

— The Textile Museum —

WORKSHOP  
NOTES

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## CLEANING AND MOUNTING PROCEDURES FOR WOOL TEXTILES

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When ancient textiles are acquired they are often dirty, distorted, dry, dull in color and ragged. In addition to being dirty, many are stiff with grease, and stained. We find that some reveal crude attempts at cleaning, patching and mounting. This is unfortunate, for a second handling becomes necessary. A second, third or fourth attempt to correct a condition always results in weakened fibers and there is the chance of having few or in some cases no fibers left. Proper protection during the cleaning process and handling only once and by a person trained or experienced, cannot be too strongly emphasized.

To identify the nature of all stains is impossible because unfortunately many of the stains have been set by age. Removal of ancient spots and stains to some extent can be accomplished, although some require the expert knowledge of chemistry. So far we have done little work on stubborn spots, but in the future we hope to accomplish more.

We have come to the conclusion that most textiles can be washed and that modern scientific methods of cleaning can be applied to nearly all ancient textiles as satisfactorily as to modern ones if the proper support and protection are given to the textile. There are exceptions, such as textiles with decorative motives in ink, paint or applied gold. Some very sheer and brittle inscriptions should not be cleaned, because the possible loss of one fiber might destroy the proof of a documentary dating.

Reactions of the fibers to the cleaning have been fairly consistent when procedures are applied to groups according to the classification of fibers and types of spinning, therefore *analysis* and *scrutiny* of each textile is very necessary before cleaning.

Our methods, equipment and handling have changed over a period of time, and are constantly changing. What we will give you now are the methods and equipment presently used. We find that we are obtaining more than fair results, with some cases better than others.

### 1. T.M. 72.165 as acquired

Here we have a textile as it was acquired, and we will go step by step through the process of analysis, washing and mounting.

At a glance we have the end of a blue decorative band terminated by apparently a complete dog. This textile shows evidence of abuse and very poor restoration.

Under microscopic examination we find the left portion is woven on S-spun undyed wool warps.<sup>1</sup> The S-spun wefts are straight wool, large in diameter. The portion to the right also has S-spun warps of undyed wool. The S-spun wefts are wool also large in diameter, but there is a difference; the wefts here are *curly* wool, the wefts to the left are *straight* wool. We see also a fiber and technique employed in the right fragment that does not appear in the left piece. Parts of the design are embroidered with linen. At this point we are suspicious. With surgical tweezers we gently lift up the edges in a number of places where the body of the animal is crudely patched to the ground and we find all edges are cut.

When a textile is woven, the warps are drawn tautly in a vertical position from the warp beam to the cloth beam of the loom. Often they become somewhat distorted, but when we find in a detail, sewed in as this tail, the warps showing a definite horizontal direction we are suspicious. Is the body of this animal true? In examining the warps we find them to be S-spun undyed wool, the wefts are S-spun wool also but there is no shading as there is in the fore part of the dog. Disregarding the incoherence of the design technical analysis of the three fragments, right portion, left portion and body of the animal, shows they do not belong together and that this is a made up piece.

### 1. Ultra-violet light

The textile under ultra-violet light gives another proof of patchwork. With the naked eye, at a glance, the blue background is the same hue in both halves. Under the lamp, the left fragment lightens up considerably, but in the right part the dyes darken.

The textile was purchased primarily for the fragment containing the animal head. We will now proceed to clean and mount the dog head. However the portion to the right is interesting and will be washed and mounted separately, as it belongs to a definite group known to us.

<sup>1</sup> S or Z-spun—Direction of twist. A yarn has S Twist if, when held in a vertical position, the spirals conform in direction of slope to the central portion of a letter S, and Z twist if the spirals conform in the direction of slope to the central portion of a letter Z. American Society for Testing Material. Designation: D 123.

## 2. Left fragment with microscope

First a decision is made of a suitable detergent for the given fibers and also the proper solvent to remove any foreign matter not soluble in water. Under microscopic examination we find dirt packed between the fibers and in addition a gummy waxy deposit in the area of the ears. Besides darkening the tips of the ears the wax holds the dirt in and therefore the wax must be removed before washing.

We find the dyes in nearly all of the Near Eastern woolen textiles fast when washed in a neutral synthetic detergent and we know this textile to be of Near East origin, but taking no chances we test to be sure.<sup>2</sup>

## 3. Dye testing for fastness

A drop of concentrated neutral detergent is dropped on each color, and the spot pressed tightly between white blotting paper. There is no sign of color on the blotter. Therefore we may use detergent. If any of the colors had bled, a test would have been made with a 28% Acetic Acid. If the color did not set then, a test would have been made with a 5% solution of common salt. Most colors set with salt or Acetic Acid.

The analysis of the fibers and technique, and the general conditions of the textile are understood at this point so we are now ready for the cleaning. The analysis and workshop cards are filed and kept for a permanent record. This textile is recorded on blue cards, the color denoting the warp fiber. (See illus. 1 and 2.)

T.M. 72.165	
WEAVE Tapestry on 1 warp	
WARP \ wool	WEFT \ wool
white	white, buff, tan,
	brown, dark-brown,
	green, dark-blue, blue,
coarse, straight	yellow, red, pink.
WHEELDEX FORM C80133-A-B	

Illus. 1. Analysis card

No. T.M. 72.165	DATE 4-20-49
TREATMENT Stoddart Solvent	
RESULTS	
TREATMENT Parazyme, Igepal CA, 10% Glycerine	
RESULTS	
WARP \ wool, coarse	WEFT \ wool, straight
TEXTILE MUSEUM OF D. C. WHEELDEX FORM 80857	

Illus. 2. Workroom card

## 4. Between lumite

First the textile is placed between lumite screening of cloth weave. Lumite is a plastic which is not affected by detergents, enzymes, acetone or dry cleaning fluids and is therefore desirable for supporting the fabric throughout the cleaning procedures. Cloth woven lumite has enough stiffness for support and the weave is open enough to allow dirt or grease to drop through the mesh.

A gummy deposit was noticed near the animal's ears, so our first procedure must be to clamp the screening into a frame which will hold the textile suspended when we place it in a vessel of grease solvent.

<sup>2</sup> On the analysis and workshop cards the mark \ before the fiber means S spun. If the fiber had been Z spun our mark would be /. See illus. 1 and 2.

Supplementary to Workshop Notes No. 1



1. 72.165 As acquired—Ultra-Violet light



2. Left fragment with microscope



3. Dye testing for fastness



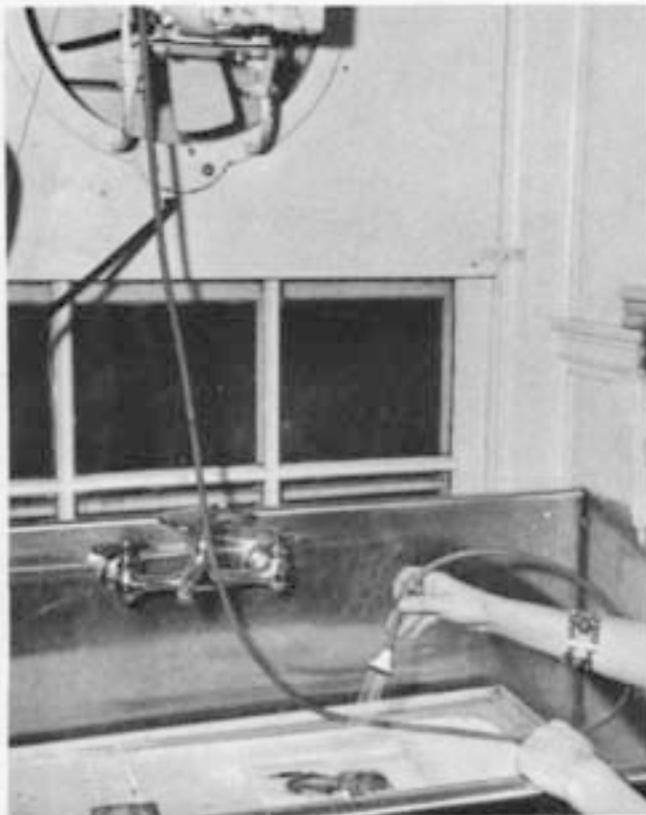
4. Between the lumite



5.. Degreasing bath



6. Between the lumite on the pan



7. Flushing



8. Igepal CA and sponging



9. Tamping



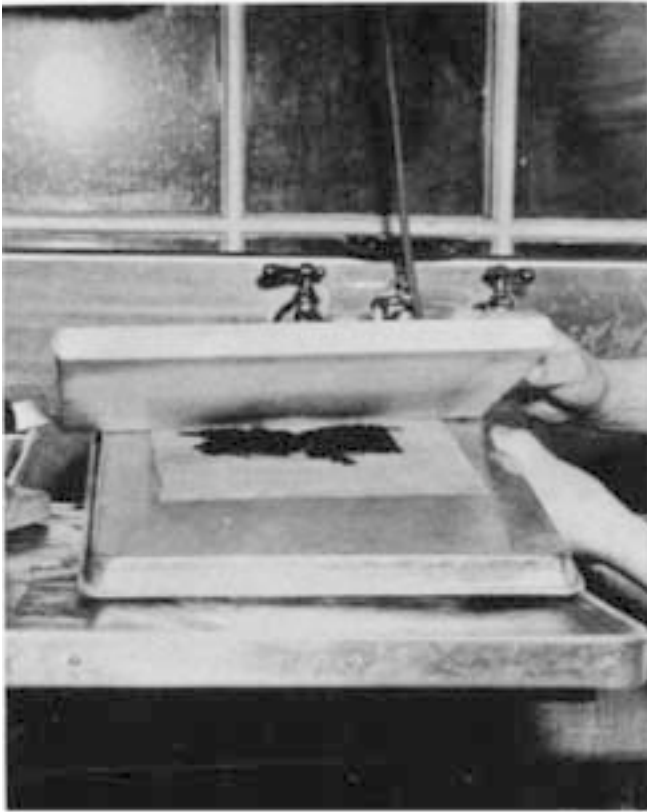
10. Microscopic examination of tamping



11. Textile and screen between toweling



12. Lifting the screen, showing tweezers



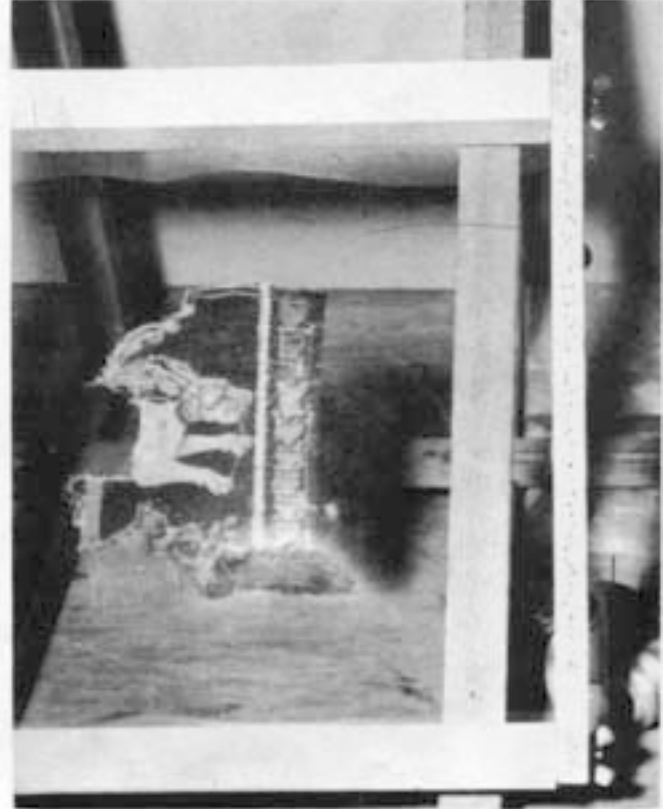
13. Turning on to drying screen



14. Drying screen over light showing pins



15. Mounting frame and rest, showing needle and square



16. Back of mount

## 5. Degreasing bath

We use a Stoddart solvent to cut grease and have found that the slight motion created in the solvent bath by pneumatic agitation will release some dirt along with the grease. To provide this agitation we have installed a  $\frac{1}{8}$  H.P. compressor and the necessary piping. We are only using one pipe for this small piece. For larger fragments we might use three or four. After degreasing, the textile *in the lumite screening* is removed from the frame and is allowed to dry thoroughly, usually over night when Stoddart solvent is used.

## 6. Between the lumite on pan

Next day it is put on a pan and saturated with distilled water and an enzymic digestive agent in a warm concentrated solution to remove with speed and little mechanical action, any stains and deposits. We use Parazyme, which contains besides the enzymes a special active wetting-agent which further speeds digestive action, and permits greater penetration plus emulsifying action and rinsibility. Parazyme contains sufficient units of both starch digestive and protein digestive enzymes. We tamp gently with a spotting brush to increase penetration of the digester, keep warm with an electric pad, and leave like this for a varied length of time; in this case about an hour.

## 7. Flushing

The protected textile is then placed on a screen in the sink and tepid water is sprayed through first from one side then from the other. The temperature of the rinsing water should be the same as that of the bath. A consistent temperature throughout processing prevents shrinkage and possible harshness of the wool. The first flushing does not have to be very thorough; it just serves to carry off dirt loosened by the enzymes.

## 8. Igepal CA and Sponging

Now with the textile back on the pan we are ready to wash with a neutral detergent. We use one part Igepal CA extra to 200 parts of distilled water, and not a deep bath but just enough to saturate the textile. A cellulose sponge has proved satisfactory in sucking to the surface stubborn embedded dirt which is then held in suspension by the suds. Also we find that in this bath a brushing stroke, through the lumite, with the tamping brush in the direction of the warp tends to help straighten distorted warps while they are wet. Again we flush with tepid water.

## 9. Tamping

If, after the suds are rinsed from the textile, grit remains, it is removed by tamping. The textile is now placed in a glass pan on a fluorescent lighted tracing table. A small amount of Igepal CA solution is added. With a flat stroke the textile is beaten with a pig bristle, #6 tamping brush. (The cut ends of nylon are jagged and would injure the fibers.) With proper flat strokes almost all delicate textiles will take this treatment and remain unharmed. We find large straight wool stands up poorly, and we therefore limit the tamping as much as possible. The crimps in curly wool tend to hold the fabric together, while straight wool has a tendency to sluff.

## 10. Microscopic examination of tamping

At this point we make a thorough examination to be sure that the textile is clean, and to inspect the state of the fibers. This is straight wool and we find we have lost a few fibers along with more dirt.

The textile is now rinsed thoroughly, this last rinse containing 10% glycerine. As ancient textiles are dry, glycerine will supply the lubrication the fibers need. The original grease in wool is lanolin, but lanolin is hard to restore without leaving the textile greasy enough to pick up dirt. Glycerine has the smallest molecules and is therefore more easily absorbed than other lubricants.

## 11. Textile and screen between toweling

To absorb most of the moisture the textile, still remaining protected by the lumite screening, is laid between toweling. When some of the dampness has been absorbed by the towel, the top layer of lumite may be lifted and the towel placed next to the textile so as to dry it more quickly. This practice is not safe if the textile is fragile or broken, as it is harder to peel it from the towel than from the lumite.



## **12. Lifting the screen, showing tweezers**

Care must now be taken in lifting the lumite and turning the textile on the blocking screen. We place the textile, in the screening, on the bottom of a pan, then lift a corner of the top screen gently to expose an edge of the textile but only high enough to insert the tweezers, in case they are needed, to start the textile to leave the screen. In some cases the textile does not cling to the screen at all; in others possibly tweezers may be needed simply to touch a fiber in a broken place. Working carefully we remove the top screen entirely.

## **13. Turning on to drying screen**

Now we place the drying screen on top of the textile and with a quick motion turn drying frame, textile and pan up side down, then remove the pan and lift the bottom layer of screening as we did the top one, with tweezers ready to free any clinging fibers.

The drying frame is made of twill woven lumite, which is not so open as the cloth screening and will therefore hold the pins with which we do our blocking, and yet allow enough air to come through so that a thick textile will dry uniformly on top and bottom.

## **14. Drying screen over light showing pins**

With large blunt tweezers we work with the textile to straighten out the warps and wefts and with a square, line them up as perfectly as possible. The smallest pins in diameter that are available are used to hold the fibers to the lumite. Fibers have varying degrees of elasticity when wet, therefore as the textile dries the fibers shrink and make it necessary to re-adjust the pins at different stages of drying to eliminate strain.

## **15. Mounting frame and rest, showing needle and square**

This textile we will mount on lumarith which is handy for study and storage and can be exhibited between two pieces of plexiglass.

Just before the fibers are completely dry, we transfer the textile to the permanent mount. The final adjusting and pinning before sewing are comparatively easy for the blocking has been accomplished, and the fibers being almost dry are already set.

Thread the color of the warp is used for the sewing. As few stitches as possible are taken, and each pin is removed as the stitch is made. We insert the #8 needle from behind and pull the thread through between two warps. We then make the stitch parallel with the wefts and go over only one warp. The mounting thread will then be completely covered by the wefts and the stitch will not be apparent.

## **16. Back of mount**

On the back the thread is carried to the next place needed and the process is repeated until as many stitches as necessary for preservation have been taken. The stitches are preferably far apart so that if it is ever necessary to unmount the textile it can be done as easily as possible. Also where possible a corner is left free for study.

Now we trim the lumarith, eliminating the holes made by the tacks, and cut to the desired dimensions. Finally we place the mount between two pieces of 1/16" plexiglass and hold together with tape.

## **Final mount**

Our first impression was that this dog head was at the end of a decorative band. Our final mount clearly shows that it was part of a larger fabric cut to fit the portion of band with which it was mounted.

