

# Scourge Marks on the Shroud - Replicating Vignon's Experiment

By Hugh Duncan

In Paul Vignon's 1938 book *'Le Saint Suaire de Turin devant la Science, l'Archeologie, l'Histoire l'Iconographie, la Logique'* (The Holy Shroud of Turin presented before Science, Archaeology, History, Iconography and Logic), he discussed the dumbbell-shaped imprints on the cloth and reproduced similar marks using a replica 1st century Roman flagrum [1], thus lending support to the theory that the marks were due to a scourging similar to that described for the Passion of Christ [2].

**The aim of this article is two-fold:**

- to replicate Vignon's experiment.
- to see if more information can be gleaned from the marks, about the nature of the instrument of torture.

Both aspects, if successful, would give more support for the authenticity of the Turin Shroud.

## Paul Vignon's Experiment

In part 1, Section V of his 1938 book, Vignon described his experiment. He used a replica 1st century Roman flagrum. It consisted of a wooden handle with three leather strips, on the end of each was fixed two lead spheres, about 1cm diameter and about 3cm apart. See Fig.1a below left [3]. To represent the victim, Vignon used a sheet of corrugated cardboard. The cardboard was struck several times in a similar way each time, attempting to mimic the actions of the person scourging the victim in the Shroud. See Fig. 1b below middle [4]. For comparison, a part of the Turin Shroud is shown in Fig. 1c below right [5].

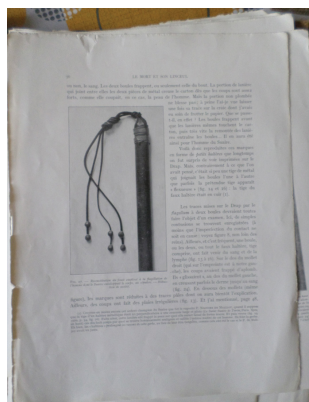


Fig. 1a. Vignon's flagrum.

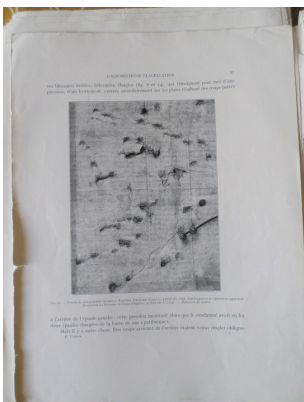


Fig. 1b. marks in cardboard.

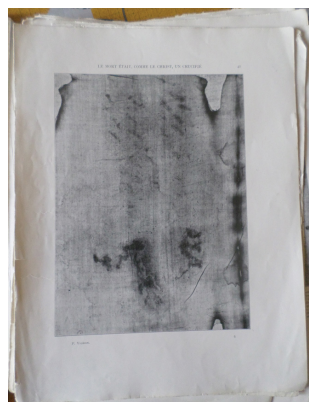


Fig. 1c. dumbbell marks on the Shroud.

Vignon's results do show a similarity to the dumbbell marks seen on the Shroud, supporting the idea that those on the Shroud could have been made by a scourging device like the one in Fig. 1a. Vignon himself admits that corrugated cardboard is not the same

consistency as human flesh. Ian Wilson suggested to me that a more realistic target would be a dead pig but we agreed that this might raise some ethical issues when it comes to experimenting, so I decided to remain with Vignon's cardboard target for this exercise [6].

### Making the flagrum

I decided to recreate the flagrum by making ball-shaped, rather than oval-shaped lead fishing weights, which I had started using initially and I called this second attempt *Marcus II*. I made the mould for the lead spheres out of clay. It ended up being a bit of a trial and error exercise, as it took 12 attempts to make four successful spheres! See Fig. 2a and 2b below of one that worked:



Fig. 2a. Makeshift lead furnace!

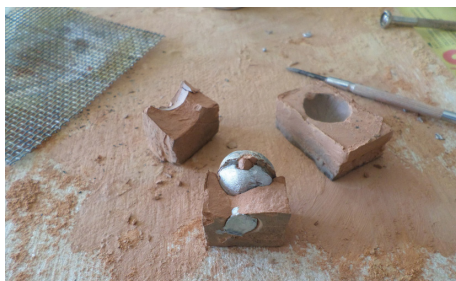


Fig. 2b. Lead sphere from clay mould.

