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**PHOTOGRAPHIC AND COMPUTER STUDIES
CONCERNING
THE BURN AND WATER STAINS VISIBLE
ON THE SHROUD
AND THEIR HISTORICAL CONSEQUENCES.**

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Introduction

Since 1997, we have been stimulated to carry out some research work in order to find some precise, and if possible, final answers concerning the contradicting theories as regards the Shroud folding system at the time of the Chambéry fire ; and concerning the origin of the large water stains along its edges and on its central axis.

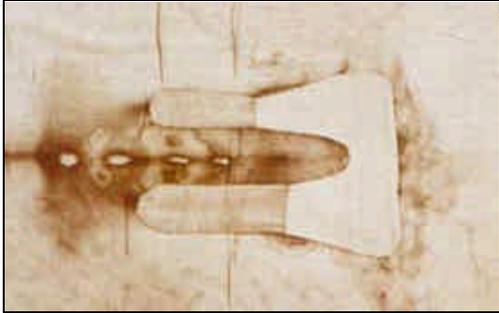


Further to the work of Don Tonelli in 1933, most experts considered certain a folding of the Shroud according to 48 layers.

Recently, however, this theory has been questioned by Mechthild Flury-Lemberg, Giulio Fanti and other specialists, who declare that when the large water stains were formed, the Shroud folding system was different, and that this occurred before the 1532 fire.

In order to achieve our goals we realised that the best way to proceed was to rebuild, as precisely as possible, the damage the Shroud had been subjected to when the fire incident took place, so as to be able to determine with exactitude its precise folding system at that time.

The damage caused by the 1532 fire.

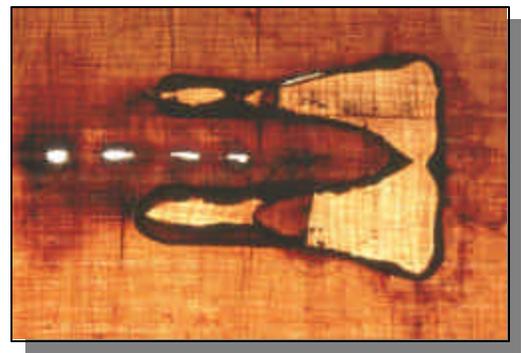


The patchwork the Poor Clare nuns had carried out in 1534, hiding the exact contour and dimensions of the burn holes underneath was the main obstacle to this end.

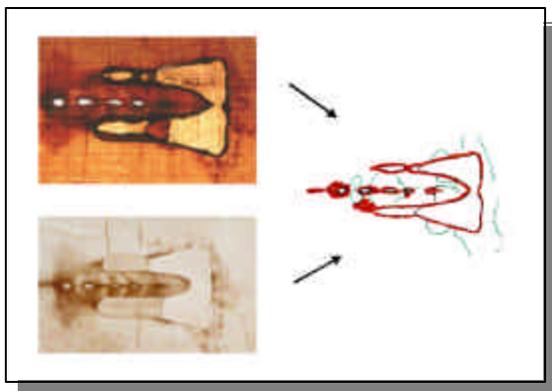
We were able to solve this problem by superimposing the 1931 Giuseppe Enrie photographs taken with direct lighting, which we show you here,

and the 1978 Barrie Schwartz photographs taken by transparency during the STURP research program.

This enabled us to determine with precision the exact contour of the burn holes around and underneath the patchwork.



We were thus able to work on a new basis taking into account not only what can be seen but also mainly what isn't externally apparent. This enabled us to achieve an exact study of the real situation produced by the 1532 Chambéry fire.

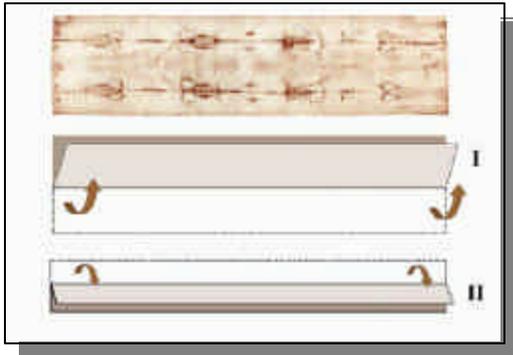


After this we were able to draw precisely the exact characteristics of each patchwork area using image data processing software and working with transparencies and half real size images.

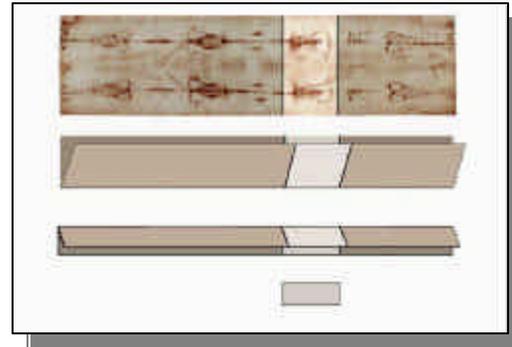
The perfectly decreasing order of the burn hole dimensions, each one belonging to a specific layer of the cloth, made it possible for us to rebuild the burn cone shape and thus

obtain the folding sequence.