## TEXTILE ANALYSIS: EARLY TECHNIQUES IN EGYPT AND THE NEAR EAST

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The Textile Museum among other projects is setting up a technical file on its various groups of rugs and textiles. In the early Christian and Byzantine field we have statistics not only on our own collection but also on some 4000 items in American Museums and 1500 more from the Victoria and Albert Museum in London. All of these have been analyzed by members of the Textile Museum staff and are on file in the Dumbarton Oaks Textile Census. Though new objects keep coming to light, the information already at our disposal seems sufficient for the basis of a preliminary set of technical papers on early textiles in the Near East. We are including a few Far Eastern techniques for comparison but we are not attempting a detailed study of them at this time. The analysis of each of our objects will be included in forthcoming catalogues.

Fiber analysis is necessary before textiles can be given to our cleaning department, because a cleaning process good for cotton may not be the best one for wool or silk. It is particularly necessary to know before cleaning whether there is more than one fiber in the textile to be cleaned. If vegetable fibers are present, the spinning direction must be noted carefully for if they are spun against their wish they tend to unwind when they get wet. During this process of analysis we are able to obtain statistics of a technical nature on spinning and weaving which we feel to be a useful supplement to the findings of Art Historians who study the design of textiles in the usual manner.

Egypt had a dry climate, and so more early textiles have been found there than in any other country in the region of the Mediterranean. It is a great temptation to believe that all the types found in Egypt were made there. However, though all four of the fibers most used for weaving in that area and in Asia have been found in Egyptian excavation material dating before the 10th century, all but linen originally belonged to quite different lands. Cotton grew in India, silk came from China, and wool was native to Central Asia. In this paper we will discuss those early fabrics which are homogeneous and occur so preponderantly as to show us the main types in which each fiber was used. In future papers we will trace the shift of techniques from one fiber to another, the developments in the combinations of fibers and also the invention of new techniques and improvements or expansions in the looms. In proposing technical progressions we have kept in mind that each change should be a step forward toward something the weaver wished to do but had been unable to do before, and that by and large, when a mechanical advance had been made, weavers did not like to go back to the old ways. They also did not seem to invent for invention's sake, but merely as a means to an end. Many of the textiles found in Egypt fall readily into an Egyptian progression. Others which appear there from time to time and form definite technical groups seem to belong to related progressions from other countries. Excavations have brought forth relatively few textiles from countries with damp climates, so that we occasionally lack the indigenous material to verify our theories of provenance, but a study of the internal evidence is interesting technically and may prove constructive. As we proceed we will define the terms used in our file, most of which are current either in America or England. In some cases we subdivide a large group, using separate terms for the subdivisions instead of the general term.

The four fibers most commonly used for weaving around the Mediterranean Sea and in Asia are linen, cotton, wool and silk. Each of these fibers is quite distinct from the other three in its physical aspect, but they are all so fine that a careful analysis can only be attempted with considerable magnification. We have found that a Bausch and Lomb wide field textile tube with 20x magnification is a good glass for routine analysis. It is powerful enough so that one fiber may be distinguished from another, and still shows a wide enough area of the fabric to allow study of the weave as well. For a text on identification of fibers we use a publication of the American Society for Testing Materials which gives useful procedures for identification and also excellent photomicrographs of common textile fibers.<sup>1</sup>

Any short fiber must be spun in order to provide a long enough thread for weaving, so our analysis of any fabric will start with the spinning. Spinning was probably invented in regions which grew vegetable fibers, for when vegetable fibers are moistened they rotate, which would suggest spinning to primitive man. This theory is borne out by the fact that even today vegetable fibers are moistened while they are being spun. We use the ASTM definition for direction of twist in spinning "A yarn has S twist if, when held in a vertical position, the spirals conform in direction of slope to the central portion of the letter 'S' and Z twist if the spirals conform in direction of slope to the central portion of the letter 'Z'". To avoid confusion with 'S' used as an abbreviation for silk, our file shows the slant rather than the letter: \ for S, / for Z.

Linen, which was grown from earliest times in Egypt, rotates in an S direction when drying. Therefore it is reasonable to find early dynastic linens S-spun, the technique being based on this inherent characteristic of the fiber. The craft of S-spinning became so firmly established in Egypt that it is found at all periods, even persisting to the 15th-17th centuries, for Cairene rugs can be distinguished from all other classes of oriental rugs by their S-spun, Z-ply warps.

Cotton, the other vegetable fiber, when moistened rotates more violently than linen. It rotates in all directions, but we have found that cotton Z-spun can be washed with comparatively little trouble whereas S-spun cotton tends to come apart. Cotton was grown in India. Early Indian cottons are Z-spun, so are the large group found at Fostat.

Wool, an animal fiber, does not rotate when moistened, but the fibers have scales all over them which will catch on each other. Consequently a good durable fabric can be made from wool by felting. (ASTM definition: "Felt is a fabric built up by the interlocking of fibers by a suitable combination of mechanical work, chemical action, moisture and heat, without spinning, weaving or knitting.") Felting preceded the spinning of wool in Central Asia where the original stock of sheep and goats was native to the highlands, and felt has been made there ever since. The pastoral, nomadic way of life spread early to Tartary, Persia, Mesopotamia, Syria, Palestine and the North of Arabia. Flocks spread also from Asia to Europe and all around the Mediterranean Sea. According to the Bible account, they were introduced into Egypt by the Hebrews. Until flocks were pastured in regions where spinning was practiced, goats were used chiefly for their milk and their skins, for

<sup>1</sup> Tentative Methods for Identification of Fibers in Textiles. A.S.T.M. Designation: D276-43T may be obtained at a nominal price from the Society at 260 S. Broad St., Philadelphia 2, Pa.

sheep wool felts more easily than goats hair. However, as the raising of flocks spread, both fibers began to be spun so that they could be woven. As animal fibers have no preference we find them spun in either direction; and tightly, with a medium twist, or hardly at all, according to local custom. Climate and pasturage also affected the wool. According to Matthews' "Textile Fibers" Egypt produces coarse wool of medium length, Syrian wool is long and very resilient, Asia Minor wool long and medium fine, and so forth. All these types of wool appear in early textiles. As various wools were produced in areas more widespread than the other fibers, so wool techniques were more varied, adaptive and even experimental.

Silk, the other commonly used animal fiber, does not rot when moistened. It has, however, one advantage over all other natural fibers, its length. 400 to 1000 yards of silk may be reeled in a continuous filament from a single cocoon, so silk may be woven without being spun at all, if the weaver chooses. It is chiefly so woven in the Far East, where sericulture originated in China. In the Near East silk warps are usually spun according to the habit of the region where the fabric is being made, but the wefts are often woven without spinning.

Because our approach to weaving is technical, we start where the weaver must, with the warp. Threads for the warp must be set up on a loom before any weaving is done. Their spacing governs to a great degree the texture of the fabric to be made. Their tension must be uniform or the fabric will be uneven. And they must be able to withstand the friction of having the wefts inserted and beaten in among them. As the physical properties of each fiber are distinct, fabric woven on warp of one fiber will differ from that woven on warp of another. In fact, if exactly the same weft were woven on linen and then on wool warps, the difference in weaving and in the finished fabric would be comparable to the difference in playing and in hearing the same tune on a piano or on an organ. The notes would be exactly alike, the manner of playing and the effect would not. Therefore the primary classification in our file is made according to the material and preparation of the warp. A fabric with linen warp is classified as linen no matter what fibers appear in the weft; one with wool warp as wool, and so forth. For convenience, and as a visual aid, we use a system of colored cards to denote different groups: white for single linen warp, blue for single wool, salmon for single cotton, and cherry for silk. Plied warps also have colors of their own, for although made of the same fibers as single warps, they require the extra process of plying before they can be put on the loom, which may point to a different time or locality of manufacture. We use buff for plied linen, green for plied wool, and yellow for plied cotton. We use cherry for all silk warps because it is difficult to tell in a number of cases how the warp has been prepared.

"Hand-loom weaving" by Luther Hooper<sup>2</sup> is a good text book on weaving, and contains charts, explanations and a useful glossary of terms. However, the reader must remember that the rules given are intended to guide modern weavers in England and may not apply exactly to ancient weaving around the Mediterranean or in Asia. For instance: the author says on page five ". . . the warp threads are seen at once to be much finer than the weft thread. This is always the case, except in the most elementary attempts at weaving." That is an excellent rule. But in dynastic and many later linens from Egypt the warp is larger than the weft. Does this mean that we shall find typical Egyptian weaving to be consistently elementary? Perhaps so. In other words, any book on weaving should be read for the basic theory, but the textiles themselves must be studied carefully for the application. We must continually keep in mind that the weaver in Hellenistic times in the Near East did not have a many-harness loom at his disposal. He had some type of cloth loom, and anything beyond that was still to be invented.

Cloth weaving is a process in which the first weft passes under one warp and over the second warp. The second weft reverses the course. All odd numbered wefts follow the first: all even numbered wefts follow the second. We find early examples of weaving with each of our four fibers in which the weft follows two alternating courses. However, some peculiarity of each fiber seems originally to have dictated its own type of weaving. For instance: Linen is a very fine, round fiber of medium length and great strength. When spun it makes smooth, tough threads which may be set up touching each other on a cloth loom and still, without damaging friction, have enough wefts beaten in among them to make durable cloth. When the warps are very close together it is not possible to beat an equal number of wefts into the fabric, so in traditional Egyptian linen we find a ratio of 3 or less wefts to 4 warps. This ratio holds good even when the threads are somewhat spaced in order to make the cloth sheer. The warps bend more than the weft. This was a standard practice in Egypt found at all periods. This type we call rep.

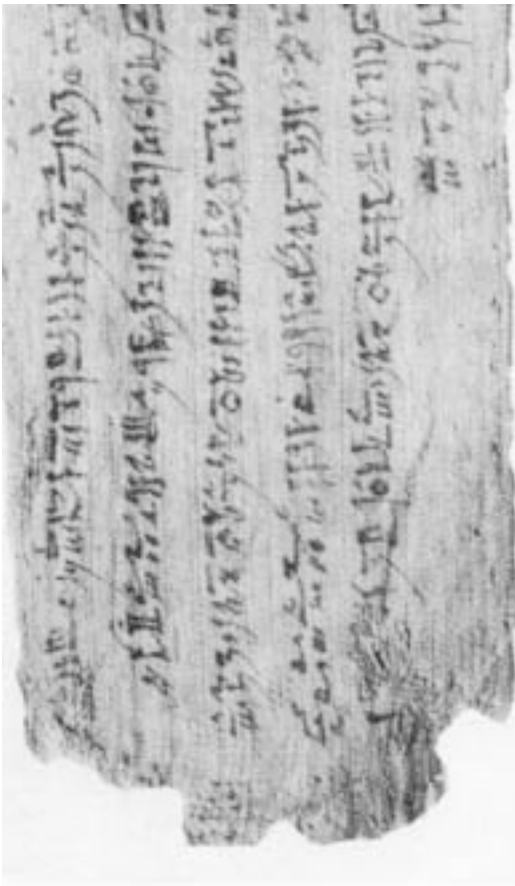
Cotton in early times was a very short fiber. Long staple cotton had not been developed in India, and long staple cotton measures only from 1 to 2½ inches. The usual Indian cottons range from ¾ to 1 inch in length. It looked like a collapsed tube and normally had twists in it. Because of the twists, it did not make a smooth thread, as the fibers could not lie close together. The thread was fragile not only because the fibers were short but also because if it gets wet each fiber squirms separately. Cotton had to be spun with skill to make even thread and woven with care to make good cloth. The Indian method was to space the warps slightly on the loom so they would not rub and cause friction in the weaving, then to beat in a like number of wefts. Both warps and weft bend. This regular binding counteracted, as far as possible, the fibers' desire to readjust themselves when wet. This was standard practice in India. This type we call tabby. Rep and tabby are usually grouped together as plain cloth but in our file we are making the distinction.

Wool is a larger fiber than either cotton or linen and fairly long. Because of its scales and a certain characteristic called "crimp," wool fibers lie even less close together in a thread than cotton fibers. The best thread stretches and will catch at other threads. Consequently wool warps were not only widely spaced on a loom but had to be held under constant tension to keep the web from bagging. As warps that were tense could not bend around the wefts, the wefts in wool weaving had to be slack enough to do all the bending. To protect this slack weft as much as possible, it was beaten tight together so that the warps did not show at all. This cloth technique, with loose weft, was standard for early wool weaving. We call it tapestry whether the color changes or not.

Silk is a long and very slippery fiber which may be woven with little friction no matter how closely the warps are crowded together. However, once the fabric is off the loom, silk warps and wefts slide out of position quite easily unless some special means are taken to restrain them. Silk rep was woven in the Far East. But a special method was devised for making sheer fabrics wherein alternate warps cross over their adjacent neighbors before the first shot of weft and then recross to their original positions before the second shot, thus locking the wefts in position. This type of weaving originated in the Far East and we call it gauze.

Various looms were developed for these four cloth weaves. Linen was originally woven in Egypt on a horizontal loom. About 2000 B.C. the loom was stood up vertically with the cloth beam at the bottom according to the representations, and

<sup>2</sup>The Artistic Crafts Series of Technical Handbooks, edited by W. R. Lethaby. Pitman Publishing Corporation, New York.



**Linen Rep (TM 73.191)**



**Silk Gauze (TM 51.44C)**



**Cotton Tabby (TM 6.151)**



**Wool Tapestry (TM 711.34)**

The illustrations for this article were selected for their material and weave and are not early examples of their respective types.

*Photographs by Perry Woltz*

the weft was beaten downward. This position would let gravity help the weavers set their taut wefts firmly among the somewhat less tense warps. Necessity was probably the mother of this invention, since the warps in dynastic linens were slightly larger than the weft and would bend unwillingly on a horizontal loom.

In making cotton tabby the necessity was different. As cotton yarn is fragile, some method had to be provided to open the whole shed at once and wide enough to avoid friction while passing the weft across the web. Pictures of early Indian looms show them to be horizontal, with harnesses for opening the two sheds, and pedals to work the harnesses so that the hands were free for weaving. Silk rep was also woven on such a loom because unlike Egyptian linen rep the wefts were larger than the warps and could compel the smaller, and often unspun warps, to bend without the help of gravity. The weft in both rep and tabby was thrown right across the web from selvage to selvage, and a whole shot was beaten in at once. This is the case also with gauze, but in weaving gauze the loom itself was more complicated, for it had to be able to cross and recross the warps. Gauze looms, like all other Far Eastern looms, were horizontal.

Tapestry weaving required a simpler loom than any of the other cloth weaves because the weft is supposed to bend round the warps which are held taut. If the slack is to be distributed evenly, the weft can be run behind only five or six warps at a time. The whole shed is never opened at once so the warps were managed by hand with no mechanical contrivance to help. As it is easier to pull warps forward than to pull them up, tapestry was woven on vertical looms. Egypt had a vertical loom with a cloth beam at the bottom. Early Greek representations of tapestry looms show them to be vertical too, but with the lower ends of the warps attached to weights to keep them taut instead of to a second beam. Therefore the cloth beam was at the top of the loom and the weft was beaten up instead of down. This important difference between Greek and Egyptian weaving was noticed by Herodotus when he visited Egypt. Small sections of weft were beaten in as they were inserted, and there was no need in either type of loom for an appliance to beat a whole shot of weft at once. Tapestry wefts often turn back in the course of a row to make some special effect, and do not necessarily cross from selvage to selvage. In rep or tabby weaving a weft turned back in the middle of a row is the mark of a poor workman who could not keep his cloth straight. Among early wool tapestries we find some classes beaten compactly, some quite loose. This may point to Egyptian or Greek manufacture, for as the weft on Greek looms was beaten up instead of down, gravity should tend to loosen the web rather than to tighten it.

So far we have discussed only fabrics which use a single fiber and which have been woven in the manner best suited to that fiber. A few additions can still be made to this category. In Egypt among dynastic linens we find rep with a facing of short or long weft loops. These loops were made by an extra weft run in the same shed with the regular weft. The extra weft was pulled forward, or backward occasionally, through the warps and passed around a gauge to ensure loops of uniform size. These loops always appear in weft rows, but there is no regularity as to how often they shall appear in the row, or how many shots of the ground weft shall be made between the rows of loops. These loops may appear on the face, the back, or on both surfaces of the fabric. In dynastic linens also, we find extra shots of weft at the side of the web, run in from the edge for a few centimeters only, to strengthen the selvage. These shots sometimes turn back immediately, sometimes they end in long loops which produce a weft fringe, not at the edge of the material, but at the inner edge of the selvage. We find self-bands too which run from selvage to selvage, made by inserting several wefts in a single shed, and occasional bands where the warps have been left unwoven. None of these techniques require any modification of the loom or of the warp set up. In the Far East, where the gauze technique bears witness to mechanical advancement of the silk loom, a type of silhouette design was developed using fancy gauze patterns to contrast with the plain gauze ground. Han Dynasty silks also show complicated damask patterns made in rep by floating alternate warps across wefts which would otherwise have bound them. This advance is in the proper tradition of silk weaving, for gauze is made by manipulation of the warp. The patterns in both types of fabric repeat exactly on the same warps, testifying to the presence of a drawloom device to govern the pattern on silk looms.

These systems of weaving were suited to their respective fibers. Let us now see how color and thereby design were applied to them. Linen was hard to dye and the surface of linen rep was not smooth, so we find dynastic linens decorated with ink and with pigments which nearly or completely obscured the texture. This decoration was not an advance in weaving but it has carried on to present times in painting on canvas, and in laundry marks, for the owner's name was often written on sheets. However the vast mass of Egyptian dynastic linen has no pattern at all. The few spectacular textiles with woven pattern have been ably dealt with by Elizabeth Riefstahl in "Patterned Textiles in Pharaonic Egypt,"<sup>3</sup> and we shall refer to them later among special groups. Cotton took dye better than linen, and tabby had a smoother surface than rep, so we find color added by stencilling, stamping or printing. This was no advance in weaving either but the practice has continued and been developed. Applied design on finished cotton fabrics was more common than on linen and probably originated in the Far East for we find silk rep and gauze treated in much the same way as cotton. Wool took dye beautifully. Weft bands of various colors are found. Then the tapestry method by which wool was woven suggested a means of making inwoven colored patterns. We have discussed above the fact that in tapestry weaving the weft is run under a few warps at a time, not across the whole web as it is in rep or tabby. For this reason it was the wool weavers who first began making colored patterns by substituting weft of a contrasting color for short spaces. If a color area is not allowed to stop between the same two warps often enough consecutively to make a long slit, the resulting fabric will be sturdy as well as decorative. This inwoven pattern can be dated to some extent, and quite certainly in relation to wool dyeing, for at the excavations made by Yale University at Dura-Europos on the Euphrates river, we find expertly shaded stripes and very simple woven patterns. Dura fell about 256 A.D. which gives us a terminal date, since there was no later occupancy. Possibly Joseph's coat of many colors which was made in this general region so long before, was tapestry woven with colored bands.

