

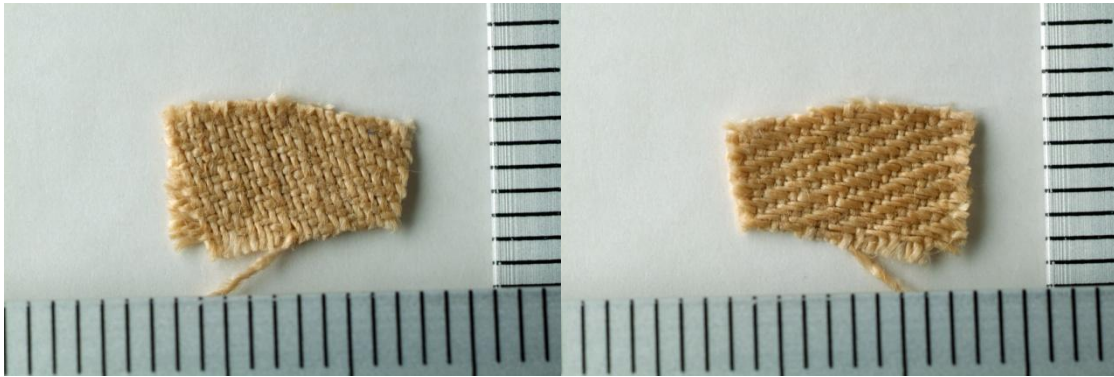
The Weave of the Shroud of Turin

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ABSTRACT

Photographs by Barry Schwartz of the front and back of a shroud sample are available in the Report on the STERA, Inc. - University of Arizona Radiocarbon Dating Laboratory Macro Photography - 30 August 2012 - available at <http://www.shroud.com/pdfs/arizona.pdf>. The front and back are shown below.



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Evelyn Campbell, who is a master weaver, concluded the above shroud sample has the weft jumping over 3 warp threads on each pass in a herringbone pattern. She set up a warp on her loom and made a sample for the conference poster.

INTRODUCTION

The shroud of Turin is a single length of linen cloth. It measures about 14 feet by 3.5 feet. The weave is a three hop (3 over 1) herringbone twill. The weft thread passes over three warp threads, under one, over three, and so forth for each run of the weft thread across the loom. The next weft is offset by one, and the next forming a twill. After a few threads the offset is reversed forming a herringbone. It was made on a hand loom probably similar to the following Egyptian painting on a tomb.



Linen is a cloth made from yarn of twisted flax fibers. Flax is a plant grown from seed from which linseed oil is pressed and for fiber for making linen yarn. Linen cloth is woven from the yarn produced by spinning flax fibers together. Flax is among the oldest fiber crops in the world. The use of flax for the production of linen goes back at least 5000 years. The best grades of flax fibers are used for linen fabrics such as the fine quality cloth of the Shroud of Turin. The thickness of the fibers from flax plants vary significantly. The average thickness of the Shroud fibers is about 13 micrometers

The Shroud of Turin linen is approximately 350 (315-390) micrometers thick. The yarn consists of approximately 70 to 120 flax fibers twisted together in a clockwise Z-twist. The various lengths (hanks) of yarn are not spliced together but laid in side-by-side during the weaving. The variegated patterns, known as banding, in both the warp and weft yarn, suggest that the yarn was bleached before weaving rather than after the cloth was taken from the loom. This is a significant clue to the age of the cloth because medieval European linen was field bleached, a process that eliminates banding.

Warp threads are the threads that are strung onto the loom before weaving begins. They run along the length of the cloth. **Weft** threads are the threads that run across, being passed over and under to create the cloth. Twill means the cloth's pattern has a diagonal wale or texture. Denim, as used in ordinary blue jeans is an example of twill. **Herringbone** means the offset is periodically reversed, hence the diagonal wale is reversed. The resulting appearance is that of a herring fish bone.

The weave is important because it is evident in one of the illustrations in the Hungarian Pray manuscript which dates to 1180-1195 which is earlier than the 1988 carbon dating of 1260-1390. The manuscript shows the burial of Jesus naked with hands over his pubic area and no

visible thumbs. It shows the identical pattern of burn holes found on the shroud. The herringbone weave of the shroud is depicted.