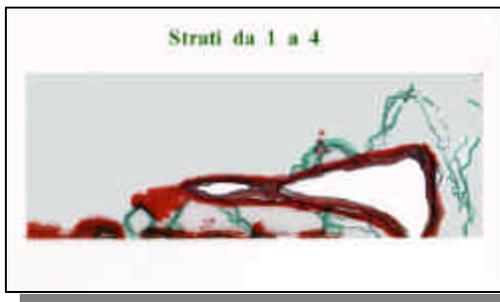
The following pictures show the folding sequence which enabled us to rebuild the burn crater.



By folding the cloth according to these two first movements(I and II) and



taking into account the clear zone as illustrated,

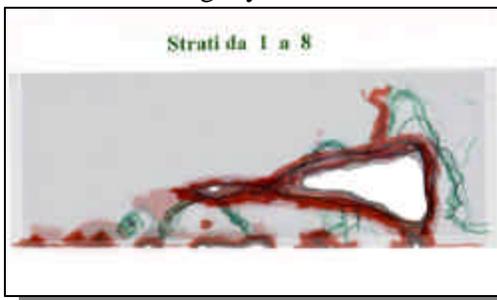
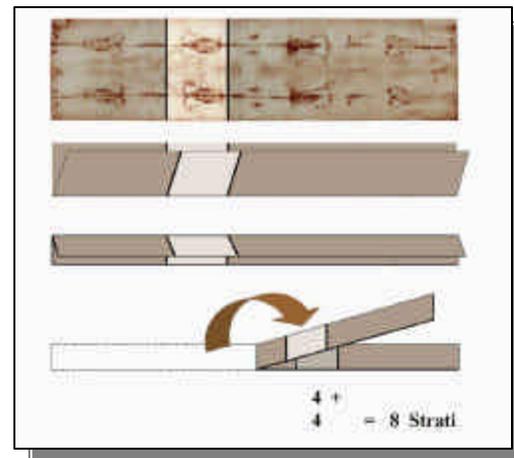


we can then observe the superimposition of the first four layers shown in our drawing, as well as a perfectly decreasing sequence of burn hole contours which together form a black edged crater.

The other burn stains along the lower edge are marked in red and the small stains marked in green are those of the water used to extinguish the fire, a little of which penetrated inside the reliquary. One can observe also the complete accordance of the superimposed contours of these small water stains confirming the exactness of our folding.

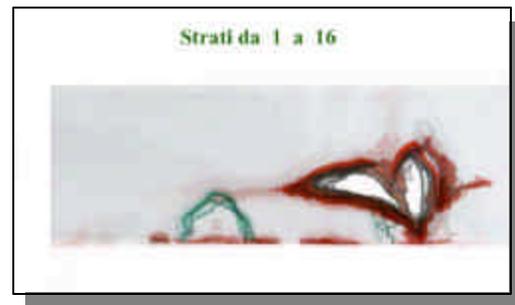
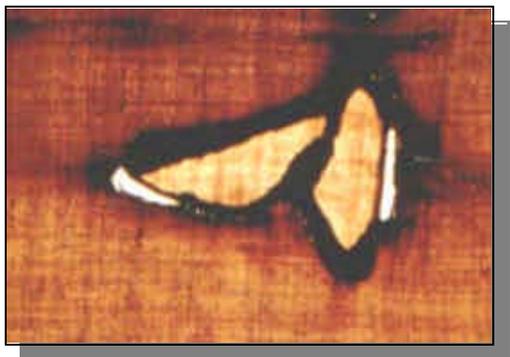
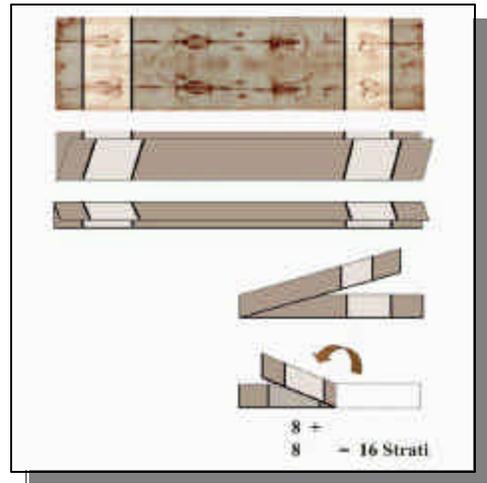
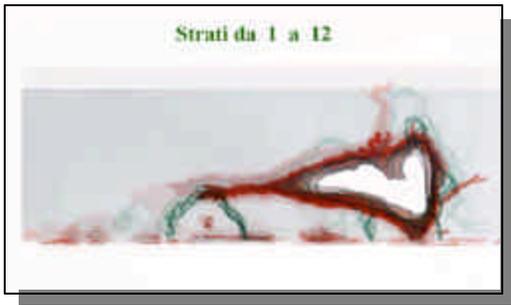
Our reconstruction work was made easier by the two parallel semi-carbonised lines following the lengthwise folds of the cloth. As one can see our work resulted in their perfect alignment.