In this paper we have discussed the basic techniques for each of the four principal fibers woven alone. In future papers on analysis we will try to trace the changes in techniques and looms used with each fiber, and the combination of fibers, which after their adoption, became a part of the permanent repertoire. We will then define some technical groups which seem to be ephemeral in Egypt, but occur in sufficient numbers to present specific problems for the Art Historian.

<sup>3</sup> Brooklyn Museum, Brooklyn Institute of Arts and Sciences, 1944.

## DEFINITIONS OF TERMS USED IN OUR FILE

**FIBER:** The fundamental unit in the fabrication of textile yarns and fabrics. (ASTM)

**YARN:** A generic term for an assemblage of fibers or filaments, either natural or manufactured, twisted or laid together to form a continuous strand suitable for use in weaving, knitting or otherwise intertwining to form textile fabrics. (ASTM)

**TWIST:** A yarn has S twist if, when held in a vertical position, the spirals conform in direction of slope to the central portion of the letter "S" and Z twist if the spirals conform in direction of slope to the central portion of the letter "Z". (ASTM)

**WARP:** 1. the yarn running lengthwise of a woven fabric.

2. the sheet of yarns laid together on a beam. (ASTM)

(In England "warp" has only the second connotation, "warp thread" or "warp end" being used for individual threads.)\*

**WEFT:** Yarn running from selvage to selvage at right angles to the warp in a woven fabric. (In England called "weft" or "woof", in America called "filling.")

**CLOTH:** A technique in which the first weft passes under one warp or group of warps and over the second warp or group of warps. The second weft reverses the process. All odd numbered wefts follow the course of the first weft, all even numbered wefts follow the course of the second weft. (In England called "tabby.")

**REP:** A type of cloth weave in which there are more warps than wefts to the centimeter and in which the warp bends more than the weft. (In England called "repp" or "ribbed tabby.")\*

**TABBY:** A type of cloth weave in which there are relatively the same number of warps and wefts to the centimeter and in which both warp and weft bend.

**TAPESTRY:** A type of cloth weave with less warp than weft to the centimeter. The weft often turns back within the row and is not thrown from selvage to selvage. (Luther Hooper: "Tapestry—Tabby weaving, in mosaic, with loose weft.")

**GAUZE:** A weave in which alternate warps cross their neighbors before the first shoot of weft and recross to their original positions before the second shoot.

### COLOR KEY TO WARP MATERIAL:

White—single linen  
Blue—single wool  
Salmon—single cotton  
Cherry—silk  
Buff—plied linen  
Green—plied wool  
Yellow—plied cotton

\* We are indebted to Mr. J. F. Flanagan for this information.

**TEXTILE ANALYSIS: EARLY TECHNIQUES IN EGYPT AND THE NEAR EAST**

**Part 2**

**Louisa Bellinger, Analyst, Curator  
Textile Museum, Washington, D. C.**

Workshop Notes, Paper No. 2 explained in some detail the physical differences in the four principal textile fibers; wool, silk, cotton and linen. It discussed the part those physical properties played in developing the different simple weaves which appeared in quantity in early times: the gauze weave for silk; tabby for cotton; rep for linen or silk; and tapestry for wool. Let us now enquire what happened when various fibers and techniques were brought together.

We have mentioned the fact that tapestry weaving required the simplest loom of our four types. When the warp is wool, a tapestry weft can only be run a short distance at a time if the slack is to be distributed evenly, therefore, no harness was needed to open a whole shed at once. The warps were spaced far enough apart and had enough tension and resilience so that the wefts might be beaten in piecemeal from in front, by a comb or spindle. Complicated patterns might be woven as easily as plain color. In fact weaving plain color by this slow method must have been monotonous.

At any rate, wool weavers in Syria, before 256 A.D. had begun experimenting with the horizontal cloth loom used by linen weavers there, which had harnesses to open a whole shed at once. Wool fragments with warps and wefts both widely spaced were found at Dura-Europos on the Ehphrates, which seem to have been woven on a harness loom. In an attempt to make a compact fabric some pieces have both warp and weft tightly spun. When these webs were taken from the loom and the tension on the warp relaxed, the result was crepe; still a rather openwork fabric. There are a few examples of rep, but when the weaver wanted to make a band of another color he had to abandon his harnesses, group his warps in pairs, and resort to tapestry weaving, because a rep weft does not show. There were a few fragments of basket weave with both warp and weft yarns used in pairs. They were plain fabrics, or at best warp stripe. A stripe must be planned before threading the loom, and results in a uniform design throughout the length of the piece. This did not seem to satisfy the weavers who had woven patterns at will, or even those who had made plain or shaded bands. They wanted to weave on a horizontal loom on which a whole shed could be opened at once for the passage of a plain weft from selvage to selvage; but they also wanted to have the weft cover the warp so that the weft bands would show, or a weft pattern could be woven when desired. It was a real problem, and the solution was revolutionary. A third harness was added to the loom. There is just enough play when the binding recurs every third time to allow the weft to be thrown from selvage to selvage and still be beaten up to cover the warp. One side of the fabric looked like an ordinary tapestry, the effect they were used to, the other looked like sateen. Here we have our first weft twill. The loom was threaded thus:

\* \* \* 1st harness  
\* \* \* 2nd "  
\* \* \* 3rd "

At this point we must explain the method of listing twills in our technical file. Twill bindings occur in echelon or chevron diagonals, and the face of the fabric may show more warp than weft, more weft than warp, or an equal amount of each. In order to note these differences simply, we have devised this system. The warp shall be mentioned first, the diagonal made by the bindings second, and the weft third. This is our listing of 4-harness twills, and their diagrams using "x" for warps and "-" for wefts.

A warp face twill would read:	3\1	or 3/1	or 3^1
and would look thus:	-xxx	xxx-	xxx-xx-x
	x-xx	xx-x	xx-xxxx-
	xx-x	x-xx	x-xx-xxx
	xxx-	-xxx	-xxxx-xx

A weft face twill would read:     1\3             or 1/3             or 1 ^ 3  
and would look thus:             x---             ---x             ---x--x--  
  -x--             --x-             --x----x  
  --x-             -x--             --x--x---  
  ---x             x---             x----x--

A twill with equal amounts of warp and weft showing would read:  
  2\2             or 2/2             or 2 ^ 2  
and would look thus:             xx--             --xx             xx--xx--  
  -xx-             -xx-             x--x-xx-  
  --xx             xx--             --xx--xx  
  x--x             x--x             -xx-x--x

The twills we have just mentioned from Dura would read: 1\2             or 1/2  
and would look thus,             x--             --x  
  -x-             -x-  
  --x             x--

as the bindings recur every third time. These 3-harness weft twills were found at Dura in 12 different colors. 11 had natural warps and dyed wefts. The warp of the 12th piece was dyed as well as the weft. They seem to be indigenous, for the Textile Museum has a whole series of fabrics with patterns tapestry woven, or woven in 1/2 twill with the same type of yarn and the same colors which appear in these early twills. Our latest piece shows the remnants of an Arabic Inscription, and so must be seven or eight centuries later than the Dura fragments. There was one piece of 1 ^ 3 twill at Dura with a purple pattern.<sup>1</sup>

There were at Dura also, three grades of 2/2 twills which I am inclined to think may have been imported for, or with, the Roman Army, since they are made of various shades of natural wool without dye, and there is no attempt at a pattern, in which Syrian weavers excelled. "Strabo says Patavus (Padua) which was situated at no great distance from Altinum on the way to Rome, was a great and flourishing mart for all kinds of merchandise intended to be sent to Rome, and especially for every kind of cloth. Padua also served as a market for carpets and blankets made of a stronger and more substantial material, which was produced in its immediate vicinity."<sup>2</sup> Padua might be a possible provenance. The material is certainly substantial.

At any rate wool weavers were the first weavers in the Near East to invent or use twill looms with more than two harnesses. Far Eastern silk looms were already much more complicated.

Let us now turn to linen weaving. Linen is a strong fiber which makes a sleek thread. It is possible to make a firm and compact linen rep or tabby, and basket weave linen is found. Linen weavers long before the Christian era had learned to make fabrics dense or sheer at will. However, neither rep nor tabby are conducive to pattern weaving. Of course stripes might be set up in a rep warp which would run through the whole fabric. But that gives the weaver no scope after the threading of the loom. Also linen is hard to dye, and it is not possible to use wool warps, which could easily be dyed, with linen because the tension of the yarns is very different. (When silk appears, occasional silk warp stripes are found, silk being a firm, non-elastic fiber like linen.) A wool warp could not be used, but wool could be used in the weft, for a weft is not under tension. However, a rep weft would not show, and a tabby weft of colored wool would just make a checkerboard effect with the undyed linen warp. Although those two habitual linen weaves were not suited to the insertion of wool, it was possible to work a colored pattern in weft loop. A complete shed was opened at once and the wool weft was run through the shed and pulled to the face of the fabric between the warps where it was wanted for the pattern. Next, a multiple linen weft was run in the same shed to hold the wool weft firm—just as it had been run for centuries to hold linen weft loop firm—and both were beaten down together in the usual manner. A number of effective types of pattern are made in weft loop, some all wool, some with linen for the white portions. But patterns made in this technique are not as flexible or as fine as tapestry woven ones can be, they must be designed more like rugs. (In fact the Spanish Alpujarras are simply weft loop rugs.)

To make fine patterns tapestry weaving was attempted, and the linen weaver immediately ran into trouble. When he spaced his warps far enough apart to weave wool tapestry, his linen fabric could not be made firm. If he set up his warps close enough to make a compact linen fabric, the wool, which was not as

<sup>1</sup>The Excavations at Dura-Europos, Final Report IV, Part II, The Textiles, No. 36, Pl. XIII., R. Pfister and Louisa Bellinger. Yale University Press 1945.

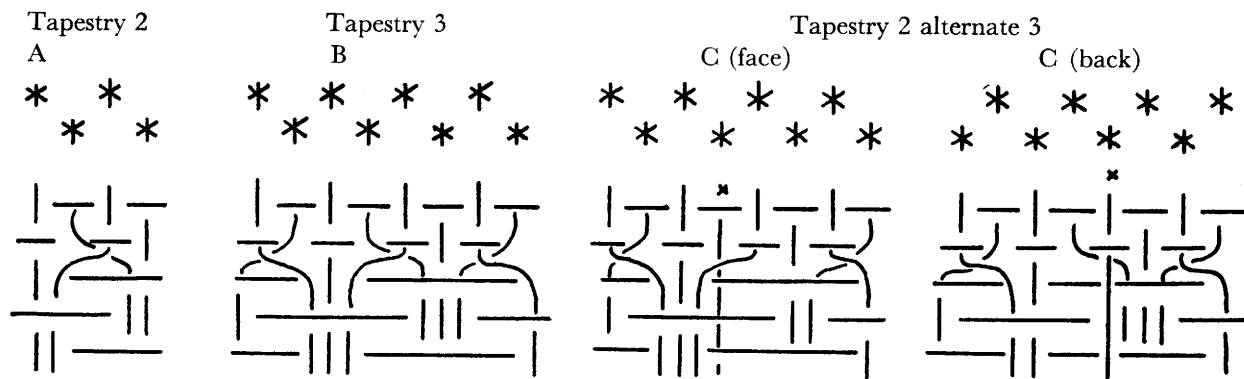
<sup>2</sup>Textorium Antiquorum, p. 102 paragraph 22. James Yates, 1834.



compact a yarn as linen, would bulge out when it was woven on single warps. A few small, scattered designs were made on single warps, and they do bulge over the surrounding plain areas. This was not very satisfactory, so the weavers tried grouping their warps for the tapestry area. This created trouble of another sort. The natural grouping would be two or three adjacent yarns; but on a cloth loom any two adjacent warps lie on alternate harnesses, thus:

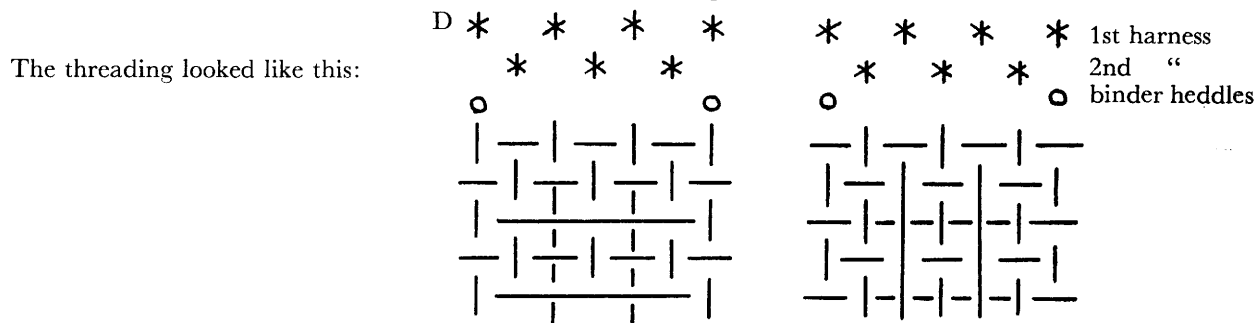
\* \* \* \* \* 1st harness  
 \* \* \* \* \* 2nd "

The weaver would have to abandon his usual manner of opening a shed and do it by hand. A more serious dilemma would appear when he tried to beat down the weft. On a vertical rep loom, a shot of weft was beaten in by a stick run through an open cloth shed. Tapestry, however, is beaten in from in front with a comb. The weaver could beat his tapestry in with a comb, but he would have no way of beating in the adjacent sections of rep. For rep warps are too close together to beat through from in front. This would not work. Therefore, the weavers grouped together alternate warps. Thus the usual sheds might be opened to weave and to beat down the rep, as alternate warps lie on the same harness. The groups of warps for the tapestry had to be managed by hand, as all cloth tapestry warps do. In order to prepare the groups of warps on the second harness, some yarns had to cross under those on the first harness. Arranging this was tedious but possible. There are a number of regular groupings found in early textiles, others are hit or miss.



In figures A and B all the warps are included in the groups. In figure C the warps marked "x" are not included and flap on the back of the tapestry. They reappear in the rep weaving beyond the tapestry area. These variations may be indications of special workshops, so in our technical file we note the warp grouping: tap 2, 3, 2 alt 3, or 2 and 3 (where the alternation is not regular) etc. Occasionally a piece is found in which adjacent yarns are grouped. Those are listed as darned tapestry for they must have been done on bare threads after the ground fabric was finished.

Another type of problem and a different solution occur in connection with the horizontal loom having a reed, on which cotton tabby had originally been woven. This type of loom and the tabby spacing of the warps were used by linen weavers in some of the fragments found at Dura. The reed which was used to beat up the weft and also to keep the warps properly spaced, had to be taken into account when grouping warps for a tapestry area. The warps in any group would have to lie within one dent of the reed. However, when a straight band of color was to be woven from selvage to selvage, a heddle rod was added which governed certain warps on the 1st cloth harness. It did not have separate warps of its own like the third harness on a twill loom.



This threading allowed the linen weaver to weave his tabby with the first two harnesses and to weave a pseudo-tapestry band by alternating the 2nd harness and the binder. This type of tapestry we list: tap 1-3- etc. counting only the number of warps on the second harness between the binders, and not the other warps on the 1st harness which in the tapestry area are left to flap on the back of the fabric. The bands thus woven are relatively narrow because of these flapping warps. When a wide band is desired a few shots of linen tabby are usually woven at intervals to hitch them. Here we have the first example of a compound harness to simplify the making of two textures. This invention came to be used in a number of ways. Self bands of multiple wefts had been used in ordinary tabby and rep weaving where they merely created a ridge. Now they were used with this binder harness and thereby became more decorative, for the floating weft caught the light. Small brocaded patterns were also bound by this harness and can be distinguished from embroidery by the regularity of the vertical binding. This we call 1-5 inlay, a name coined by Luther Hooper. In this case we do count all the warps between the binders, for they all appear continuously in the weaving.

It may be possible that this harness was more used in Syria and Asia generally than in Egypt, for when silk was introduced into Egypt the binder harness was not used. Silk pattern bands on our Egyptian tiraz are tapestry or embroidery, not inlay. Whereas some Asia Minor patterns are inlay, and inlay is still found in the 10th-11th century silks from Mesopotamia.

The advent of silk in Egypt brought no new incentive to linen weavers to expand their looms. They had merely found a fiber, which might be dyed, to use with linen in their old established techniques, for silk was fine enough to be tapestry woven on single linen warps. Exquisite work was done but the loom remained a two-harness affair, since rep or tabby were the best weaves for the slippery, compact linen yarns which had little or no elasticity. It is an interesting contrast to the wool weavers who were busy devising new techniques in which to use their wool.

#### **DEFINITIONS OF TERMS USED IN OUR FILE.**

**BASKET WEAVE:** A cloth weave with both warps and wefts used in pairs.

**CREPE:** A fabric, usually cloth woven, in which an uneven appearance is obtained by over-spinning the warp or weft or both.

**DARNED TAPESTRY:** A tapestry area made by darning bare threads after the ground fabric is finished. Space for the tapestry may have been left during the weaving, or threads may have been pulled from finished goods.

**INLAY:** A simple type of brocade in which the pattern is bound vertically by certain main warps.

**TWILL:** A type of weave in which the weft does not retrace its course more often than every third time. The underpasses are in echelon right or left or chevron.