I used a leather shoelace about 1.2m long and threaded two lead spheres onto each end, keeping them in place with knots. The leather strip was fixed to a wooden log handle, such that one strip half was slightly longer than the other one, in order that the lead weights hit at different places.

In the end, the handle length was 33cm and the longer leather strip 44cm making the whole flagrum 77cm long. By holding the handle, I estimated that the full length from the right shoulder as the pivot point to the end lead weight was about 1.4m. See Fig. 3 and 4 below.

Note, I took individual close up photographs of each lead sphere, in fact four pictures of each, giving each ball a quarter turn to have an all-around view of each ball (not shown here). This was for the purpose of trying to match up each ball with its imprint after scouring. It was easy to identify the different blemishes on each lead sphere and I was curious to see how much of this detail would be seen on the imprints themselves, once the spheres had hit their target.



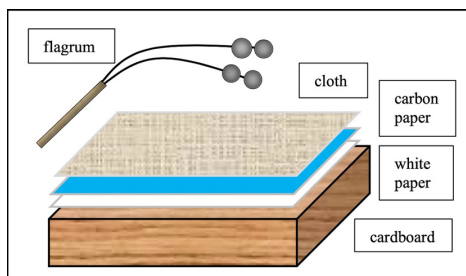
Fig. 3. Flagrum Marcus II.



Fig. 4. Close up of lead spheres showing differences.

## How to make a surface for capturing the imprints

I wanted a surface that would ‘give’ a little when struck by the flagrum, but would also offer some resistance. I saw in Vignon’s 1938 book about the Shroud, that he used some corrugated cardboard, so that seemed as good a place to start. I cut A4 sized rectangles of cardboard, each about 0.7cm thick and lightly glued them together in pairs so the total thickness was about 1.4cm. Onto that, I lightly glued a sheet of white A4 paper 160g/m<sup>2</sup>: twice as thick as normal writing paper. Onto that, I placed (not glued) an A4 sheet of carbon paper with the carbon side up. Finally, onto that I placed a slightly larger rectangle of cotton bedsheet. I folded the edges over the sides of the cardboard and stapled them at the edges to avoid too much sideways movement when the cloth was struck. See Fig. 5 below:



*Fig. 5 Set up for creating the scourge imprints.*

Out in the garden and placing the cardboard onto a thick horizontal, hardboard surface about waist height and flagrum in hand, I wore safety goggles and was ready. I tried out six identical strikes with Marcus II, two onto each of three A4 prepared targets. I hit as hard as I could, one after the other with only a second or two delay between each one. I did try to aim at slightly different places on the A4 sheet to make it easier to distinguish the individual strikes, but my aim was not very good!

## Results

On dismantling the A4 targets, the indentations on the cardboard due to the lead weights could be seen tearing through the thick A4 white sheet of paper and also through the top layer of cardboard and even affecting the bottom cardboard, but not leaving any marks on the hardboard table surface. The carbon paper was also quite torn with the impacts, many smaller pieces breaking off the original sheets, some even being stuck onto the underside of the cotton cloth. On removing the carbon paper, the imprint of the spheres could be seen as ink marks transferred from the carbon paper onto the cloth. Generally the imprints were roughly circular and the cloth was showing concave indentations like little craters where the lead spheres had hit it. All the pairs of lead ball imprints were roughly parallel, which was expected as I was always scourging from the same direction and an A4 area is not really enough area to see the imprints spreading out over a large angle. See Fig. 6 and 7 below. Note Fig. 7 is the same target as Fig. 6. The imprints can be matched up with the holes in the cardboard.



*Fig. 6. Indentations made in the cardboard.*



*Fig. 7. Ink transferred onto the cloth.*

In addition to the lead spheres leaving their marks, the knots in the leather strip that were keeping the spheres in place on the flagrum also left their imprints, and these marks were stronger than expected. I wondered if the knots were too large compared to the lead weights. While trying to hit in slightly different places on the target area, a couple of the spheres fell too close to the edges of the A4 carbon paper and did not leave a clear mark. Also, a couple of pairs of lead ball marks were too close to each other and overlapped, making it harder to separate one image from another.