We applied the same method for the superimposition of the following layers.



By folding the Shroud over a third time, dividing it half length, four other layers are added to the first four layers, making it a total of eight thicknesses with a complete and precise accordance.

The forth folding movement, dividing the Shroud half length once again, adds eight further layers to the pack, making it now a total of 16 thicknesses.

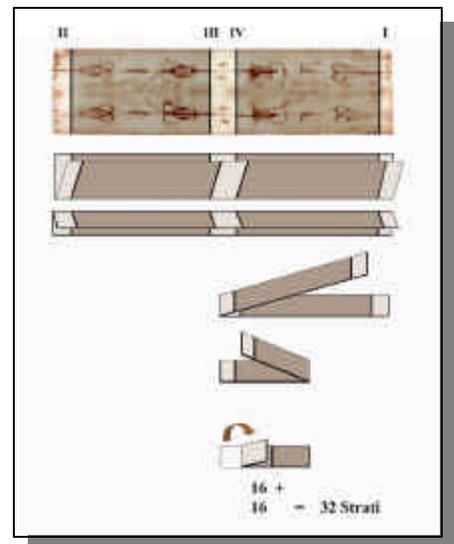
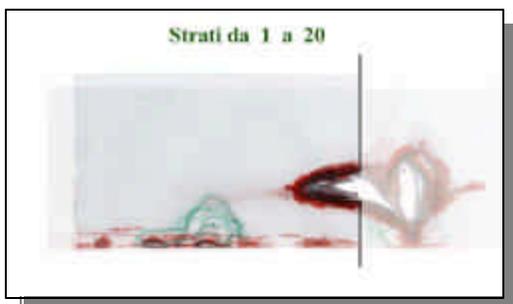


We can now observe in this 16th layer that the carbonised hole divides itself in two. As we later illustrate, only the LH opening continues its course further.

A final folding over movement is carried out at this stage, not at half length as previously, but at about a third of the Shroud pack length.

The pack now includes the clear zones indicated in the following illustration.

Firstly the RH end part, then next the LH end part and finally the centre part, making it now a total of 32 superimposed thicknesses.



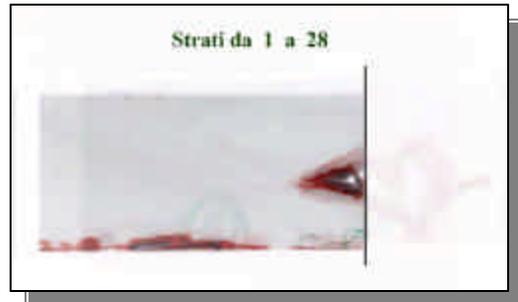
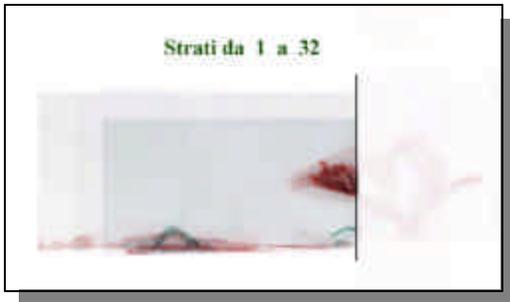
The first 20 Layers.



The first 24 layers.

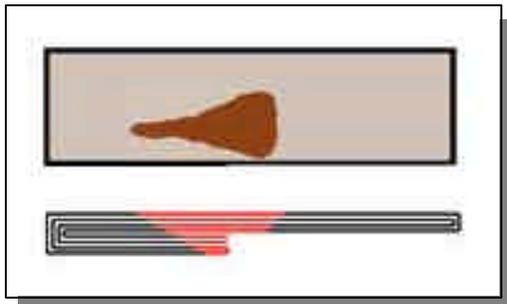
This 21st layer includes the corner indicated by the arrow from which was taken the sample for the C14 dating tests

The first 28 layers.....



....and finally the total of 32 layers.

The RH side of the Shroud pack thus folded up includes a total of 16 layers and its LH side a total of 32 layers, with once more a complete and precise accordance between its various parts.



We conclude that at Chambéry the Shroud was thus folded up and that the Shroud pack length was about 75 cm and its width about 29 cm, with four layers of four thicknesses on one side and eight layers of four thicknesses on the other side.