**BAND:** A color division in the weft direction.

**STRIPE:** A color division in the warp direction.

## PROCEDURES FOR CLEANING COTTON TEXTILES

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We have found in the Textile Museum, after considerable experimentation, that "all-cotton" textiles are perhaps the easiest to process. The procedures are listed in consecutive order and are summarized below.

1. The microscopic examination to determine the fiber, the probable degree of deterioration, and any other qualities not apparent to the naked eye.
2. Chemical tests to estimate the reaction of the dyes to detergents, alkalies, acids, and salt. These tests are standard and can be followed in testing the dyes of other textiles besides cotton.
3. The washing methods appropriate for "all-cotton" pieces.
4. A short blocking procedure.

If these steps are followed in order, cotton textiles will show great improvement and the danger in processing them will be relatively slight.

The Textile Museum wishes to express its gratitude to the National Institute of Cleaning and Dyeing for the benefit of its technical background in the cleaning industry, and its most sincere appreciation to Colonel James W. Rice and Major Ross Wright for their cooperative assistance.

### MICROSCOPIC ANALYSIS

**Essential Materials** (see supply sheet for all materials):

1. Microscope
2. Photomicrographs of fibers
3. Blunt tweezers

In the cleaning of textiles, the first step after assembling the materials is the microscopic analysis. The primary objectives of this examination are to determine:

- A. What the fiber is (cotton, wool, silk, or linen, etc.)
- B. What the spinning is (S, Z, or Plyed, see *Workshop Notes, No. 2*)
- C. The amount and kind of foreign matter present
- D. The general condition of the fibers; that is, the amount of mechanical and chemical action that can be applied safely
- E. If there are any repaired areas to be tested separately

Upon completion of this examination, the fibers have been seen under magnification and compared with the photomicrographs of other fibers for their identification. If the fiber is found to be cotton, then proceed in the following manner to test and clean cotton textiles.

### TESTING THE COLORS

**Essential Materials:**

1. 4 dropper bottles containing respectively—
  - A. Detergent solution (one and a half to two teaspoonfuls to a gallon of distilled water)
  - B. Distilled water
  - C. Acid—28% acetic acid, chemically pure

- D. Alkali—26-degree ammonia, chemically pure
2. Absorbent paper, i.e., white blotters or kleenex
3. Tweezers—always used in handling textiles
4. Common salt

NOTE: If the textile is to be washed immediately following the testing of the colors, enough distilled water should be heated and in readiness for the washing process.

Without testing it is impossible to know what reaction dyes will have when exposed to water or to different chemicals useful in cleaning; therefore, tests have been devised to determine the fastness of the dyes. With these tests it can be determined if the textile can be washed safely and the preferred method to use. There are other advantages to testing. In most cases, it is possible to surmise the agents that will bleed the dye and those that will have a setting effect upon them. When "spotting"<sup>1</sup> stubborn stains, it must be known, in advance, if alkali or acid or both can be utilized in attempting their removal. Each of the tests should be made in a different area, and it is important to allow sufficient time for the agent to penetrate before firmly pressing the textile between the folds of a blotter or kleenex. If any patches are found, they, too, must be tested or removed before washing. After each test, thorough rinsing with distilled water is necessary, even if bleeding occurs.

### TEST I

#### Procedure:

- A. Place a blotter or kleenex, preferably near the edge, under a portion of the textile containing the color to be tested (see *Workshop Notes, No. 1*).
- B. Apply a drop or two of a synthetic detergent solution on the area, allowing it to remain a few seconds to loosen any dye. Test with the detergent that is to be used in the washing.
- C. Fold the blotter or kleenex over on top of the spot and press it firmly.
- D. Any color bleeding will be apparent when the blotter is observed. There will be difficulty sometimes in distinguishing dye from dirt.
- E. Rinse the area thoroughly with distilled water.

The synthetic detergent is used to indicate whether the dye is fast or fugitive. If the color is fugitive in the test, it can be expected to bleed if the textile is soaked in synthetic detergent; therefore, do not wash it.

### TEST II

#### Procedure

- A. Place a blotter or kleenex, preferably near the edge, under a portion of the textile containing the color to be tested.
- B. Apply a drop or two of distilled water on the area.
- C. Add a drop or two of 26-degree ammonia.
- D. Fold the blotter or kleenex over on top of the spot and press it firmly.
- E. Rinse the area thoroughly with distilled water.

If the colors withstand this test, then it is possible to add ammonia to the detergent bath when cleaning this cotton.

### TEST III

#### Procedure:

- A. Place a blotter or kleenex, preferably near the edge, under a portion of the textile containing the color to be tested.

<sup>1</sup> Spotting—The process in attempting the removal of spots, stains, and other foreign substances from particular areas of textiles.

## SUPPLIES

Incorporated with the supply sheet accompanying Workshop Notes, No. 1, 1948.

Acetic acid, 28% chemically pure—Laundry supply house.

Ammonia, 26-degree, chemically pure—Laundry supply house.

Club Wheeldex—Wheeldex Manufacturing Co., Inc., 53 Park Row, New York 7, N. Y.

Detergents—Laundry supply house.

Orvus, WA—Procter and Gamble.

Renex 48—Atlas Powder Company.

Mentor Beeds—Colgate Palmolive-Peet Company.

Igapal CA, Extra—General Dyestuff Corporation, 435 Hudson St., New York 14, N. Y.

Dropper bottles—Laundry supply house.

Glycerine—chemically pure; i.e. 98%—Laundry supply house.

Lumarith—Celanese Plastics Corporation, 180 Madison Ave., New York 16, N. Y.

Cellulose acetate, clear transparent, 47 inches wide, L-818, .010 inch thickness.

Lumite—Chicopee Mfg. Corporation of Georgia, 47 Worth St., New York 13, N. Y.

Cloth weave—Natural, 32 x 32 construction .010 filament diameter.

Twill weave—Natural, 80 x 36 construction .010 filament diameter.

Microscope—Bausch and Lomb, 30 Rockefeller Plaza, New York, N. Y.

Long tube, wide field, 20x. Catalogue listing: K-2040, B & L.

Parazyme—Morris and Eckels Co., Laundry supply house. Executive Office: Carman and Co., Inc., 629 W. 27th St., New York 1, N. Y.

Photomicrographs of Fibers—"Tentative Methods for Identification of Fibers in Textiles."

A.S.T.M. Designation: D 276-43 T., published by the American Society For Testing Materials, 260 S. Broad St., Philadelphia 2, Pa.

Pins—Star Pin Company, Marbridge Building, 47 West 34th St., New York, N. Y.

Smallest domestic pin. No. S., wire gauge .021.

Plexiglas—Rohm & Hass Co., Washington Square, Philadelphia 5, Pa.

Still—Arthur H. Thomas Co. 230 South 7th St., Philadelphia 5, Pa.

Barnstead, No. 4684, electric, capacity 1 gallon per hour.

Stoddart Solvent—A standard product and must comply with commercial standard, CS 3-140.

Minimum flash point 100° F. Obtainable from any of the larger oil companies.

Tamping brush—Morris and Eckels Co., Laundry supply house, #6 "Tag Line." Executive Office: Carman and Co., Inc., 629 West 27th St., New York 1, N. Y.

Thermometer—Thermometer with a retainer's cup, Eaton's Chemical Company, 1490 Franklin St., Detroit 7, Mich.

"Candy" thermometer obtainable at any hardware or department store.

Tweezers—Surgical supply house.

- B. Apply a drop or two of distilled water on the area.
- C. Add a drop or two of 28% acetic acid.
- D. Fold the blotter or kleenex over on top of the spot and press it firmly.
- E. Rinse the area thoroughly with distilled water.

Acetic acid is sometimes very useful in "spotting," but is not as safe on cotton as is ammonia. If the color had bled in the two previous tests, the test with acid is helpful to determine if it will set the dye. If the acid does not set the color, make a test with a five percent solution of common salt. Most colors will be set by either salt or acetic acid.

A textile can be washed if it bleeds to either acid or ammonia. The only caution is not to use the agent that bled the dye. However, if the textile does bleed to the synthetic detergent, do not wash it.

## CLEANING

### Essential Materials:

- 1. Distilled water
- 2. Synthetic detergent (one and a half to two teaspoonfuls to a gallon of distilled water)
- 3. Acid—28% acetic acid (a teaspoonful to a gallon of distilled water)
- 4. Alkali—26-degree ammonia (a teaspoonful to a gallon of distilled water)
- 5. Glycerine—chemically pure, 98% (a cupful to a gallon of distilled water)
- 6. Stove to heat distilled water
- 7. Blunt tweezers—handling the textile
- 8. Lumite screening (cloth weave) to hold textile flat
- 9. Shallow pan large enough to hold the textile
- 10. Sponge and tamping brush
- 11. Thermometer
- 12. Lumite screening (cloth weave) stretched over a frame for rinsing

## CLEANING

### Procedure:

The cleaning should not be attempted until after the microscopic analysis and the colors tested. When this has been accomplished, it is then safe to proceed with the cleaning.

- A. Heat the distilled water to a temperature of approximately 90 degrees Fahrenheit.
- B. Add the glycerine (a cupful to a gallon of heated distilled water). The glycerine has been found to be extremely desirable in the lubrication of the fibers and is reputed to have some synergistic or detergent aiding action.
- C. Into the pan pour only enough of the heated solution to cover the textile. The textile must not float and must be kept flat.
- D. Place the textile between a cloth weave lumite screen, as was described in *Workshop Notes, No. 1*.
- E. A suitable detergent should be added (one and a half to two teaspoonfuls to a gallon of distilled water).
- F. The textile (between the lumite screening) can be placed in the above ingredients and allowed to soak. The time is dependent upon the amount of soil present (20 minutes to one hour).
- G. Distilled water should be heated for the rinsing.
- H. It is important for the bath water to remain at a fairly constant temperature (a thermometer is recommended). In the final rinsing the temperature can be lowered by degrees.
- I. After soaking, the textile can be sponged or, if necessary, tamped on a flat surface.

J. The textile can then be rinsed. The easiest method is to place the textile on a cloth woven screen so the water can be flushed through.

Dirty textiles can seldom be satisfactorily cleaned by a single application of detergents. Usually two, three or more soakings are required. When more than one washing is planned and there was not a reaction to ammonia in the color test, a teaspoonful of 26-degree ammonia to a gallon of distilled water may be added to the bath.

The ammonia has the advantage of saponifying the dirt, thus aiding the cleansing process. The colors will often brighten after this addition. The small amount of ammonia used will volatilize and will not harm most cotton textiles. When the textile appears clean it is time for the final rinsing. A cupful of glycerine can again be added to the water.

## **BLOCKING**

### **Essential Materials:**

1. Towels to absorb the excess moisture from the textile after the final rinsing
2. Pins
3. Tweezers
4. Lumite screening (twill weave) for blocking.

### **Procedure:**

After the textile, still between the screening, has been rinsed it is placed between towels to absorb the excess moisture. It can then be taken from between the screening with tweezers and placed or turned onto a twill weave blocking screen. The warps and wefts should be straightened carefully, using blunt tweezers, pins, and a "T" square. Fibers expand when they are wet; therefore, as the textile dries the yarns shrink, requiring readjustment of the pins at various stages in the drying.

## RUGS: PRESERVATION, DISPLAY AND STORAGE

George Hewitt Myers

Textile Museum, Washington, D. C.

"Patina" is an abused word. Close inspection, often even a casual one, usually discloses that it really means dirt. It should, of course, refer to a well-worn or polished surface, more attractive than a raw surface or finish. But when, in the case of a rug or textile, the original color is merely dulled by dirt, the dirt should be removed, because it cannot logically improve the artistic effect.

When a rug is acquired it should at once be put into condition for display. By that we mean if it is dirty it must be washed; if ragged, it must be repaired. If it is to be hung, tapes and rings must be applied also.

Our present method of cleaning a rug is washing. An antique rug with wool pile dyed with vegetable colors will not fade if washed in a neutral synthetic detergent.\* However, before washing, the rug must be carefully examined to see if there has been any repair or patching. Repair is sometimes done with aniline dyed yarn or patches cut from recently woven aniline dyed rugs, and the colors may not be fast. Or when a rug is seriously worn so that the pile is gone and the warp is left exposed, it often happens that an effort has been made to cover this defect by painting the warp. The pigments used for this purpose may not be fast colors and hence will run in the washing. Therefore all forms of repair must be discovered before washing the whole piece. Ultra-violet light can be used very effectively for this purpose. Different dyes and fibers react characteristically to ultra-violet light so that the light will show at once whether the material is homogeneous or not. It is not necessary to understand the significance of these reactions to ultra-violet light, many of which have not yet been determined. We use it just as a quick method of determining whether any parts of the rug react differently from the rest, and are therefore probably repair. All dye in repaired parts should be tested for fastness. If either paint or aniline dye is found, a reputable specialist experienced in washing rugs should be consulted, for either the paint or the dye may run or fade during the washing and harm the rest of the rug. Also it must be remembered that vegetable dyes fade *in hue* when they fade, the color getting less intense or duller; while aniline dyes fade *out of hue*, thus producing a new color which may clash with the rest of the rug.

If there are holes in the rug they must be repaired, after the washing, so that no further damage may ensue. This can be done in several ways.

1. The missing parts may be re-woven. This is the most expensive method but is sometimes necessary when large areas are missing.

2. Small holes can be patched. Patching takes less time than re-weaving, provided patches from similar rugs are available. Either of these methods requires:

- A. A skilled weaver and
- B. A supply of the proper materials.

Warp, weft and pile should all be similar to those in the rug. Warp and weft need not be the same material as those used in the rug, but should be approximately the same size yarns with the same degree of flexibility and stretch, especially if the rug is to be hung. Special care should be taken to see that the wool for the pile is the same type and degree of fineness as that of the rug. When a different type of wool is used, even if the color is good, the repair will show, for various types of wool reflect light

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\* See Workshop Notes. Paper No. 1.



differently. The dyes should be vegetable dyes, and both the rug and the material for the re-weaving or patching should be cleaned before the work starts. If the colors match when they are clean they will probably continue to harmonize, whereas if a clean color is matched to a dirty one, or two dirty colors are put together, subsequent washing may throw them out of harmony. (See fig. 1, an illustration of good repair done with the wrong materials.)

3. Flat weaving is sometimes used as a way of restoring the pattern with no attempt to replace the pile knots. This method takes slightly less skill and experience than re-weaving or patching. When the missing design is repeated in existing parts of the rug so that it may be copied, it is possible to attain good results with re-weaving or flat weaving. When the pattern must be improvised the result is likely to be less satisfactory.

4. Unless the proper materials are obtainable it is better to sew a backing patch on the rug extending well beyond the hole. The design may then be painted in on the backing, taking care not to get any paint on the rug itself. This is the cheapest process.

In any case (and this applies to almost all antiques), all worn or unfinished edges must be overcast to prevent raveling.

When the rug has been cleaned and repaired, preparations must be made to exhibit it safely. Weak rugs should be backed under the whole or the weak parts. The materials used should be firmly woven and must be pre-shrunk to prevent sagging or pulling when carrying the weight of the rug. If imperfect weaving has caused a rug to bulge in certain places, then use on the floor may result in extra wear upon the pile, and when that is gone, upon warp and weft. This is difficult to obviate and careful shrinking or stretching is about all that can be done.

Although pile carpets or rugs were intended to be used chiefly as floor coverings, in museum practice they are more often hung upon walls and, if so hung, are more highly regarded by the general public than if spread upon floors. As a matter of fact many if not all rugs show to better advantage on floors than if hung upon walls. Many rugs are unevenly woven and it is more difficult to make them hang flat than to have them lie flat.

If rugs are to be hung for exhibition, care in proportion to the size of the rug must be taken to relieve strain on the warps. The aim is to distribute the strain of the rug's weight evenly over all parts. This may be done by means of a strong tape sewn to what is to be the top of the rug when hung. Sometimes a rug may be taped vertically also, to help carry the weight. The vertical tapes should be 10 or 12 inches apart and should be carefully applied so that the rug will lie or hang flat. If a rug has to be hung sideways because of space or design, this taping is particularly necessary since the weft of a rug is not intended, as is the warp, to carry weight. If the width of the rug is not too great, the tape at the top may be doubled over forming a loop, and a rod, stiff enough not to bend under the weight, inserted into this loop. This rod may be hung from a cord attached to either end. If such a rod cannot be used, rings must be sewn onto the tape at frequent intervals across the top. Then hooks must be properly spaced in a strong piece of wood from which the rug may be hung by the rings. When putting the hooks to the board it must be remembered that good, old rugs are seldom woven quite straight so that if the hooks are put in a straight line the rug will probably not hang flat. The contour of the top of the rug should be taken into account and a wide enough board should be used so that the hooks may follow the line of the rug. This must be done by trial and error, but it usually can be done. When the hooks have been properly adjusted for a given rug it is best to keep that board for that rug, since the arrangement of hooks for one rug is not likely to fit any other. (See fig. 2, showing a rug hung from hooks placed in a straight line. Above the rug a crooked line is drawn on the board which shows the proper placing of the hooks for this rug. Fig. 3 shows the same rug hung on the properly placed hooks.) As a rule pile should lie from the top down, i.e., so that it feels more smooth when the hand brushes it down rather than up.

Rugs should not be hung too long at a time. It is best to give them a rest of at least one month per year. In the rest period they may lie flat or be rolled.



2. R 2.66 Rug hung from hooks placed in straight line. Above the rug a crooked line is drawn on the board which shows the proper placing of the hooks for this rug.



3. R 2.66 Rug hung on the properly placed hooks.



1. R 7.8 An illustration of good repair done with the wrong materials.



4. Showing rugs on rug racks in one of the storage rooms.

Rugs to be stored should always be rolled against the pile, right side inward; they should never be folded. They should be rolled on poles three inches or more in diameter made of light weight wood which has been thoroughly seasoned so that there is no risk of sap leakage onto the rugs. Or, if the rug is not too heavy, strong cardboard tubing may be used. When planning rug storage there are several points which should be taken into consideration.