Where imprints were clearly separated, their form was compared to the individual spheres and it was not difficult to match up each ball with its imprint. Bumps and dips on the balls appeared as darker ink marks or spaces empty of ink. I wondered if I was striking in the same way each time, if so, then would the balls present the same face hitting the target? In other words, would the imprints made by the same ball all look the same each time? The answer was no in this case, as, in spite of tying the knots tight to keep the balls in place, they were still able to rotate a bit and on top of that, the leather strips were also twisting, causing different facets of the lead spheres to strike the cloth.

### **Other observations of note**

The elemental metal ‘lead’ is not used in pencils (it’s graphite), but if you take a lump of even new, shiny, clean lead metal and rub it on a sheet of paper you can write and draw with it. The lead spheres were leaving grey marks on the cotton cloth that they were hitting. Lead is a very soft metal (hence, being malleable, it can be easily bent into shapes to create the waterproof flashing on some rooves etc). Being soft, the lead balls became deformed with the force of each strike. The first indication of this was to see the thread structure of the cotton cloth actually being left imprinted on the lead balls themselves. See Fig. 8a. and 8b. below. When dropping a lead ball in a previous trial, I missed the cardboard target and it hit the ceramic floor tiling. The ball ended up with a flat patch on its spherical surface a few mm across. The point is that with each strike, a ball will gradually deform and/or rub away. Thus over time, even if the ball didn’t rotate, the imprint it made would slowly change with each strike. Relating this to the scourging of

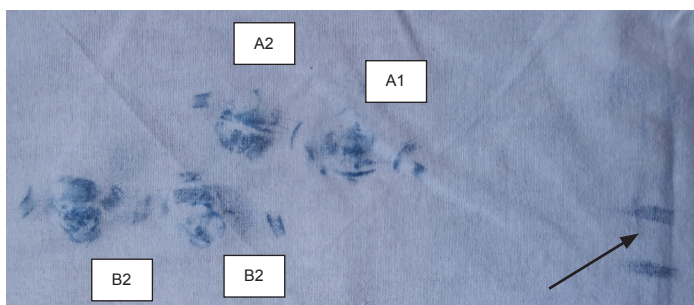
the man in the cloth, one would expect the scourging to take place in a short period of time, but with each hit the lead spheres would deform and change their imprint shape; unless a harder metal was mixed with the lead when making the spheres. This is actually very likely, as significant amounts of antimony have been found in Roman lead water pipes to make it stronger and stiffer [7], so it wouldn't be unreasonable for it to have been used to harden other lead implements.



*Fig. 8a. Spheres show cotton weave imprint.*



*Fig. 8b. Close up showing weave on cotton sheet.*



*Fig. 9. Scourging imprints. Note the lead spheres and knots to the left, but what's that far right?!*



*Fig. 10. Negative of Fig. 9, to mimic the negative view of the Turin Shroud.*

Let us look at a negative of another pair of scourge marks from the experiment, shown in Fig. 11. below. You can see similar marks to the far right and in fact, they can be seen on all results. The cause for them seems obvious.



*Fig. 11. Shows a typical set of negative scourge imprints with knots, weights and extra marks to the right.*

The images caused by the four lead spheres are quite clear, but note also that the leather strip knots before, between and after the spheres have also left some marks. I am unaware of any 'knot' marks on the Turin Shroud, suggesting that that flagrum had much less prominent knots or no knots and the lead spheres were fixed by another means. Note also the sphere imprints are not uniform. Curiously the leather thongs holding the lead spheres have caused an imprint on the far right of the cloth. This is where the cloth and cardboard come to an end, hence presenting a sharper cornered target, which has allowed a more forceful contact between the leather strap and the cloth. Could there be similar marks on the Turin Shroud?

I asked Barrie Schwartz for his opinion on this matter and he kindly replied [8] saying: *I don't know of any data showing evidence of leather strips leaving marks on the Shroud, along with the scourge marks. In fact, as far back as I can remember, you are the first to raise that issue with me. As you probably know, there is still considerable debate on the exact construction of the flagrum itself.* He then went on to make other observations of the practical method: *Of course, your experimental setup using cardboard and carbon paper is very different to human flesh, so I'm not sure that you can expect to get the same results as what is seen on the Shroud. A lot also depends on your distance from the target. The further one stands from the subject the less likely that the strips themselves would ever touch the body. I also think that the size or thickness of the lead weights would probably keep the strips from getting to the body or at least minimizing their impact.* His final comments were about the likelihood of strip marks having been missed: *Remember that the Shroud has been thoroughly studied in depth over the past 120 years so it is hard for me to believe there are still undiscovered items visible on the cloth that no one has detected before (including leather strips as part of the scourging). Still, it is worth pursuing to either confirm or reject that as a possibility.* Certainly, food for thought so I had a look at the Shroud again using a site that Barrie had recommended [9] see below:



Fig. 12. Shoulder blade area.