At this stage we wish to point out that all the checking and measuring operations for this work were carried out with real size photographs and

cloth samples.

Here we have done a schematic drawing of the whole Shroud pack, according to our reconstruction.

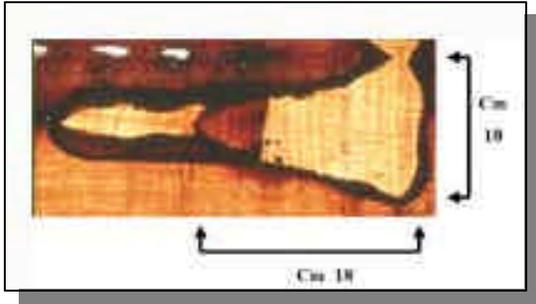
The research work we carried out beyond the 32nd layer proved the non existence of other folds.



Indeed, if the pack thus formed had been folded again over its opposite side, the upper part of the carbonised channel would have then continued its course, but we could not find any trace of such an event.

Our research work thus allows us to conclude that the reliquary casket given by Margaret of Austria was longer and more in proportion in size with that of the Chambéry chapel niche. At the time the Shroud was folded up in such a way as to account for the interior dimensions of the casket.

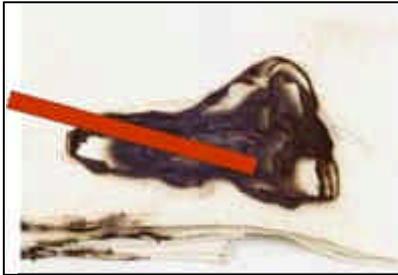
Unfortunately, we haven't the time to go into further detail concerning our observations as we would wish to, however we feel it is important to make the two following remarks :



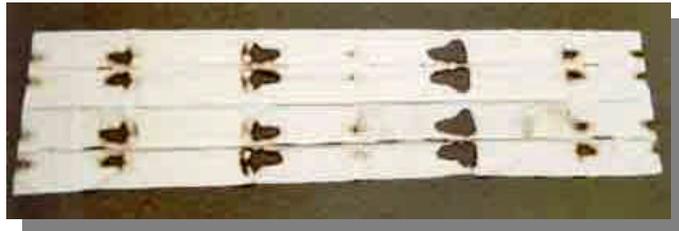
- Firstly, looking at the considerable initial size of the burn hole crater which forms a rough triangle with a base of 10 cm and a height of 18 cm, we cannot believe it possible for it having been produced by simply a few drops of molten metal.

If such had been the case, a few drops of metal would not have been able to burn through 32 thicknesses of linen .

A collapse of the centre of the reliquary casket lid seems more likely, perhaps caused by the impact of a burning object.



The real fire experiments, as well as the data processing simulations we carried out, demonstrate the possible slanting fall of a burning metal strip or lid part.



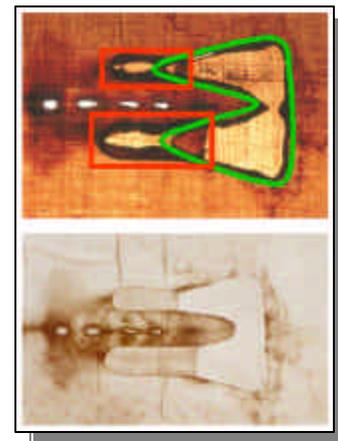
- Secondly, the repair patchwork concerning the burn holes of the first four layers seems to have been carried out at two different occasions.

Indeed, regarding the 1st and 4th layers, each individual patch was first of all triangular in shape according to that of the burn hole it covered up.

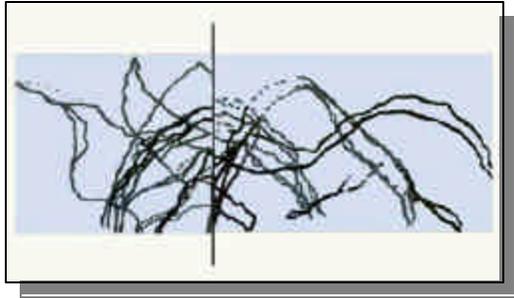
Then, some time afterwards, a second patch was added to the first, probably because of the brittleness and disintegration of the remaining burnt areas.

One cannot explain the reason for two different and contemporary patches if this was not so.

The second patch appears different to the first in texture as well as shade.



Coming back to our main account ; the reconstruction which enabled us to define precisely all the disastrous Chambéry fire consequences, also made us see clearly that the large water stains we mentioned first of all do not have any connection whatsoever with the folding system we have just described.



Indeed, after drawing these large water stains on transparencies which we folded according to the system just described, we observed that there wasn't any accordance whatsoever. Therefore, we consider that these large stains cannot be considered part of the same incident.