1. Humidity.
2. Accessibility, with proper support.
3. Fumigation or moth proofing.

## **HUMIDITY**

Standard conditions should be 70° F. and 65 per cent relative humidity. The humidity should not be allowed to get beyond 70 per cent. Storage space should be located in a dry, cool part of the building with reasonable ventilation. A hot, unventilated attic would be a poor storage room; so would a damp, unventilated basement. Fibers breathe and there must be a certain amount of moisture in the air to keep them from becoming dehydrated, but in a damp place fibers are apt to mildew or mold. Too little humidity is bad but too much is worse.

## **ACCESSIBILITY**

As rugs are comparatively heavy objects, storage should be arranged so that as many rugs as possible may be easily reached without moving others. In this museum skeleton rug racks are built against the walls of the rug storage rooms. They consist of uprights placed at four-foot intervals all along the wall. From the uprights arms three feet long extend horizontally forward at levels one foot apart. The uprights are installed so that they tilt back slightly, the top being placed against the wall, the bottom one inch away from it. This tilts the arms just enough so that rugs will not roll forward. With this arrangement a large rug rolled on its pole may rest on three or four arms while a small prayer rug rests only on two. Few rugs rest one upon the other and the backs of all are visible and their accession numbers may be seen. It is seldom necessary to move any rug except the one wanted. It is, also, much easier to remove them from or put them back on the arms of the rack than it would be to remove them from or put them back on shelves. (See fig. 4 showing rugs on rug racks.)

As our collection numbers over 250 rugs we have found it a convenience to set up a visible file of rug cards in our storage rooms. These 3" x 5" cards are separate from the accession file and are used as a "working" or "case history" file. Each rug has a card carrying its registration number and its permanent location. Then in columns are given dates of cleaning together with dates and places of exhibition. With this record each rug can be accounted for at a glance if it is missing from its storage space. The information is helpful also as we check the rugs annually for cleaning. The record may decide whether the rug should be re-washed or whether a vacuum cleaning will be sufficient.

## **FUMIGATION**

Annually in July, before fumigating the entire building, the rugs are given individual attention.

1. The back of the rug is vacuumed.
2. The front of the rug is vacuumed.
3. While the rug is on the floor, right side up, it is sprinkled with para-di-chloride-benzene flakes,\* approximately 1/2 lb. or 2 handfuls to a 4' x 6' rug.
4. The rug is then rolled on its pole, usually starting at the top.

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\* We use flakes instead of crystals as they do not press into the rug when it is rolled.

5. When all the rugs have been vacuumed, sprinkled with flakes and rolled, the storage rooms are sealed for fumigation.

6. The temperature should register between 90° and 100° F. to evaporate the flakes as quickly as possible.

A fumigation can be given in 48 hours. But as our entire collection consists of rugs and textiles we take the extra precaution of sealing our whole building for three days when fumigating, with the temperature registering in the high 90's.

If only a few pieces are to be fumigated they may be sealed in closets or chests of drawers for 48 hours with 1 lb. of flakes to 10 cubic feet of space, sprinkled in the closet or container. Large rugs can be packaged and sealed. However, the temperature must be raised to 90° F. at least, to evaporate the flakes which do not do their work until they have evaporated and saturated the fabrics with their fumes. The presence of the flakes will merely retard the progress of moth development; the fumes will kill.

### **PACKING FOR SHIPPING**

Small rugs should be rolled (preferably on cardboard tubing) when packed for shipment. When shipped in a lot, they can be placed in a box, each one rolled separate or one rolled upon another. If rolled separately the shipment may be checked upon arrival with less trouble than if several rugs must be unrolled to get the total count. A well-preserved large rug may safely be rolled and packaged, if it is strong enough to stand the strain of bending to which it will be subjected if carried over someone's shoulder. A brittle or fragile ancient rug should by all means be rolled and packed in a box.

Waterproof, tar-treated paper should never be used to line the box if para-di-chloride-benzene flakes have been rolled in the rugs, for the fumes from the flakes will melt the tar paper, which will in turn damage the rugs.

### **STORAGE AND FUMIGATION STANDARDS**

**STORAGE:** Standard conditions should be 70° F. and 65 per cent relative humidity. Humidity should not be allowed to get above 70 per cent.

**FUMIGATION:** 48 hours with the temperature between 90° and 100° F. using 1 lb. para-di-chloride-benzene flakes per 10 cubic feet.

**CAUTION:** NEVER use tar-treated water-proof paper with para-di-chloride-benzene.

## TEXTILE ANALYSIS: EARLY TECHNIQUES IN EGYPT AND THE NEAR EAST

## Part 3

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Workshop Notes, Paper No. 2 explained in some detail the physical differences in the four principal textile fibers: wool, silk, cotton and linen. It discussed the part those physical properties played in developing the different simple weaves which appeared in quantity in early times: gauze for silk; tabby for cotton; rep for linen or silk; and tapestry for wool. Paper No. 3 brought out the points: that cotton weavers, and linen weavers in Egypt, seem to have been satisfied with cloth looms; that in Syria at Dura-Europos before 256 A.D. a binder harness was used on linen cloth looms which governed certain warps on the first cloth harness; and that wool weavers at Dura were using a three harness twill loom. In this paper we shall try to trace the further evolution of loom set-ups introduced by the wool weavers which were subsequently adopted for silk weaving, and the light these techniques can throw on the history of textiles.

Linen weavers as well as cotton and silk weavers threw their shuttles from selvage to selvage of their cloth looms. They were able to do this because their yarns, even in the case of fragile cotton, had little stretch. Wool weavers, on the other hand, had to manage an elastic yarn which would catch at other yarns. They, therefore, kept their warps under great tension in order to hold them as firm as possible, and their wefts had to be loose to bend around the tense warps. If the slack is to be distributed evenly, a loose weft may be run only behind a few wool warps at a time on a cloth loom, and cannot be thrown across the whole web. However, the added space between bindings on a twill loom did allow wool weavers to throw their shuttles from side to side of the web, thus speeding the process of weaving a plain fabric and making it comparable to linen, cotton or silk weaving on a cloth loom. As the twill loom would have brought no added advantage to the weavers of other fibers we are not surprised to find plain twills woven only on wool warps.

The twill loom was a revolutionary step forward in loom construction, but it did not satisfy the wool weavers completely. They were used to weaving patterns, and weaving twill mosaic is quite as slow as weaving cloth mosaic. Therefore, the wool weavers were apparently still trying to find a faster method of weaving patterns.

The next experiment seems to have resulted in a coalescence of the three harness loom and the binder heddles from a cloth loom. The three harness twill loom had been threaded thus:

```

* * * * * 1st harness
 * * * * * 2nd  "
  * * * * * 3rd  "

```

On the cloth loom, binder heddles were attached to certain warps on the 1st harness thus:

```

* * * * * 1st harness
 * * * * * 2nd  "
  o o o o binder heddles

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In this new experiment the yarns which had been threaded through the 1st harness and the binder heddles on the cloth loom, were threaded only on the third harness, making a set-up like this:

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* * * * 1st harness
 * * * * * 2nd  "
  * * * * 3rd  "

```

Now either the 1st harness or the 3rd could be used to bind an inlay pattern, and by using the 1st and 3rd harnesses together a tabby could be woven with the 2nd harness. By using the 1st and 3rd harnesses alternately a different cloth binding could be made, with the warps on the 2nd harness lying be-

tween the binders in such a way as to assure a long enough float so that a wool weft, which could be beaten up to cover the warps, might be thrown across the web. The only drawback was that if the weft were thrown in front of the warps on the 2nd harness too many times in succession, those warps would flap on the back of the fabric, as they would not be incorporated in the weaving. Similarly, if successive wefts passed behind the second harness the warps would flap on the face of the fabric. (This point was discussed in Paper No. 3 in connection with pseudo-tapestry.) To overcome this difficulty, two wefts were used in each shed; one in front of the second harness, the other behind.

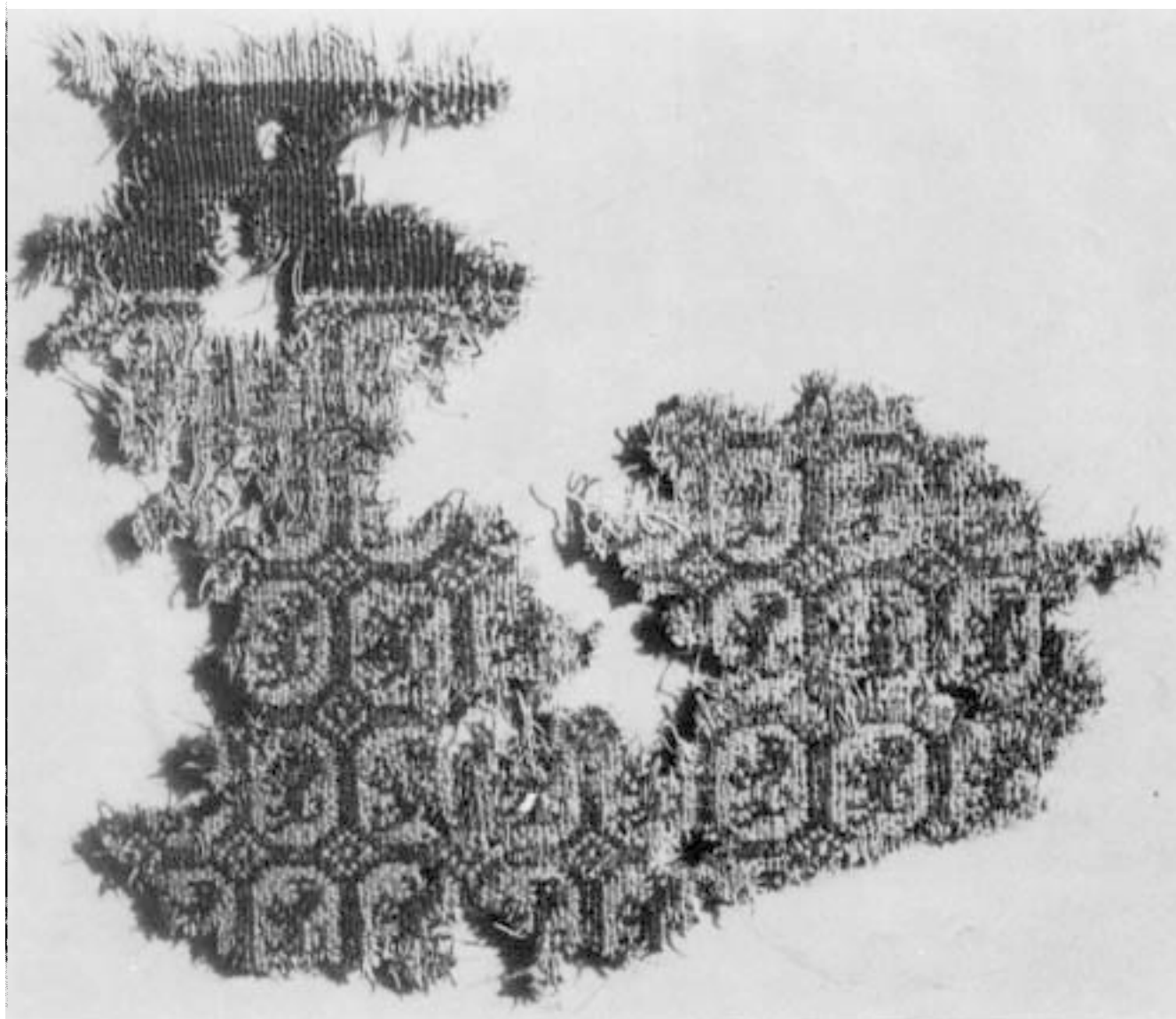
At this time the fashion was for a silhouette pattern in a single color against a contrasting background. The two-weft system was ideal for the purpose. At first the pattern may have been darned on the warps of the 2nd harness with one weft, the background with the other; one weft coming to the face where the second went to the back and vice versa. However, very soon some type of drawloom harness seems to have been devised, for early examples of this type of weaving show small patterns repeated in a diaper, covering the surface of the web. (See 73.384) That this system of weaving was the invention of tapestry weavers is attested by the fact that the finish bands are usually tapestry. A notable piece at the Victoria and Albert Museum (Kendrick, *Catalogue of Textiles from Burying-grounds in Egypt*, Vol. II, no. 537, pl. XXV) contains two tapestry squares inwoven in a cloth of drawloom weaving. The tapestry pattern is much finer and more delicate than the drawloom pattern and seems to show that the latter was a faster but, at least at first, a less particular method of decoration.

Once the system was invented different versions appear which may eventually help us to distinguish between weaving centers. We find drawloom cloths with one main warp between binders, or with two main warps between binders. We list them in our files as drawloom cloth (dl-cl) 1M 1B: 2m. or dl-cl 2M 1B: 2m. This follows our usual procedure of mentioning the warp first and the weft second. As we have two systems of warp in this case, we mention the main warp first, the binder warp second. After the colon, we list the wefts. We use capital letters to initial the systems of warp and small letters for the weft categories.

In Nancy A. Reath's textile classification these fabrics are grouped with others as plain compound cloth. We do not follow this classification because it does not give us sufficient information about the loom set-up or the method of weaving. Arab historians mention the fabrics as cloth with two wefts. This we have not followed either because there are sometimes more than two wefts. The drawloom after its invention is used in many fabrics with repeating patterns. However, we use the word drawloom in connection with these categories because they are the only type in which there are warps used to make the pattern which are not otherwise concerned in the weaving. In other words the main warps are controlled by the drawloom harness alone, and the system of binding is cloth.

It was not long after the invention of drawloom weaving that silk yarn as well as woven silk fabrics began to be carried in quantity over the trade routes from the Far East. In the Far East complicated systems of weaving had already been devised which could produce complex warp patterns. This type of weaving was virtually unknown in the Near East where a warp pattern was particularly foreign to tapestry weavers. Near Eastern wool weavers, who had a springy warp to deal with, had the habit of keeping their warps under tension and their wefts loose. They would have found it difficult to manage a comparatively loose silk warp, to say nothing of the complexity of threading a warp pattern which, instead of their twenty or thirty wool warps to the inch, might require three or four hundred silk yarns. The question was: how should Persian weavers use silk thread? Literary sources tell us that the Sasanians took weavers from their Western Provinces—at that time Persia extended as far west as Syria—to their weaving centers or factories in the East to weave silk. It must have been the wool weavers who were taken, for the Near Eastern silks which appear in quantity in the 5th century A.D. are woven in these drawloom techniques. Apparently Byzantium also adopted the same methods of weaving silk.

The Near Eastern silks are woven in the same techniques used for wool and we can be sure that they were woven by Near Eastern weavers, because the warp yarns for this class of silk are all well spun like the wool warps. The Far Eastern weavers at that time did not spin silk yarns for their own weaves. As a general rule they spun silk only for a solid color satin damask when they wished the light to be reflected differently by a spun warp and an unspun weft. They did spin and ply the warp for k'o ssu when the tapestry technique finally got to the Far East from the Near East but that, aside from the fact that



73.384 D1-cl. 2M 1B: 2m. Tap 3 band at top.  
Comber repeat woven with wool



73.555 D1-1 / 2tw. 2M 1B:2m.  
(Photograph taken on reverse side.)  
Point repeat woven with wool and cotton.



721.10a D1-1 \ 2tw. 1M 1B: 2m.  
3 pattern warps controlled together  
Woven with silk



it was part of the technique they were copying, may have been done in an effort to make the warps less slippery so that the wefts would stay in place. There would have been no need to spin the warps for a drawloom technique where the wefts were locked in place by the binder warps. There are enough Far Eastern examples of this type with unspun warps to substantiate this point.

As the silk yarns were so much finer than wool ones, many more warps were required to make a compact fabric of the same width. This circumstance led to further changes in the looms. Cloth bindings were so close together that the short weft floats did not reflect the light as well as the longer warp floats of the Far Eastern silks. We find several solutions for this problem. When the cloth binding was used, a number of main warps were put between the binders to make the floats longer—in some cases as many as four main warps to one binder. However, the solution found most often in early silks is the use of the drawloom harness with a three harness twill loom binding thus:

dl 1\2tw. 2M 1B: 2m.	** ** ** ** ** ** ** ** **	drawloom harness
	*                   *	1st binder harness
	*                   *	2nd " "
	*                   *	3rd " "

As the silk yarns were fine, it was possible to carry more than two wefts in a single shed without making the fabric too stiff or thick. When several colors were used, one came to the front for the pattern and all the rest lay at the back. Thus a fabric was produced with a definite face and a definite back; the face showing one color at a time, the back at least two. There are wool examples also with several wefts, and a related wool group in which small details were brocaded with a weft not carried from selvage to selvage but turned back at the edge of the figure in which it was used. This latter device kept the wool fabrics from becoming too thick. These drawloom twills are listed in our files thus: dl 1/2tw. 1M 1B: 2m.; dl 1/2tw. 2M 1B: 4m.; or dl 1^2tw. 2M 1B: 2m 1br. The listing of the twills follows the procedure given in Workshop Notes Paper No. 3 in connection with simple twills.

The Sasanians and Umayyads used drawloom weaving and the Seljuks elaborated on it in Persia. It was used by the Byzantines too, and they are said to have established factories for silk weaving in various parts of their empire. However, the Abbasid and Fatimid weavers in Egypt did not use it at all, at least in their tiraz fabrics, for a comparatively narrow repeat was not suited to their long historical inscriptions. (This point is dealt with in the Chapter on Technical Analysis of the *Catalogue of Dated Tiraz Fabrics* recently published by the Textile Museum.)\*

Mr. J. F. Flanagan has an excellent article on silk fabrics of this class in the *Burlington Magazine* for October 1919, pp. 167-172. As the article was written before the Yale University Excavations at Dura-Europos on the Euphrates, he placed the origin of this method of weaving in Egypt, for he recognized it as a Near Eastern rather than a Far Eastern invention. However, as both three harness twills, unusual in Egypt, and a piece of silk drawloom cloth were found at Dura and the expansion of this method of weaving was Asiatic rather than Egyptian, I propose the change of provenance to Syria. Mr. Flanagan draws attention to one way of simplifying the drawloom harness by controlling the pattern warps in groups of three. (See 721.10A) This increased the width of the pattern unit three times, and thereby lessened the size of the harness necessary to make the pattern by two-thirds. It is quite possible that this was an adaptation of a method devised by linen cloth weavers in order to group their warp yarns for tapestry areas.