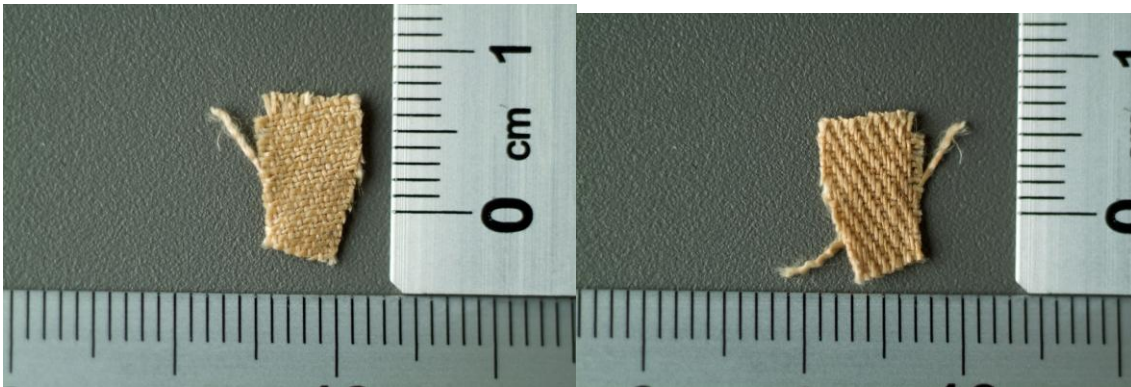
The Pray Codex or Hungarian Pray Manuscript is one of the most important historical documents showing that the Shroud of Turin existed prior to the 1200s within the Byzantine Empire.

The image at the bridge of the nose on the Shroud of Turin taken by Mark Evans copyright 1978 shows the 3 over 1 weave.



Figure 22: Dark Image at bridge of nose on the Shroud. © 1978 Mark Evans

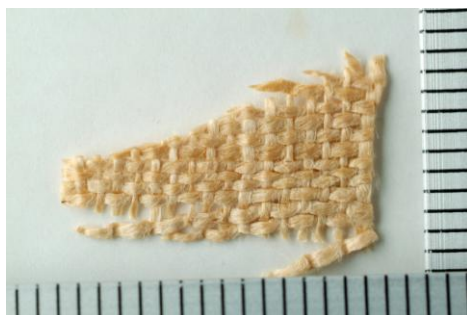
Photographs by Barry Schwartz in August 2012 of the front and back of a shroud sample are available in the Report on the STERA, Inc. - University of Arizona Radiocarbon Dating Laboratory Macro Photography - 30 August 2012 - available at <http://www.shroud.com/sterah.htm>. A zip file with all the shroud and blind sample photographs is at http://www.schwartz.com/Stera/Arizonia_Images.zip. The back and front are shown below.



Photograph of the reference sample linen threads taken by Schwartz are shown below.



All the blind samples were 1:1 weaves as shown below. It was obvious which samples were from the shroud and which were not.

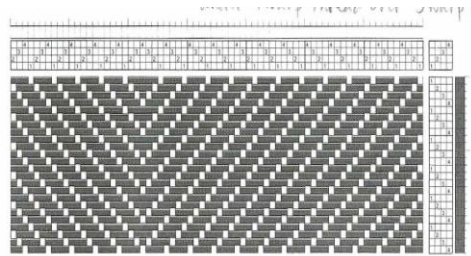
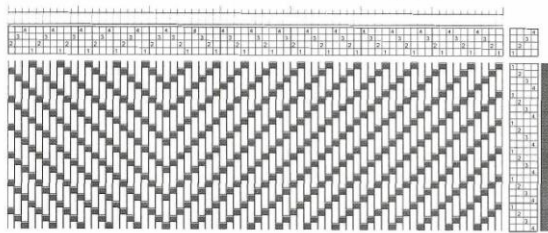


WEAVING THE SHROUD LINEN

The size of linen yarns is based on the traditional measure of the lea, which is 300 yards (1 lea) of yarn. The linen shown below is a 16/1 yarn measuring 4,800 yards per pound (16x300) and a Sett (ends per inch) of 24. The yarn is a singles yarn. One pound of yarn was purchased from Glimakra USA. A natural colored line singles yarn of the 16/1 size was chosen because it approximated the size of the yarn in the Shroud.



The herringbone twill pattern back and front (shroud side) with the warp being white and the weft being black are shown below.



Evelyn Campbell at the loom used to make the shroud sample. The loom is a 4 harness NILUS LECLERC loom with a 48" weaving width. It is a Jack-type loom (Rising Shed Loom).



The warp on the loom



The woven linen piece on the loom

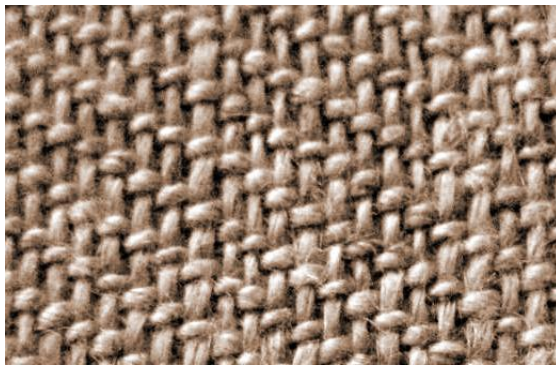
The linen piece woven on the loom was stiff. It was washed with SOAK, a mild, rinse free formulation that resulted in a softer, darker straw color linen.



Back



Front (image side)



Back



Front (image side)



A Weave of the Shroud lecture and other Shroud of Turin and Cloth of Oviedo papers and lectures are available at the Cloud archive <http://is.gd/4NnP1Z> in the Shroud directory. The Weave of the Shroud lecture includes a movie of Evelyn Campbell weaving the Shroud sample.