* * *

Apart from the image of the crucified body and the blood stains, there remains to be examined on the Shroud two very different and separate kinds of deterioration :

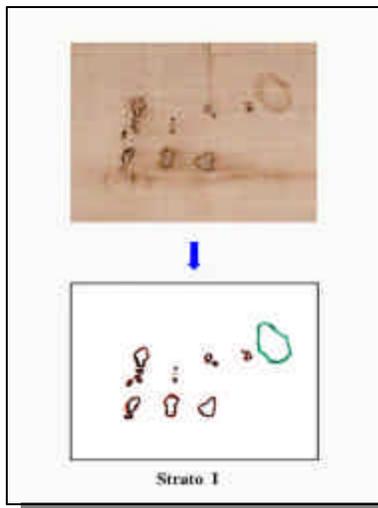
1° Underlined in red ,the so called «poker holes » which are painted on the Codex Pray manuscript dating back to 1190 and kept in the Budapest library.

2° Underlined in blue the large water stains along the edges and on the centre axis of the Shroud.

The « Pray poker holes »

Firstly, regarding the four series of so called «Codex Pray poker holes », we applied the method described previously taking into consideration the clear round areas illustrated.

This demonstrates a four layer folding system of the Shroud such as that already described in 1933 by Don Tonelli.

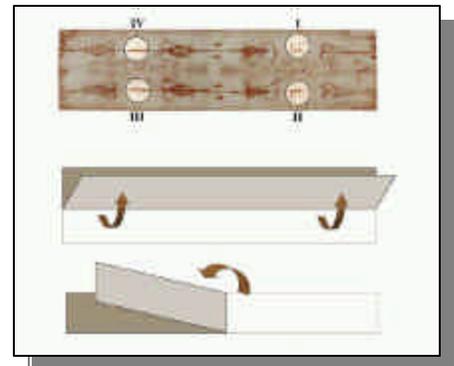


The origin of these burn holes remains unknown.

Mechthild Flury-Lemberg suggests these could have been produced by an acid liquid.

This illustration shows the four well known burn holes arranged in an « L » shaped figure to which one should add a few smaller stains existing in the same area.

A little water stain also exists in the same area with different characteristics from those we examined earlier. One should also keep this in mind.





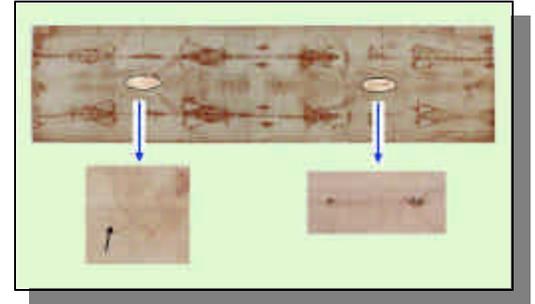
After doing drawings reproducing this area and having proceeded with the folding operations, one could observe an accurate superimposition of all these elements with regularly decreasing dimensions.

Let us now examine the clear oval zones

on the centre axis of the Shroud which follows the edge of the first lengthwise fold.

There are two small burn stains in the RH oval and in the LH oval a second little burn stain just under the crossed hands of the crucified body.

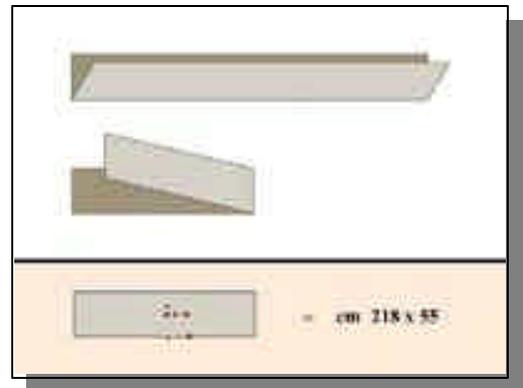
This little stain matches the larger of the two stains in the RH oval.



At the time when these burns were formed the Shroud was folded into four layers (pack dimensions 218cm by 55cm).

This makes one imagine a minor accident when the Shroud was being used as a Byzantine altar cloth during some solemn religious ceremony, preceding or following a public exposition.

The bottom picture of our illustration shows the figure L « poker holes », the little water stain in green and the small burn stains along the lower edge.



The large water stains

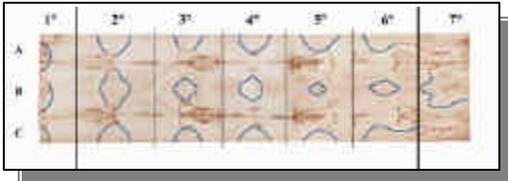
After having examined the Chambéry fire related burns and stains as well as the « Codex Pray poker holes », the large water stains remain to be considered.



At first glance these large water stains seem to be similar and equidistant.