The conversion to silk had its effect on the weaving of wool. Silk being a comparatively fine fiber, the use of a sizable drawloom harness to manage the many pattern warps was a necessity even for a small pattern. When the same harness was used by wool weavers, patterns of much larger scale than heretofore were possible. (See 73.555) These larger patterns brought with them the use of vegetable fibers for undyed wefts. The wool weavers used a wool warp and one wool weft, but the second weft, if not wool, might be either linen or cotton. The use of the vegetable fibers throws light on the question of provenance of another usage which seems to have come in with silk: the point repeat set-up.

----  
 \**Catalogue of Dated Tiraz Fabrics, Umayyad, Abbasid, Fatimid* by Ernst Kühnel with Technical Analysis by Louisa Bellinger, 1952.

comber repeat	point repeat
* * *	* *
* * *	* * *
* * *	* * *
* * *	* *
x x x	x x
xx xx xx	xx xxx
xxx xxx xxx	xxx xxxxx
xxxxxxxxxxxxx	xxxxxxxxxxx
xxx xxx xxx	xxx xxxxx
xx xx xx	xx xxx
x x x	x x

The point repeat set-up produces a symmetrical pattern. Therefore, with the same amount of drawloom equipment a unit may be produced which appeals to the eye as twice the width of a comber repeat unit. It seems logical to believe that this device originated with weavers using a fine warp, in order to make the most of their equipment. The origin, therefore, would be in the silk factories of Persia or Byzantium rather than among the wool weavers of Syria. The vegetable fibers throw added light on this question, for while drawloom textiles made entirely of wool are woven with either comber or point repeats, those using linen as a weft are comber repeats, and those using cotton are point repeats. Linen belonged in the countries bordering the Mediterranean and cotton belonged in Persia and Mesopotamia, so that this latter region rather than Byzantium is the more likely provenance for the point repeat.

If we compare the techniques used in the early wool and silk drawloom fabrics we find that there is a great deal of variety in the wool ones, not so much variety in the silk. Comparatively few silks are woven with comber repeats and fewer still with cloth bindings, although comber and point repeats as well as cloth and twill bindings are common in wool fabrics. The silk warps are Z-spun and the wefts unspun, whereas we find either S- or Z-spun, single or plied wool warps, and S- or Z-spun wefts. This confirms our opinion that the silks were made in weaving centers or factories situated chiefly in Persia, Mesopotamia or Byzantium with a uniform method for each factory, while the wools were probably made by the inhabitants at large in the same regions as well as in Syria where the method was invented.

The various combinations of spinning and loom set-up may prove to be an aid in uncovering the peregrinations of this type of weaving for we have pertinent technical information at our command to use on the problem.

For determining the general area of manufacture:

Twill loom	Syria before 256 A.D.
Drawloom cloth	“ “ “
Comber repeat	“ “ “
S-spun single warp	Egypt, Syria, Palestine
Linen	“ “ “
Sasanians took weavers East.	
Drawloom twill	probable origin Persia
Point repeat	“ “ “
Z-spun single or plied warp	Persia, Mesopotamia, Asia Minor
Cotton	“ “
Unspun warp	Far East

For a possible grouping by weaving centers we have three other criteria:

- The ratio of main warps to binders
- The use of cloth or twill binding
- The Z or S echelon of twill binding

When information on these points is tabulated and used in conjunction with design the elements in the puzzle of provenance may begin to fall into place.

## RUG ANALYSIS: DISCUSSION OF METHOD

Nancy E. Hunter, Librarian

Textile Museum, Washington, D. C.

The intent of this paper is to explain the Textile Museum's method of analysing rugs; this method will be charted in the forthcoming rug catalogues. In the technical analysis of rugs as in textiles, each of the component parts must be taken into consideration. The technical analysis gives a foundation to the Art Historical, and in cooperation with the Art Historical, helps to localize the provenance. The analysis of rugs is relatively simpler than that of textiles since the variety of techniques is few; however, this is not to imply that their analysis is negligible.

Since the Cairene and Spanish rug catalogues will appear this year, this paper will use the statistics and deductions gathered from these two categories when supplementary examples are required.

In analysing rugs technically, the Textile Museum uses a microscope<sup>1</sup> giving 20 x magnification which enables close visual contact with the fiber. For taking the knot count and distinguishing the type of knot, a smaller, less powerful magnifying glass gives a wider view. Medical tweezers are in some instances valuable in isolating a yarn. A meter tape is more desirable than a meter stick since its flexibility proves convenient when measuring the length of the pile as well as the dimensions of the rug itself.

The charts are used for studying a group of rugs; the distinguishing features are filed on Wheel-dex cards,<sup>2</sup> as illustrated below.

KNOT	single	NAP	4	HOR	11,10	PERP	10
COLORS goat: ivory, tan, brown, dark-brown brick-red, yellow, blue							
SIDES	cut	L. END	cut	U. END cut			
WARP	△ goat	LEVEL	1	WEFT	// goat	SHOOTS 1	
	ivory				ivory		
LOUISA BELLINGER				R 84.18 WHEELEDX FORM 80337			

The order of presentation on the charts differs from the Wheeldex cards. This is because the chart lists the fundamental structures first, while on the Wheeldex cards, a quick, handy reference can be made more easily by color and knot association. The color of each card denotes the classification according to the *warp* material.<sup>3</sup>

### WARP:

In the analysis of a rug, the warp is the first thing to be considered as it is the material upon which the rug is woven. The warp must necessarily be of a firm, strong nature to resist the friction of weaving. It is usual to have a plied warp since the ply gives added strength. When more than two yarns are plied, a weaving center is indicated because the plying of three or more yarns demands the specialized work of a spinner. Thus, more than two yarns plied will mean it is not the work of a nomadic weaver.<sup>4</sup>

<sup>1</sup> *Workshop Notes*, No. 1 Supplies.

<sup>2</sup> *Ibid.*, Supplies.

<sup>3</sup> *Workshop Notes*, No. 2 Definitions, for Textile Museum color key.

<sup>4</sup> *Oriental Rugs*, Hawley A., p. 35.

The material of the warp is usually native to the region of production. If the fiber is indigenous, it is a less expensive material to employ, the weaver has a knowledge of its characteristics and he has used it traditionally. The warp is usually completely covered by the weft and pile and therefore is seldom dyed, except in fine warp rugs, where the warps are frequently striped and serve as a guide to the pattern. The quality of the fiber, along with the natural color, may be associated with a certain geographic region, viz. Asia Minor wool is clear, Persian goat has many colors in it. Further distinctions can be gathered from Mathews.<sup>5</sup>

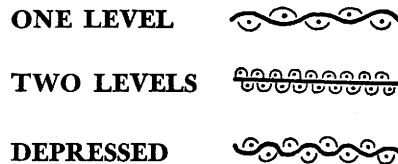
A cotton warp is usually found in rugs made in Persia, India and China. When cotton is used, the ply is higher than wool, because cotton is not in itself a strong fiber and needs added strength.

Spanish rugs use wool or goat according to the weaving traditions of each center. Rugs made at Cairo have wool warps; those made in the Royal Factories at Broussa have warps of silk. The fine silk warp demands skilled workmanship and the number of knots to a 25mm square gives the rug the appearance of great luxury.

Linen is used for the warp in the Spanish Alpujarras and embroidered rugs, but it is rarely found in other groups. Rugs of recent production may use various less expensive materials for their warp, not following the tradition of the region.

The direction of the spin may be either "S" or "Z".<sup>6</sup> The ply goes in the opposite direction from the spin. A Z-spin warp is found in all areas of the Near and Far East, save in the rugs made at Cairo which are S-spun, the traditional Egyptian method.

Warps that are set far apart allow each warp equal prominence on the back which is called one level. However, the knotting of warps closely set up tends to push alternate warps under; when alternate rows are visible, it is called two levels. When all warps are seen but do not share equal prominence, it is called depressed.



#### WEFT:

The weft gives an important clue to a possible center of manufacture. The weft make-up and color frequently differ within a country as in Spain where the rugs with a weft of goat were produced at a different factory than those with a weft of wool. The same applies to color. To illustrate how various centers of weaving show up, the information deduced from analysing the Spanish rugs is cited here.

WEFT MAKE-UP	MATERIAL	COLOR	FACTORY
////	wool	ivory	Alcaraz
^	goat	tan	Chinchilla
////	goat	red	Cuenca
//	goat	ivory	Letur

After each row of knots a characteristic number of weft shoots are put in to pack and bind the knots. The number of shoots is characteristic to a large area. In rugs having two levels and three shoots, the center yarn of the shoot will frequently be of a different material from the other two yarns. Spanish rugs are found to have one shoot where Cairene rugs have two to three shoots.

<sup>5</sup> Mathews' *Textile Fibers*, Herbert R. Mauersberger, New York, fifth edition.

<sup>6</sup> *Workshop Notes*, No. 2 Definitions.

Technical Chart of  
..... Rugs

W A R P

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reg. no.	Location by pattern	Date	Material							Color					Level
			Wool	Goat	Camel	Cotton	Linen or jute	Silk	natural		dyed				
									Ivory	Tan	Brown	Dark-brown	Grey		
R 84.18	Letur ? Spain	E.15c.		^							I			Red selv.	1
R 3.81	Persia						/4\				I				dep
R 1.84	Bergama		^								I	Db	Yellow ends		dep
R 6.8	India	17c.							^		I		Red Green Blue		2
R 51.9	China						/3\				I				1

# WEFT

# PILE

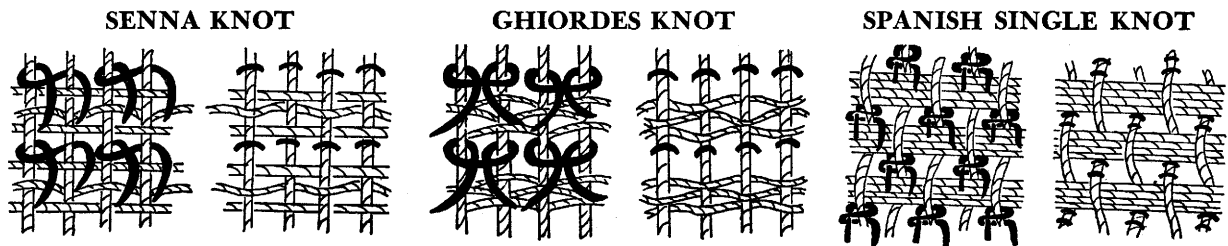
WEFT					PILE																											
Material					Color		Shoot	Material					Color																			
					natural	dyed							natural	dyed																		
Wool	Goat	Camel	Cotton	Linen or jute	Silk	Ivory	Tan	Brown	Dark-brown	Grey	Wool	Goat	Camel	Cotton	Silk	Ivory	Tan	Brown	Dark-brown	Grey	Pink	Red	Orange	Yellow	Olive	Green	Blue-green	Blue	Purple	Red-purple	Black	White
	//					I					1	G				I	T	B	Db			O	Y					B				
			//-///			T					3	//				I	T					R	Y	2		3						
/									Red		2	/				I		B	Db		P	R	Y				2		Rp			
				0					Red		3	//////				I	T		G		P	R			2		B					
			///-////			I					2	/m				I	T		DbG								2					

# K N O T

Nap in mm.	Senna Ghiordes Single Weft Loop Soumac or kilim Embroidery	Count to 25mm. (1 inch)			Sides Overcast Selvage or web Hemmed Cut or repair	Lower End Selvage or web Braided ends Rows of knots Hemmed Fringe Cut or repair	Upper End Selvage or web Braided ends Rows of knots Hemmed Fringe Cut or repair	Quality	
		Horizontal	Perpendicular	25 mm. sq. (1 square inch)				Weave	Texture
								Fine Medium Coarse	Firm Medium Loose
4	Si	11,10	10	105	C	C	C	M	M
2	Sn	12.5	14	175	C	C	C	M	M
2	Gh	9	11	99	0(red)	R	R	F	M
1	Sn	25	20-22	525	C	C	C	F	F
4	Sn	6.5	5	33	C	F	F	C	L

## PILE:

The senna or Persian knot is found in Persia, India, China and the Turkoman area; later it was imported into Egypt by the Mamluks. The ghiordes or Turkish knot is found nearer the Mediterranean basin in Asia Minor and the Caucasus; it also travelled into Persia. The Spanish single knot is found only in Spain. Other types of knots tied on one warp seem to have been experimented with at an earlier date in the Near East and examples have been found in Central Asia (see *Investigation of Silk from Edsen-Gol and Lop-Nor*, Vivi Sylwan, pp. 47-49).



The easiest and most satisfactory manner of detecting the nature of a knot is to bend the rug along a warp or weft thread. Bend the rug along a warp and if the pile appears between the knots vertically, it will be a senna. To determine a ghiordes, bend the rug horizontally along a weft thread and the pile comes in the middle of the knot.

The pile feels smooth to the hand if stroked toward the lower end of the rug; a feature important to realize when a rug is being hung.

The apparent spinning of the pile is not important as the true spinning can be reversed in the tying of the knot. The pile is usually wool. Undyed cotton is used as pile occasionally as it remains white, viz. the Ottoman rugs woven at Broussa. Linen does not prove satisfactory for use as pile because it does not spread to give the desired results. Silk is used infrequently but, like linen, it does not prove a satisfactory material. Metal weft threads are used in rugs as brocade, but they cannot be used as pile.

The materials and colors present in the pile are helpful in assigning rugs to a specific center. The quality and physical properties of fibers are peculiar to certain areas and may be analysed further according to the methods so ably discussed by *Mathews' Textile Fibers*, page 497-8 and Chapter XIII.

Some regions use many natural colors; others use only dyed colors. The only dark brown which remains in old rugs is the wool of "black sheep." Black dye is not satisfactory since the dye "eats" away the wool. The Textile Museum notes the natural colors first; the dyed are noted second according to the spectrum for convenience.

The length and size of the pile yarn show amazing uniformity in each category of rugs, therefore they will aid in giving some idea as to the condition of a rug, viz. a rug with pile of 15mm may belong to a group normally having pile of 30mm thus suggesting that this particular rug shows signs of wear.

A knot count is taken horizontally and vertically. The number of knots per 25mm is counted in the horizontal direction. The number of rows of knots in the vertical direction (a knot and the wefts between it and the next row of knots are counted as a single unit) is multiplied by the number of knot rows in order to get the count to a 25mm. In the case of the Spanish single knot, the knot count is considerably more complicated since the knots are tied on alternate warps and on alternate rows. It is necessary to count the warps horizontally and multiply this number by one half of the number of rows, because it takes two rows to get a knot on each row. The number of knots may vary within a rug, hence a count should be taken in more than one place to find the average.



### **SIDE FINISHES:**

There are several manners by which the sides may be finished.

- Weft overcast
- Double overcast
- Weft selvedge
- Added selvedge

These finishes are in reality a means to an end because they are intended to resist wear. The various methods of strengthening the sides vary according to the centers and traditions of the region.

### **END FINISHES:**

The end finishes are important because they begin and end the rug weaving process. Each end must be considered separately for they may be different. The lower end may have been looped over the rod and the upper end has to be cut in order to take the rug from the loom. Although the warp of the rug is usually of a natural color, the ends of the warp are frequently dyed.

Web, selvedge, braid, hem, fringe, and patterns with ornaments or color are various common finishes. For illustrations, see *Notes on Carpet Weaving and Knotting*, A. F. Kendrick, Victoria and Albert Museum, London.

### **WEAVE:**

The weave of the rug depends upon the fineness of the yarns. The relative quality can be judged by the warp, weft pile and number of knots to the 25mm square. The number of knots determines whether the rug is fine, medium, or coarse. A coarse rug might have a rather thick warp, and few knots to 25mm square, whereas a fine rug would have a small, yet firm warp and a comparatively high knot count.

### **TEXTURE:**

The texture of a rug is determined by the method of production. A rug may be of fine material yet loosely woven. The Spanish Armorial rug in the Textile Museum collection, R 84.18 has excellent material and is well matched, yet the rug is pliable and without body. The reverse could occur. A rug might be of firm body yet it could have coarse materials and the relative quality of materials could be poor.

This method of analysing a rug is not always going to point specifically to a workshop or center. Yet in studying the pattern historically, the analysis will prove to be of great value. The pattern of a given rug may appear to suit a known category, however, the technique may indicate that the weaving is dissimilar to the others in the group and further study may prove that the pattern has travelled. Centers of production have traditional working habits which are slow to change. A systematic study of the technical analysis of rugs has only recently begun. The gathering of a large amount of data is necessary to differentiate clearly between production centers.

Rug charts on plain or ruled paper may be obtained from the Textile Museum for 20¢ per sheet or three sheets for 50¢.

## PRESERVATION OF DATED TIRAZ FABRICS

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Textile Museum, Washington, D. C.

The Textile Museum, in 1952, published a *Catalogue of Dated Tiraz Fabrics* by Ernest Kühnel and Louisa Bellinger. This fall an exhibition of 44 inscribed textiles has been assembled to show a cross section of the Tiraz Fabrics. It is currently on view at the Museum but will be available for loan after January 1954. It will be designated as Traveling Exhibition #2.

When preparing the fabrics for publication and exhibition, the analysis and methods of handling were recorded, and the data have been charted in the seven technical groups into which they were divided before processing. The facts deduced from this chart provide information for the restorer who may be contemplating the preservation of any of this category of material.