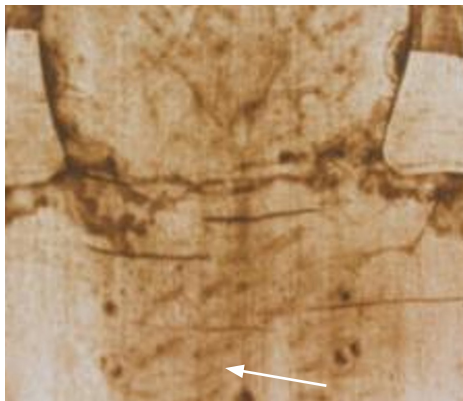


Fig. 13. The buttock area.

In Fig. 12. above left, is the dorsal positive view of the right shoulder and one can see several long, faint lines (see white arrow), while towards the middle of the back, the lines are much shorter and darker. Fig. 13. above right, shows the buttock area and within the bottom left quadrant are also several long, faint lines (white arrow), while in the top left and bottom right quadrants they are shorter and darker, though the difference between the two sets is not as marked as in Fig. 12. Could I be looking at the leather strip marks (long and faint) and the lead sphere marks (short and dark) as two distinct types of marks or am I imagining things? I contacted Ian Wilson about the subject and he replied saying: *Regarding the leather strips, yes markings consistent with these have been noted from quite a while ago, principally in the shoulder area if I recall correctly* [10]. That being the case, perhaps one could match up the leather strip marks with the corresponding lead dumbbell marks and hence work out in more detail the construction of the flagrum that was used on the Man in the Shroud.



Fig. 14. Imprints matched up with lead spheres.

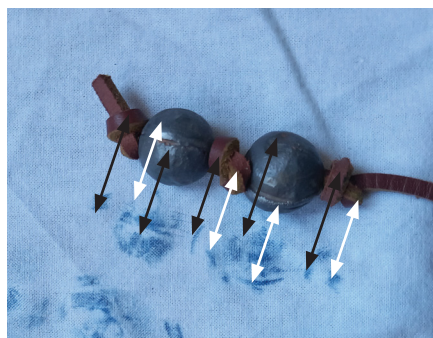


Fig. 15. Same photo with highlighting arrows.

Getting back to the results of my specific experiment, the individual imperfections on each lead sphere can be identified from the imprints themselves, as shown in Fig. 14 and 15 above. I don't think such detail is retained in the dumbbell images on the Shroud

of Turin. The original lesions in the flesh of the man in the Shroud would have at least been bruises (contusions) that swelled with the haemorrhaging and the process by which the image formed on the Shroud could have caused further distortion, so as to mask any greater resolution in the injuries that might have existed at the time of the scourging [11]. However it might still be worth investigating.

## What next?

I wondered if the different images of the same lead weight (e.g. A1 in my experiment) could be superposed and combined to make an average image of higher resolution. I ask this, as I know a similar technique has been used to combine images of double stars in astronomy to raise the resolution and create a more detailed image of the pairs of stars. This would require someone with a better knowledge of manipulating images on a computer than myself! While the dumbbell images on the Turin Shroud have somehow come from the bruising of the flesh of the man in the Shroud, I wondered if, with such a treatment of superposing these images together, one might be able to discern just how many lead spheres were on each thong and how many thongs there were on each flagrum, along with other useful physical characteristics.

## References

- (1) Le Saint Suaire de Turin devant la science, l'archéologie, l'histoire, l'iconographie. La logique by Paul Vignon 1938.
- (2) Gospel readings Matthew 27:26, Mark 15:15 and John 19:1-3.
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- (5) Paul Vignon's 1938 book P41 fig. 24.
- (6) Ian Wilson, private communication (e-mail).
- (7) Discover: Roman pipes delivered water and toxic antimony:  
<https://www.discovermagazine.com/planet-earth/roman-pipes-delivered-water-and-toxic-antimony>
- (8) Barrie Schwartz, private communications (e-mails).
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