One can also note that these large stains have very irregular edges, very different from those of the water stains we examined previously.





This picture shows the distribution of the large water stains over the linen divided into sections numbered lengthwise from 1 to 7 and designated crosswise by the letters A, B and C.

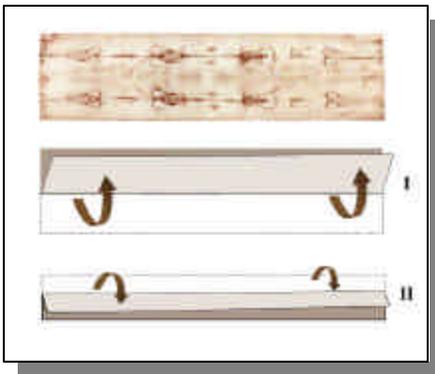
One can observe the equidistance and symmetry of the large stains, particularly along the edges A and C.

On the other hand, along the central zone B of the linen, the stains repeat themselves from the left to the right in a decreasing manner with no longer rounded shapes but become irregular lozenges.

The situation becomes abnormal and more complicated when considering the shape of the large stains in the end sections 1 and 7.

After carrying out numerous experiments we concluded that an orderly type of folding system would not have produced this type of distribution.

We then studied thoroughly the only solution we found yielding satisfactory results, as follows :



After a first lengthwise folding where the Shroud edges do not exactly coincide, a second folding operation is made even more slanted than the first.

Folding irregularities are easily made with the Shroud.

So as to be able to understand this properly we used a cloth with the same dimensions as the Shroud to carry out experiments in order to check the probability of such folding irregularities.

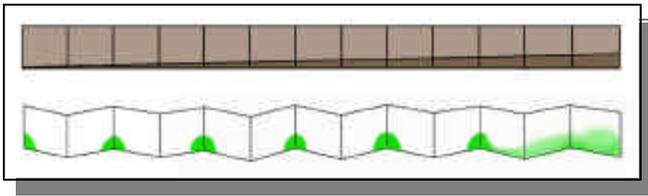
If satisfactory conditions do not exist for laying out the Shroud correctly over a flat even surface and if one does not have sufficient time to be able to do this operation taking great care, the result will necessarily be unfinished with edges not coinciding properly.

On the contrary, at the time of the Chambéry fire, the Shroud had been neatly folded up with great care with its edges in perfect accordance, as we have already demonstrated.

But we also know that during that period of time the Shroud was regularly exposed to the public with great ceremonial. On such occasions it was manipulated with calm taking all the necessary time to do the folding accurately with great care before putting it back in its reliquary.

However, in the case of the large water stains, the folding operations seem to have been carried out hastily, probably by inexperienced hands.

We feel that the checking work we carried out proves this point.

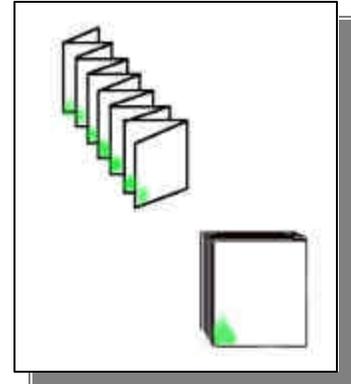


Indeed, the first two folding operations are followed by a series of accordion like folds.

Each individual fold of this accordion like system includes half a large water stain and half the space between two stains.

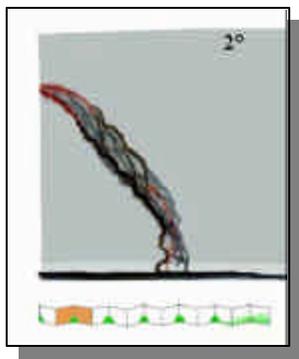
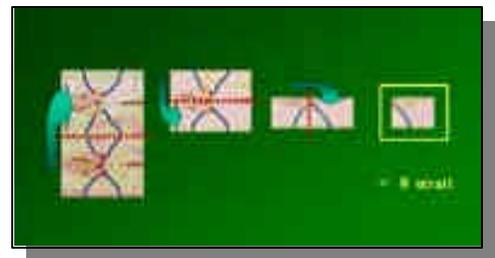
The superimposition of these half stains demonstrates that the water having produced them soaked one corner of the Shroud pack.

We determined this folding system using the same procedure and techniques as previously described.



Excluding, for the time being, the sections 1 and 7 end stains, and taking into consideration the clear section 2, the Shroud is folded half its width twice lengthwise.

The third stage of our folding is this time carried out crosswise and this results in the superimposition of 8 cloth thicknesses.

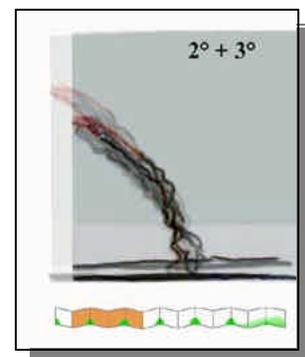


This picture shows in detail the folding sequence which we carried out using drawings of the second section water stain outlines.