Ancient documents in this medium of art are among the most fragile textiles, and we find that for various reasons some entire technical groups of fabrics should not be washed, whereas others could. Every textile, however, was improved somewhat when handled with caution and judgment appropriate to the individual characteristics of the fibers and techniques that were employed in the fabrication. Regardless of the technical group into which a Tiraz was classified for processing, no general method of practice suitable for individual groups was an ironbound rule or was taken for granted. Each textile within its classification, as always, remained an individual problem, for each one had been subjected to varying abuses, and the state of deterioration of each was different. Only after careful scrutiny of each fragment was the prescribed treatment, and the ways and means of handling it, prepared for and executed. The textiles were processed one after the other within their individual groups; e.g., the work on all tapestry woven inscriptions on linen ground was completed before that on the embroidered inscriptions on cotton ground was begun. There was far less risk of destroying or injuring an embroidered inscription worked on linen ground than an embroidered one worked on cotton. There is a logical reason for this difference in reactions of the fibers. When cotton fibers are drying they rotate more actively than linen fibers, and as this movement of the ground fibers beneath the delicate dehydrated tram silk continues, it tends to destroy the silk.

Since "Practice makes perfect," processing all fabrics within one group, one at a time, before turning to other kinds, proved most satisfactory. An inscription once wet should, if possible, be carried through the entire laundering process, and be mounted and covered before work on the next one is started. This was sometimes impossible; some of them took longer than one day to finish completely. When the mounting had to be continued the following day, the fibers were redampened by spray from an atomizer.

In order that a Tiraz be analyzed, handled, and preserved properly, the restorers must have a fair knowledge of the fibers and the spinning, weaving or embroidery techniques employed. The reaction of fibers, or combinations of fibers, upon one another, when wet and when drying, varies according to the individual nature of the fiber, the technical construction of the weave, and the condition in which the textile was received when purchased.

The intent of this paper with the chart from the workshop is to inform you of our method of approach to such a project, and to put before you the desirability of keeping a current, expanding file of such data. Systematic recordings once begun, with various technically grouped fabrics, will become invaluable as reference charts for the restorer when preserving similar textiles in the future.

For example: You have at hand, to preserve, an inscription. When analyzed, you find it to be on a cotton ground material, embroidered with tram (unspun) silk. A glance at the data charted under the headings of Ground and Decoration will show that, as a group, embroidered cotton tiraz should not be washed.

Suppose that the tiraz at hand is embroidered on a linen ground. From the chart under this particular classification you will find that generally a tiraz embroidered on a linen ground can be washed, but textiles similar to 73.629 (with braided tails) should be treated with special care. This is a warning, and the restorer would have to make his own decision as to a method of preservation for a similar piece, taking into consideration:

1. The state of preservation of the textile.
2. The extent of his own dexterity in handling the textile while it is being subjected to risks during the various stages of processing.

Currently expanding working charts will serve not only as a guide to what has been done successfully, but also as a warning as to what could not be done, and what fiber or fiber combinations (i.e., Mulham) presented problems.

In this paper, the textile registration and plate numbers are correlated with those given in the publication, *Catalogue of Dated Tiraz Fabrics*. The methods of analyzing, testing the dyes, and handling textiles generally, have been published in our previous *Workshop Notes*, Papers Nos. 1 and 4. The procedures given in these papers for wool and cotton may be applied to the Tiraz textiles, as they also apply to linen and silk. It would be difficult to process a textile merely by studying a chart, for the procedures involve far too many details that are impossible to chart. However, as a general guide this chart can be used to considerable advantage.

The technical analysis of these textiles has been discussed in a special chapter of the Catalogue. The laundering and mounting procedures will be discussed here.

### DRY CLEANING

Dry cleaning has been done in former times with Benzol. This procedure has largely been discontinued since it tends to dry the already brittle fibers.

### DETERGENTS

For washing we use a neutral synthetic detergent.

1. For Linen, Cotton and Silk; Orvus was used on all fabrics that were washed.
2. For Wool; Orvus has proved to be a fairly satisfactory detergent over the past few years of experiments. 73.396 (not dated, and therefore not in the Catalogue, but to be seen in the exhibition) and 73.447 (wool inscription and decorative band on linen ground) were washed with Orvus. 73.524 and 73.550 were processed in 1947, and at that time a detergent, Aldox, was used which is not on the market. However, recently our experiments with Renex, also a neutral synthetic detergent, have given better results with the wool fibers.

### LUBRICATION

One means of removing deposit from a fabric is lubrication. For this we use glycerine. Glycerine is an alcohol,  $C_3H_5(OH)_3$ , which exists in all fats and oils. As a lubricant it has an effect similar to that of lanolin, which is the natural oil in wool. However, glycerine molecules are smaller than those of lanolin, and therefore it lubricates dry fibers more easily and helps to remove deposits from a fabric with little friction. For the unglazed tiraz fabrics, the addition of an average 5% of glycerine to the washing solution aided in lubricating the dry fibers and also helped clean them. For the glazed tiraz fabrics, glycerine aided (with little friction) in the removal of the deposit from the glazing. Therefore, it was regularly added to the bath.

### SPOTTING

In modern laundries, before the "spotter" attempts to remove stains, he must first determine the nature of the stain. Among other data he must also determine whether or not the stain itself has affected the fabric. In order to do this, many tests are made and most of these tests require thorough rinsings. An archeological laundress is handicapped from the start, especially with inscribed texts that are worked with tram silk, either in embroidery or tapestry. Tram silk will not withstand many rinsings. The object is to wash and lubricate the fibers with as little motion as possible and to protect them permanently when mounting them. To do this a balance had to be kept between the ideal methods and the state of deterioration of each fabric. The procedures had to be planned to handle the fabrics as little as possible for fear of damage to the text. Systematic "spotting" of all pieces was not undertaken. A few were justifiably spotted with ammonia and acetic acid. These "spotters" could be employed safely where the dye tests made before washing had determined that the dyes did not fade to acid or alkali. Sodium Perborate is a mild, slow bleach. On two fabrics that could withstand the long soaks, this agent was effective. Long soaks with Calgon, a water softener, improved others. In some ancient textiles the stains are "set" with age, heat or alkali and cannot be removed. Some textiles were sturdy enough to be tamped. More responded to soaking without physical action.

## PREPARATION FOR MOUNTING

Before each textile was laundered, preparation was made for its mounting. In this group it was important to see both the face of the inscription and the back. Therefore, the textiles were to be mounted either on Lumerith or net. Fragile fabrics were blocked to net without sewing, in which case the net had to be stretched by thread to one of a pair of pieces of glass or Plexiglas cut the proper size for the textile in question. The second piece was then ready to be applied immediately after the blocking and sealed in place to keep the textile from moving. Sturdier fabrics were to be sewn to Lumerith thumbtacked to a mounting frame. As sewn textiles cannot move, the Lumerith is trimmed to size after the mounting, eliminating the thumbtack holes. However, it is important to have the Plexiglas or glass cover cut to size beforehand.

Besides the mount and the cover, it is necessary to fill an atomizer with a 5% Glycerine solution to be used during the mounting, since it is best to keep an inscription slightly damp while it is being sewn, and it is impossible to block a textile to net unless it is damp. When the textile was to be blocked to net without sewing it was necessary also to provide a number of small blocks  $\frac{1}{2}$ " or 1" wide to hold the textile as it was worked, keeping each small portion in place.

## PREPARATION OF TEXTILE FOR BATH—Netting in addition to screening.

After placing the tiraz face up on the bottom layer of the screening, a covering of desized fine silk netting, just smaller than the screening, was laid on top. As a marker or guide for the right side of the textile, a piece of sewing thread an inch or so long was laid somewhere on top of the netting. Next, the top layer of screening was laid on. The net, in addition to the screening, gave an added protection to these most fragile embroidered tiraz. The embroidery is generally more raised on the right side than on the back. There was the possibility (which we dared not risk with a dated document) that some of the embroidery threads would break loose if an added protection was not given, since the silk is unspun and dehydrated. Spun silk or plied silk would be a bit easier to process. Regardless of spinning or plying, dehydrated silk easily powders away. When washing embroidered tiraz, more sponging and rubbing is given the back than the front. Too much friction created on the front may cause the embroidery to slough away, damaging the text, particularly in the ones where the embroidery is more raised on the front than on the back.

The added protection of netting was also given the silk tapestry woven tiraz on linen ground. The state of preservation of the fabrics is seldom better than fair. The fine unspun silk wefts (making the inscription) when broken would, in some fabrics, slough from under the more substantial linen warps. The thread placed upon the top of the net as a guide to the right side proved to be a help. When textiles protected in the manner described above were placed in the shallow bath and became wet, the front and back of a great many tapestries were difficult to distinguish. While soaking, a weight was kept on the screening; this group of tiraz was too delicate to be subjected to any unnecessary motion.

## AFTER THE BATH, REMOVING THE NETTING AND SCREENING AND ABSORBING EXCESS WATER.

Because of the fragility of these documents, each move made, from the first one of placing them right side up between toweling to the last one of reversing them onto the permanent mount, was worked out in advance. The screening or boards for protection when reversing, and the blocking mount or the permanent mount were in readiness and were placed conveniently close. Any one of the several reversings necessary to rid a textile of the screening and net and place it eventually right side up, are moves that had to be executed cautiously. A clumsy technique in handling could have been a fatal catastrophe. Unnecessary moves were avoided. The minimum number necessary were made in the following manner and sequence, the front of the textile being uncovered first because there was less danger to the text if it was unnetted while the ground fabric was still clamped by moisture to the screen in which it had been washed.

1. The fabric remaining between the screening was placed right side up for five minutes between bath toweling that was folded only slightly larger than the screening. (The thread placed on the net served as a guide to the right side.)

2. The top towel was removed. Next the top screening was carefully peeled off, which left the textile exposed except for the net covering.

3. A dry towel or absorbent cloth was then placed over the netted fabric and allowed to remain for about five minutes if the textile was sheer, longer for a more heavily woven one.

4. After removing the cloth or towel, the textile was left exposed to the air for a short while, remaining covered with the net. The net then peeled off easily.

### **PREPARATION FOR, AND REVERSING OF THE FABRIC**

1. A cardboard of firm texture, and of a size to support all of the folded towel, was slipped under the bottom toweling. As before stated, this towel was only slightly larger than the textile.

2. A tautly mounted screening (the blocking screen) was carefully placed on top of the textile so that the fabric was supported by two firm layers, one on top and one underneath.

3. The left hand was placed with fingers outstretched under the bottom cardboard, and the right hand was placed on the top screening. Holding the layers firmly together, they were turned upside down with a quick motion and were laid back on the table.

4. The cardboard was removed, next the towel, then the screening. This left the back of the textile exposed and the right side down on the stretched screening.

5. The permanent mount was then placed on top of the exposed back of the textile. Again the left hand was slipped underneath the bottom screening and the right hand was placed on the top of the mount. As before, a quick complete flip was made to reverse the textile.

6. The screening was removed, leaving the textile right side up, and on its permanent mount.

From this point on, the blocking, or the blocking and sewing, were executed as quickly as possible, never letting the inscription become dry at any time.

### **GENERAL RULES FOR MOUNTING INSCRIPTIONS**

1. It is important to keep the inscription damp throughout the blocking and mounting process. This may be done by spraying with an atomizer. The spray should be prepared before laundering the textile.

2. Have the mount ready before laundering the fabric.

3. Place the center of the fabric to the center of the mount, and pin down immediately or block.

4. Concentrate next on the inscription area which should be aligned horizontally.

5. Align the ground material quickly and pin down enough to hold out of the way. You will return to more detailed aligning later on.

6. Return to the center to start sewing the inscription to the mount.

7. Finally starting from the center, align the ground material in detail.

8. Often, when the ground material is not broken or ragged, sewing the edges of the fabric to the mount is all that is necessary. When the fabric is broken in one or many places, after blocking, sew the edges, then sew around the holes.

### **SPECIAL RULES FOR MOUNTING WOOL TAPESTRIES WITH $\wedge$ WARP**

1, 2, and 3 as above.

4. Quickly set the fabric generally in place and pin the corners; then pin across the top and bottom.

5. Concentrate next on the inscription area if it is broken in places. The curling warps can play havoc with the text. Pin each warp into place.

Wool shrinks when drying and there will be adjustments to make. When the fabric is almost dry:

6. Return to the center and sew the fabric to the mount in a vertical line.

7. Return to the center again and sew the fabric to the mount in a horizontal line.

8. Concentrate on detailed adjustment of the inscription area as the textile is slowly drying. Re-pin each warp and sew to the mount.

9. Always working out from the center, readjust section by section and sew.

The dexterity of the technician when handling such delicate materials improves with practice. Technicians with little experience should not attempt the preservation of DATED documents belonging to this group of fabrics.

**PRELIMINARY HISTORICAL STUDY:  
A LATE ROMAN TAPESTRY FROM EGYPT.\***

Alan J. B. Wace

Textile Museum, Washington, D. C.

This textile from its size (3.25 by 1.80 meters) and its character as a polychrome † tapestry-woven hanging was presumably intended for use as a curtain. It may thus be compared with the modern tapestry-woven kelims of the Near East which are often used as curtains. The modern kelims are usually narrower, but there are many which are woven as wide as this textile. The use of curtains for hanging in doorways or colonnades has a long history in the Near East and in the Mediterranean countries. At Mycenae the doorway into the megaron of the palace was closed apparently only by a curtain.<sup>1</sup> On the walls of a lobby near it were fresco paintings<sup>2</sup> identified as representing hangings, which were almost certainly tapestry-woven. Those figures in the fresco from Mycenae are decorated with parallel horizontal bands and would appear to have been made in narrow strips sewn together. The parallel bands display several well known Mycenaean designs including a frieze of argonauts.

A famous example of a large curtain or hanging was that given by Antiochus Epiphanes to the temple of Zeus at Olympia.<sup>3</sup> This was described by Pausanias as of wool, as purple in color and as of Assyrian weaving.

The relief at Munich,<sup>4</sup> said to be from Corinth and dating probably from the third century B.C. shows the use of a large curtain in a Greek sanctuary. The relief of the Apotheosis of Homer by Archelaos of Priene in the British Museum<sup>5</sup> displays a long curtain hanging before a colonnade. Curtains also appear in the Ikarios reliefs.<sup>6</sup> An instance of a curtain in a doorway is provided by the well known tale that Claudius<sup>7</sup> on the murder of Caligula hid in the curtain of a door. The use of curtains in houses is well attested by the discovery of hooks for hanging them in the doorways and colonnades of houses at Herculaneum and Pompeii. The use of curtains and hangings was common in Egypt and the Ptolemies made much use of them in their displays of luxury.<sup>8</sup> The anecdote of Crates and Zeno<sup>9</sup> shows that textiles could be used to curtain off part of a stoa to secure privacy.

Another ordinary use of decorated curtains was in the Roman theater.<sup>10</sup> There Vergil refers to a stage curtain the sides of which were decorated with figures of "Britanni" as supporters. This presumably was made of several figures of barbarous or semi-barbarous people or "wild men". This use of curtains naturally continued into late Roman times and an excellent example is to be seen in the mosaics of St. Apollinare Nuovo at Ravenna where curtains are seen hanging in the façade of the palace of Theodoric.<sup>11</sup> A large hanging from Egypt of similar design to that in the doorway of the palace is actually in the Victoria and Albert Museum.<sup>12</sup> Other imperial curtains are shown in the background of the mosaic of the Empress Theodora in the church of San Vitale at Ravenna.<sup>13</sup> There is no need to multiply references for the whole subject has been well treated by Chapot and Navarre.<sup>14</sup>

We need thus have little hesitation in seeing in this textile a hanging which would have been

\* This tapestry, No. 71.118, is the subject of a paper on "The Cleaning and Mounting of a Large Wool Tapestry" by Francina S. Greene, Curator Preparator of the Textile Museum, which will appear in a forthcoming issue of *Conservation*, the journal of the International Institute for the Conservation of Museum Objects.

† The colors used are: natural shades from ivory to dark-brown; dyed colors include shades of red, pink, orange, yellow, green, blue and purple.

<sup>1</sup> Wace, *Mycenae*, p. 77.

<sup>2</sup> *Eph. Arch.* 1887, pl. 12.

<sup>3</sup> Pausanias, V.12.4.

<sup>4</sup> Lawrence, *Later Greek Sculpture*, pl. 41 a.

<sup>5</sup> Smith, *B.M.Cat. Sculpture* III, 2191.

<sup>6</sup> Picard, *A.J.A.* 1954, p. 139 ff., figs. 1-3.

<sup>7</sup> Suetonius, *Claudius*, 10.1

<sup>8</sup> Athenaeus, V, 196 ff.

<sup>9</sup> Apuleius, *Florida*, 14.

<sup>10</sup> Vergil, *Georgics*, III 25.

<sup>11</sup> Morey, *Early Christian Art*, fig. 176; Grabar, *Byz. Painting*, pl. 56.

<sup>12</sup> Kendrick, *Cat. of Textiles from Burying Grounds in Egypt*, I, 6, Frontispiece.

<sup>13</sup> Morey, *op. cit.*, fig. 182; Grabar, *op. cit.*, pls. 60, 63.

<sup>14</sup> In Daremberg and Saglio, s.v. *Velum*.

called *aulaia* (*aulaeum*) or *parapetasma*, or *velum*. What if any was the actual difference in meaning or use of these words we do not yet know. We can assume, however, that our textile would have been called by one of these names.

We possess among the textile fragments that have been recovered from Egypt many fragments of large hangings but practically no complete hangings of this kind have survived. This is largely due to the manner in which excavations have been carried on in Egypt on the sites which yield such textiles. Most of the sites have been illicitly excavated by the local inhabitants often financed by Egyptian dealers. Such excavators, of course, from the nature of their operations make no attempt to recover large textiles in as complete a condition as possible. So the better preserved pieces of a large textile are torn away and disposed of separately and thus no attempt to recombine them can be made, for the fragments are, as likely as not, scattered among many museums and collections. It is thus most fortunate that the fragments of this particular textile were kept together by its finders and that the dealer into whose hands it fell also kept the fragments together, so that, when they ultimately came into the possession of the Textile Museum, it has proved possible to reconstitute it. We thus are now able to see and to study almost for the first time the appearance and decoration of a large curtain of this type.

