot is on the left in the figure above) has been updated to a more recent format here; an earlier iteration may be found in Fig. 6 of this paper on page 21. Please ignore the numbering for the right foot in the figure above.

The numbering sequence for the left foot (on the right hand side of the figure above) is intended to indicate the temporal sequence of events in the complex blood flow pattern on the left foot. The red "X" indicates the hypothesized perforation from which the blood exudes on the left foot. All flows on left foot emanate from this point.

A semi-stylized version of the left foot photograph may be visualized as follows. Notice that the blood gathers consistently at the lateral blade (edge) of the foot:



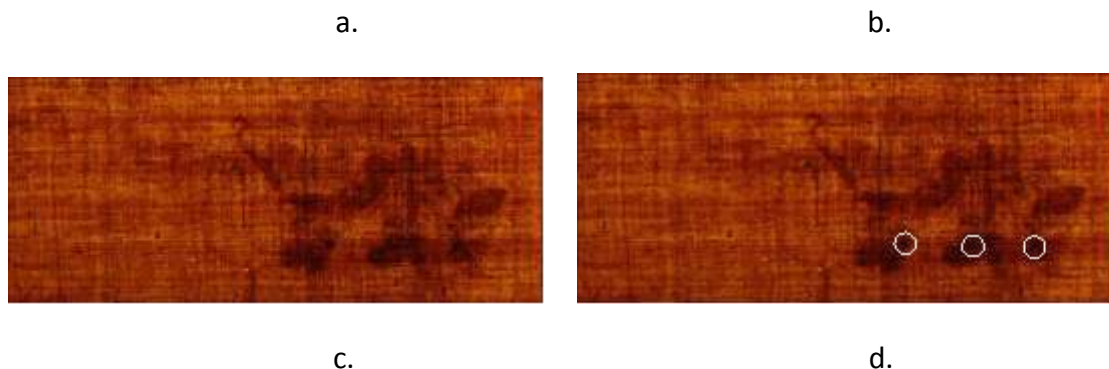


Fig. 22 a., b., c. and d. The simulation (a.) and the profiled foot (b.) illustrate the assumption that the blood dripped off the edge (blade) of the left foot during the swiveling action (red arrows). The tucking of the cloth around the left foot in the burial picked up this pattern from both the bottom of the foot and the blade of the foot. The black arrow in the drawing points to the assumed “ball of the foot.” (24) (The blood flow pattern in the profiled drawing above (b.) is excerpted (ultra-cropped) and adapted from the high definition photo (1978) made by the late Vernon Miller. I am deeply indebted to Barrie Schwartz for the ultra-high resolution photograph of the backlit Shroud showing the excerpted blood flow patterns on the left foot (c.) and the blood clot portions (white circles) on the photo on the right (d.) If the blood clots are used as the bench mark for the edge of the foot, notice that the blood flow actually extends beyond the clots themselves. (Ultra-high resolution backlit photo copyright B. Schwartz, 1978).

Note the puzzling “mottled” appearance of the blood on the left foot Shroud reflected light photograph (See Fig. 21 above). A comparable “mottled” pattern does not occur on the right foot; but it can be matched by a similar looking appearance on the back of

the head. However, the effect is completely “on the surface” of the cloth because in the ultra-high resolution backlit photographs kindly provided to me by Barrie Schwartz, these “mottled” images are not apparent. They not be visible because the backlighting “drowns” them out; or they may not be visible because they truly are on the surface. I have no scientifically founded explanation for this “mottled” pattern but speculate that it may be evidence of blood solids and serum from individual droplets beginning to separate which may be clotting producing serum exudate in the center of each droplet. On the other hand, perhaps it is evidence of droplets of sweat on the bottom of left foot during the raising and sagging sequence of the Man of the Shroud. But would this hypothesis apply to the back of the head as “beads of sweat?” This is a challenge for further investigation by medical and blood specialists.

The above photo/chart (Fig. 21) is an adaptation of the tack sharp photos kindly provided to me by the late Vernon Miller of Brooks Institute who did the scientific photography on the Turin Shroud in 1978 as a member of the STURP team. My thanks are due to him for this kindness.

PART ONE: Analysis of the left foot blood flow(s).

7.5.1. First blood flow rivulet group.

7.5.1.a Beginning rivulet.

7.5.1.b Rivulet extension.

7.5.2 Blood flow (extension from 7.5.1.b) Crucified pushes up fully, blood runs toward big toe.

7.5.2.a Diversion of 7.5.1.b toward big toe. The “break” may be due to a wrinkle in the cloth.