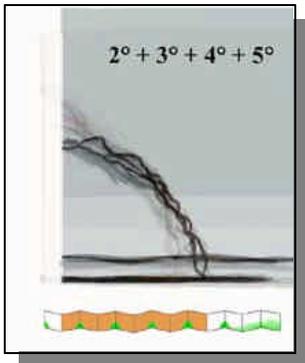
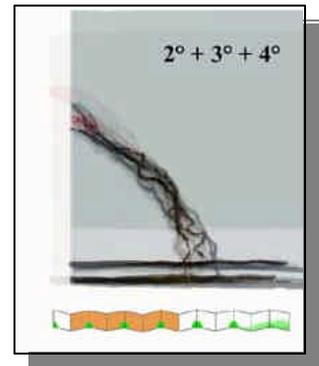
This illustration shows tracings of the second section water stain outlines from a half real size photograph revealing in detail the sequence of the folds.

The folding over of this second section following the procedure illustrated results in the superimposition of eight layers of cloth with a perfect accordance between the water stain outlines and the edges of the cloth.

The bottom part of this picture shows the folding sequence which we applied.

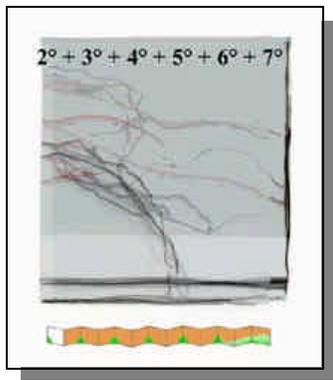
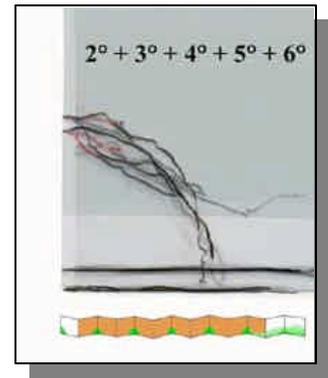


One can also observe a perfect accordance between all these elements when adding the fourth section to the pack



and equally so when adding to it the fifth section.

The stain outlines begin to spread when adding the sixth section to the pack.

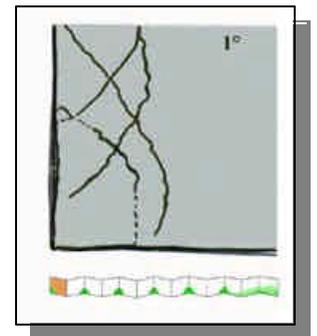


When adding the seventh section to the pack the stain outlines spread out and no longer appear clearly, however they still remain located in the lower part.

Let us now consider the first section.

If we try to rebuild the first section using the folding procedure applied previously, the stain outlines no longer coincide in any way and seem to have a completely abnormal distribution.

From this, we conclude that the first section passed through a different kind of wetting process.

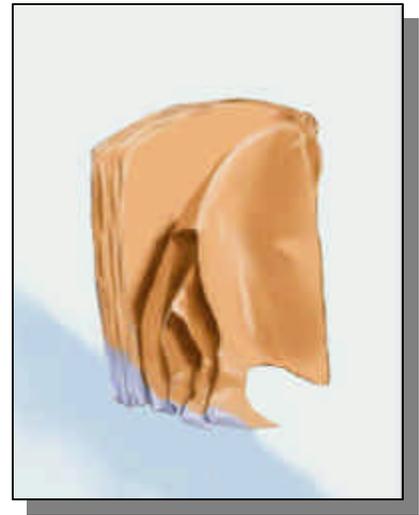


The best answer to this ,that we found after carrying out numerous experiments ,was that the Shroud ,at the time ,was folded up into 52 layers resting one on the other **in a close to vertical slanting position.**

Indeed, in such a position with the seventh last section resting against a vertical surface, the first section tends to collapse.

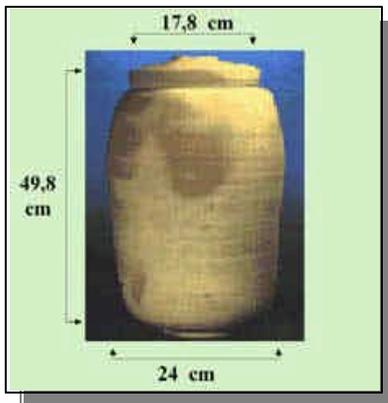
Pietro Vercelli kindly supplied us with a length of linen with a herring bone texture having the same characteristics and dimensions as those of the Shroud (436 cm by 111cm). This fabric was exactly like the one he reconstructed in 1998 according to his thorough examination of the Shroud.