7.5.2.b Continuation of 7.5.2.a

7.5.2.c Further continuation of 7.5.2.b

7.5.2.d Terminus of flow 7.5.2 near big toe (on ball of foot?)

7.5.3.a Extension of 7.5.1. a. and b. to “blade” of foot.

- 7.5.3.b Sagging changes flow of blood further back toward heel but still front oriented.**
- 7.5.4.a Blood begins flowing further back toward heel, center oriented.**
- 7.5.4.b Blood trending toward rear portion of 7.5.4. flow; reaches “blade” of foot; still center oriented.**
- 7.5.4.c Blood trending further back toward heel but still part of 7.5.4. center oriented.**
- 7.5.5.a Blood now trending toward heel in a newly oriented flow.**
- 7.5.5.b. Blood flow now in established rivulet toward heel.**
- 7.5.5.c. Blood flow on 7.5.5.b reaches “blade” near heel.**
- 7.5.6. Swivel pattern now establishes a flow back and forth between 7.5.4.c. & 7.5.5.c.**
- 7.5.6.a. Early swivel flow between 7.5.4.c. and 7.5.5.c.**
- 7.5.6.b. Final swivel flow between 7.5.4.c. and 7.5.5.c.**

PART TWO: Sequential Reconstruction of the above notes:

The left foot was generally aligned with the big toe pointing downward toward the ground (7.5.5.1.a). As the Man of the Shroud began to tire his left foot pivoted ever so slightly so that the big toe seemed to point toward the big toe of the right foot. But, due to slight pivoting as the Man of the Shroud pushed up to maintain his ground oriented stance, the blood flow began to establish a wet flow toward the little toe. It is not known how many pushes in the upward direction that occurred in this phase.

Gradually, as the Man of the Shroud began to tire, his foot pivoted so that the little toe of the left foot was oriented more toward the little toe of the right foot (7.5.5.1.b.). Again, it is not known how many pushes the Man of the Shroud made on the nail that held his feet. By now the blood was coursing generally toward the little toe (7.5.2.a). But at some point in this phase cramps must have begun to develop in his calves and thighs. He made a mighty effort to push up to gain some relief from these cramps (7.5.2.a, b., c.). He held this position long enough for the blood to course toward the big toe on the left foot but began to sag slowly as the blood reached the terminus (7.5.2.d).

Tiring, , the front edge of his foot tended to aim toward the ground—that is, the side of the foot allowed the blood to drip off the outer edge of the foot, but still in a manner that was forward of the perforation from which the blood emanated (7.5.3.a and b.).

But, the Man of the Shroud continued to tire and thus he enters the second phase of the sagging pattern and the central flow began to be the path of choice for the blood moving toward the side of the left foot (7.5.4.a and b.). In order to explain the forward evidence of the rivulet on this central flow, we must picture the slight swiveling to continue so that the blood terminated at 7.5.3.a. but dripped off at 7.5.3.b. periodically.

The third phase was a major shift in the position of the left foot. The blood is now beginning to aim toward the heel (7.5.5.a and b.). But 7.5.6.a. shows that a new swivel rivulet stems away from 7.5.5.b moving toward the central flow of 7.5.4.a. Eventually, however, the flow of 7.5.5.b moves further downward and establishes a new pathway at 7.5.6.b. and moves back and forth on the edge of the foot between 7.5.4.c. and 7.5.5.c.

PART THREE: The “Mottled” appearance of the left foot blood flows.

I have generally not addressed the matter of the “mottled” appearance of the blood flows on the left foot in this paper. I have done some experimentation but much much more work needs to be done by specialists in blood before anything definitive can be proposed. However, as a challenge, let me suggest a possibility here.

One possible hypothesis that might be developed, after further experimentation with blood that coagulates, is that these may be droplets of blood deposited during the swiveling of the foot, and such droplets formed on the bottom of the left foot and hung there while the coagulation took place. This exudation caused the solids to gravitate toward the outer periphery of the droplet and the serum was left in the center.

A similar pattern may be seen on the back of the head in the dorsal view of the Shroud. At this point in time it is difficult to propose how both of these patterns could have been formed. This is why there is a considerable amount of study and investigation that must take place before we can propose an answer with any kind of certainty.

It should be noted here that the blood flows on the bottom of the left foot have a kind of “crispness” to their edges and do not exhibit any kind of “smearing” as might have happened

if someone was carrying the body to the tomb by holding onto the left foot. (See my discussion above in endnote 11).