We redid the folding procedure described previously using the length of linen he supplied us with and observed that the high flexibility of the cloth indeed tended to allow the first section to collapse ,as illustrated in this reconstruction. This explains the water stain irregularities we had observed.



The theory of a safekeeping of the Shroud in a slightly curved slanted near vertical position, incited us to try and find what kind of receptacle could have been used to store the Shroud in this way. We had reasons to believe that it could have been an ancient earthenware jar like those produced in quantity during antiquity.

Further to this we investigated the website of the Israeli authority for antiquities showing photographs of the objects found at Qumran with their dimensions.

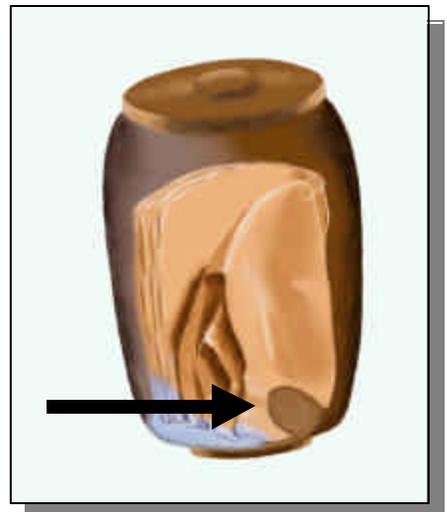


Amongst the ancient objects shown we noticed a type of earthenware jar which seemed to us, considering its characteristics and dimensions, to be the kind of receptacle we were looking for, in order to explain the process of water stain formation described earlier.

first water stain edge.

Although we cannot ascertain that this jar was the precise receptacle that kept the Shroud, it would certainly answer exactly our problem.

We find it interesting to point out that the sample for the C14 dating tests was taken from the



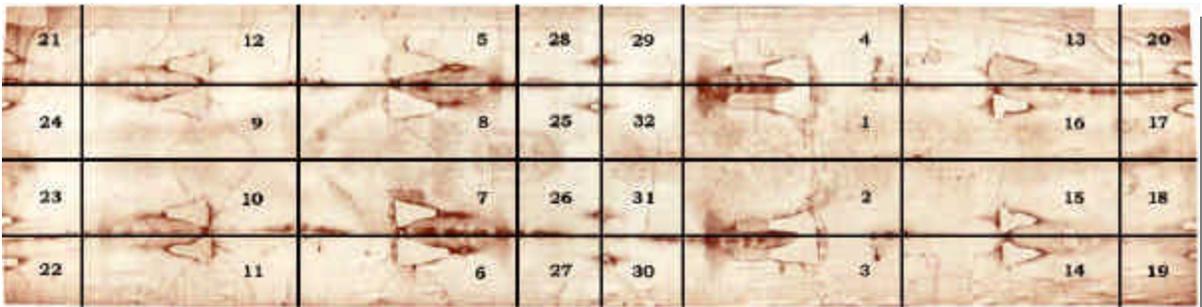
CONCLUSIONS

To conclude, as a logical consequence of our research work but also with necessary caution, we feel we can give the following answers as regards the conflicting theories first mentioned :

The Shroud has been subject to at least three important accidents during the course of its history.

Of these accidents, the most recent was the 1532 Chambéry fire when the Shroud was folded into partly 16 layers and partly 32 layers, thus forming a pack of about 75cm long by 29cm wide.

Regarding that occurrence, here is the map of our folding system giving the reference numbers of the successive layers.



The accident having produced the « Pray poker holes » took place before the Chambéry fire at an unknown date, probable before 1190 as put forward by many Shroud specialists.

The large water stains along the edges and on the centre axis of the Shroud were not produced at the time of the Chambéry fire but are prior to that event because the Shroud lining doesn't carry any trace whatsoever of the large water stains which are visible on both faces of the Shroud itself, as the scanning recently carried out showed.

At the time when the large water stains were produced the Shroud was folded up in 52 layers according to an accordion like system into a pack measuring 34cm by 32cm. As previously mentioned, the folding seems to have been executed hastily by inexperienced hands.

The water having caused the large stains only wetted the Shroud in one corner as it rested thus folded up in a slightly curved, near vertical slanted position.

The accordion type folding system like the near vertical position suggest that the Shroud was kept in an ancient earthenware jar at the time of the incident.

The historical periods when the Shroud was hidden in secret seem to support the possibility of such primitive safekeeping conditions.

We feel that this eventuality should now be explored by historians seeking the truth.

We also suggest the usefulness of carrying out chemical analyses of the traces of substances having impregnated the water stain edges produced by diverse situations at three different occasions in the Shroud's history.

Indeed, in 1978, the STURP had found traces of nonorganic iron after examining some water stains, but without implementing comparisons.

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