We can imagine that curtains of this type were frequently hung in the colonnades of palaces and public buildings in Ptolemaic and Roman Egypt. Curtains were used to make interior divisions in the large pagan basilicas. Probably too in the first Christian basilicas, where as in the Basilica of St. Menas<sup>15</sup> the altar stood more or less in the open at the east end of the nave and not in the apse, curtains closed the upper part of the enclosure, usually a low marble balustrade with intervening columns, separating it from the body of the church. A curtain decorated with Christian symbols in the Graf collection has been published by Swoboda.<sup>16</sup> The loops still attached to it show that it was not used as a door curtain but was probably hung between the columns of the ciborium or used for some similar purpose. \* It was 3.71 m. high and originally 2.80 m. wide. Its border has ovals of twined foliate sprays with vine leaves in them. A tapestry-woven curtain from Egypt in the Textile Museum (No. 71.18, Pl. II) of similar shape and size although it has no Christian symbols was probably intended for a like purpose.<sup>17</sup> It shows a definite architectural composition. Two columns support a gable in the center of which is a square enclosing four rosettes within a double border of dots like the squares in band 5 of our curtain. The columns have late Corinthian capitals and Attic-Ionic bases. Between them is a rectangular trellis work bearing bunches of blue and white grapes and birds. The gable at the top is flanked by a bird on either side. There is nothing Christian in this curtain and it may have been designed to hang in the colonnade of a house, and to give the spectator the impression of looking through at a garden.

We may now after this introduction turn to the tapestry curtain with which we are immediately concerned. Examination of its general scheme of decoration shows that it is composed of thirteen horizontal bands which are arranged on a kind of repeating system. In particular we may note that the three uppermost bands and the three lowest bands are strongly similar in pattern. Their patterns and grouping suggest the arrangements of the narrow woven bands visible in the tiraz textiles of the Fatimid period, especially those of the middle and late phases.<sup>18</sup> This suggests that the tradition of the arrangement of patterns in horizontal bands and the types of the patterns persisted from late Roman times into the Fatimid period. This is not surprising for if this textile was woven in Egypt we should expect to find upon it the patterns and compositions traditional in Egypt. It is not unlikely that the Arab conquerors took over the workshops and methods which had been used by their predecessors. So we need not be astonished that this hanging shows in its composition the Late Roman antecedents of the Fatimid style.

The horizontal decorative bands on this textile from the top downwards are as follows:

1. A line of lozenges with narrow borders of small ovals.
2. A line of lozenges with narrow borders of a wavy line with dots on either side. This is perhaps a conventionalization of a vine pattern.
3. A twining vine pattern which forms a series of ovals. In each oval is set a small bird (quail?) pecking at fruit or flowers. In the band are inserted two roundels each bearing the head of an Eros

\*The selvage of this tapestry is broken in many places. It is possible, therefore, that it also, originally had loops.

<sup>15</sup> *P.B.S.R.* XVII, pl. XI.

<sup>16</sup> Swoboda, *Römische Quartalschrift* VI, p. 95 ff.

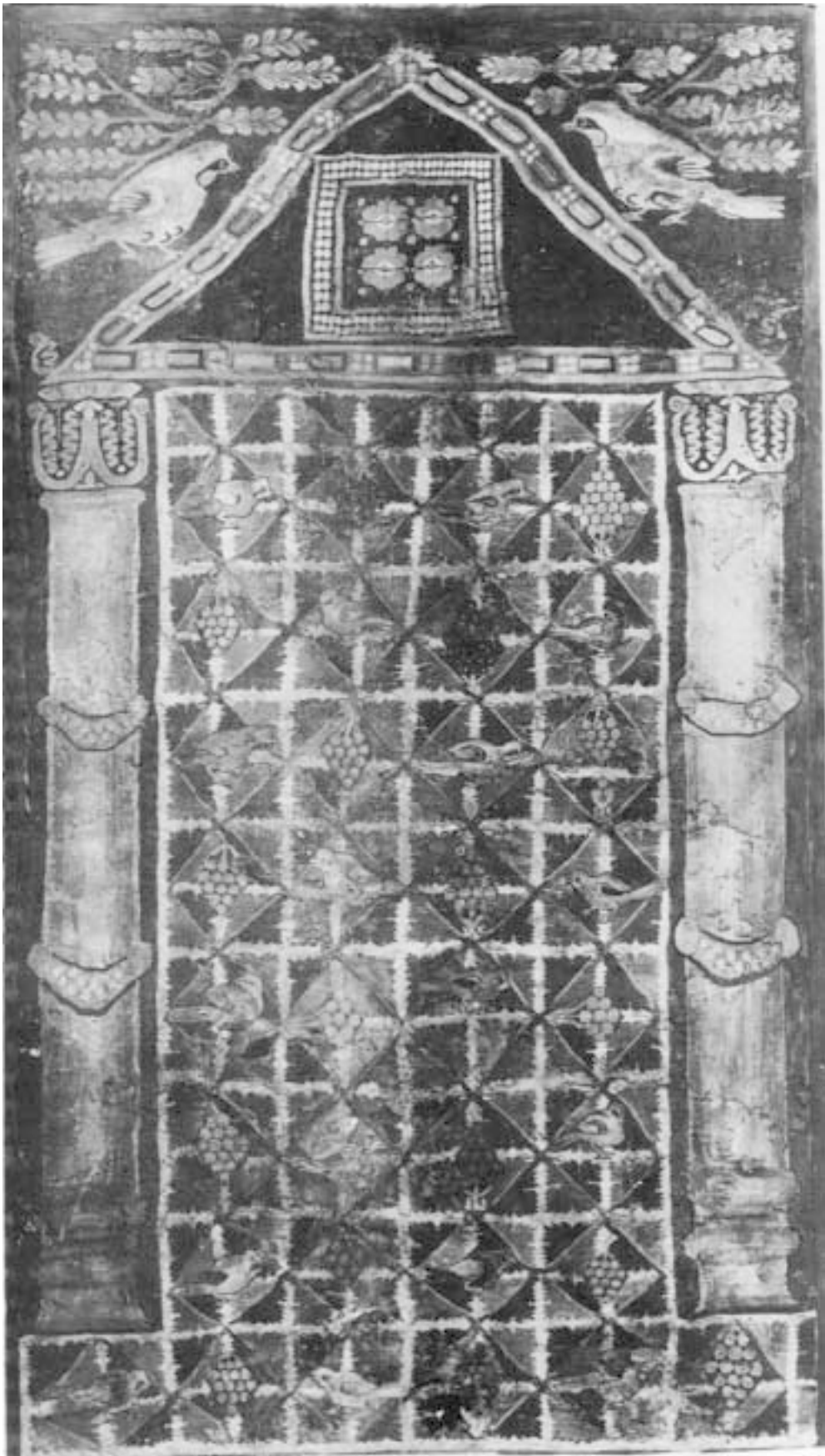
<sup>17</sup> Swoboda, *op. cit.*, p. 107, and Strzygowski, *Orient oder Rome*, p. 90 ff. discuss the use of hanging in churches.

<sup>18</sup> e.g. Kühnel, *Cat. of Dated Tiraz Fabrics*, pl. XXXV (73.673) and Textile Museum No. 73.76 (unpublished); Vollback-Kühnel, *Late Coptic and Islamic Textiles*, pl. 97.

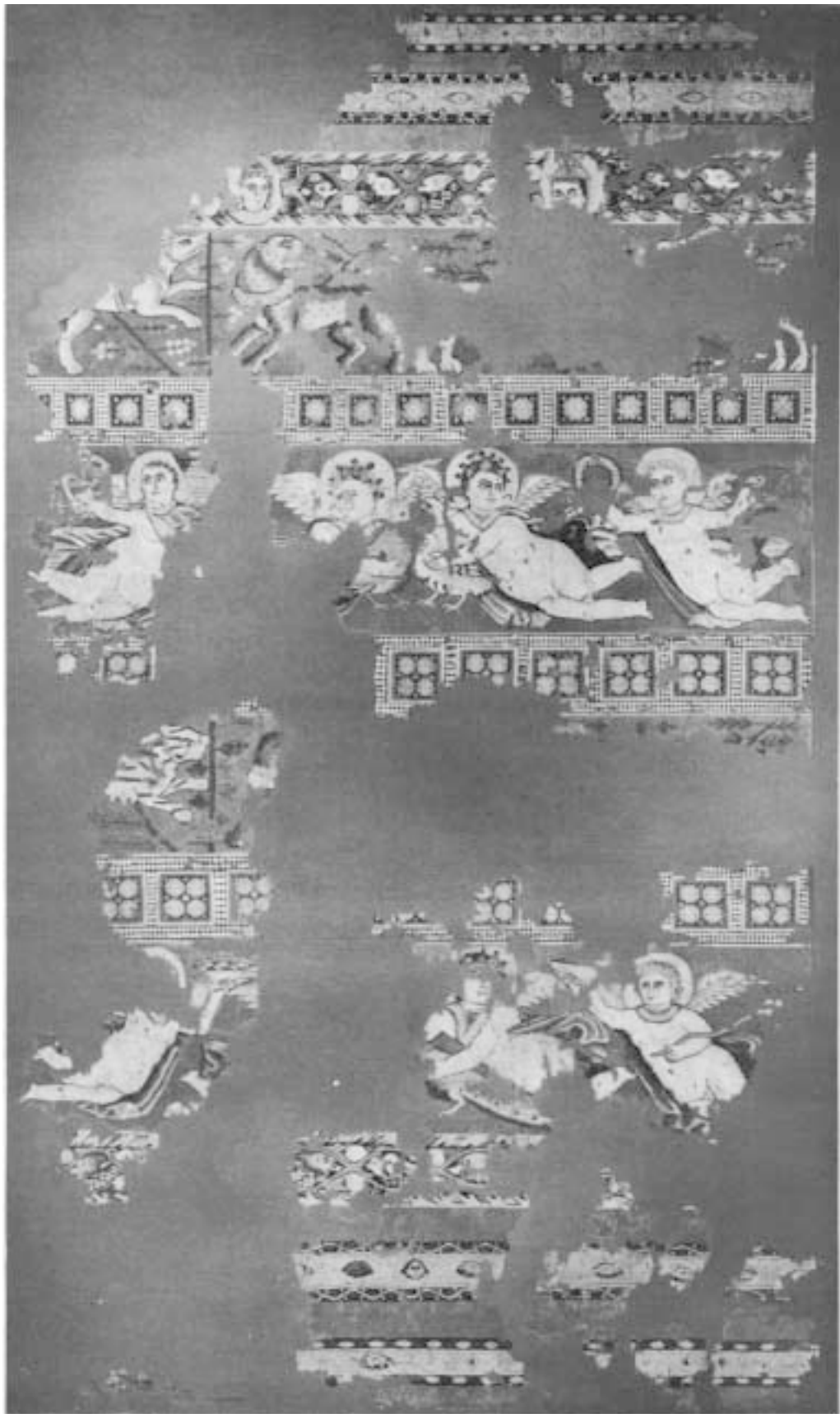


71.118 Fragment showing figure with wreath and inscription.



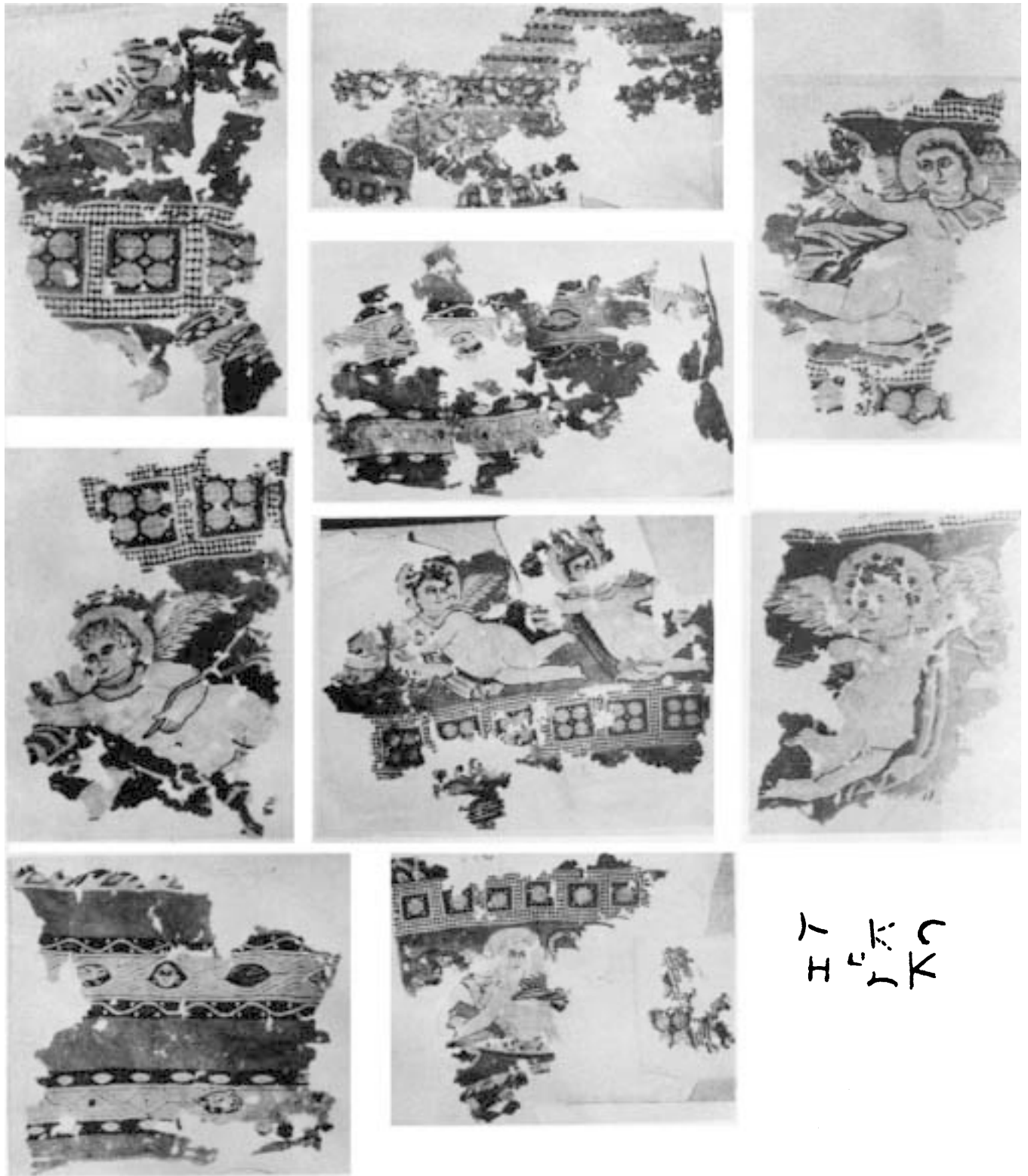


71.18 Another tapestry probably from the same center as 71.118.



1  
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12  
13

71.118 After cleaning and mounting.



71.118 The fragments as they arrived dirty and distorted, and a tentative drawing of the inscription. Pl. IV

full face within a wreath. Each has an elaborate coiffure and the one on the left wears earrings. In the bends of twining vine there are set on either side apples or pomegranates. A narrow leaf runs along each side of this band.

4. This is a wide band and shows the parts of four animals. On the left is a hound bounding to the right. It wears a leather collar and wide strap round the body. Before him is a cheetah facing left, but with its head turned back over the shoulder. It has a red collar. It appears to be growling at something behind it. Next to the right was another animal apparently a hound, but only the paws of the hind feet survive. It faced right. Lastly at the right end was another animal of which again the hind feet are preserved. These with antlers visible just below the upper border seem to indicate that this animal was a deer facing to the left. At all events its hind feet seem to be ungulate and different from those of the hound and the lion. In the background behind the animals are the twisting branches of shrubs or bushes. They would seem to be intended to suggest that the action, a deer hunt probably, is taking place in a thicket or wood.

5. This is a broad band with double lines of dots making a row of squares. In each square is an open rose with four petals, and with four dots set in the space between the petals. The rosettes resemble the rosette in the textile from Dura.<sup>19</sup> The whole band suggests that it is a series of *semeia* or *tesserae*, the technical names for the squares inwoven in garments.<sup>20</sup>

6. This is one of the main bands of decoration. It is the widest and the most ambitious. In it appear four Eroses or putti, against a plain background. Each Eros wears a halo-like wreath. Each also wears a short cloak fastened with a jewelled clasp round the throat but flying open and leaving the body naked. The first Eros on the left is flying to the right, but his face is turned towards the spectator. In his left hand he holds grapes in a basket shaped like an inverted cone.<sup>21</sup> In his right hand he holds a wreath. Within the wreath is an inscription in Greek characters but very much damaged. The photographs on Pl. I and sketch on Pl. IV show how much is preserved. No satisfactory meaning or explanation of the inscription has yet been suggested. If it could be read or a parallel for it discovered, it would help much to interpret the textile especially as regards its date and style. Next to the right is another Eros flying to the right with his head also turned to face the spectator. He is holding a large bird, a bantam cock (?), in his hands. Next is an Eros flying to the left. His head too is turned to face the spectator. In his right hand he holds a wreath and in his left he apparently held a green bird.

7. Next follows a band similar to No. 5 but in each *tessera* there are four rosettes instead of one. They are of exactly the same type and since they are smaller show an even greater resemblance to the Dura rosette. These *tesserae* are similar to that in the gable of the curtain in the Textile Museum (No. 71.18) quoted above.

8. This is another band of animals and thus was apparently intended to match No. 4. Unluckily the animals are almost entirely lost. Part, however, is preserved of the end animal of the left, which was a large yellow feline, bounding to the right. The horizontal dark green stripes on its body do not seem to indicate that it was a striped animal. The stripes are apparently intended to represent the branches of a thicket through which the animal, a female cheetah (?), is dashing. The dark green color of the stripes is exactly the same as the color of the foliage and branches of the woody background. If they are not taken as green branches of the background they could be interpreted as shadows cast on the animal's body by the shrubs through which it is rushing.

9. This band is a repetition of No. 7.

10. This band repeats No. 6. There are four Eroses, two on the left flying to the right and two on the right flying to the left. The first Eros on the left has lost his head and right arm. In his left hand he is carrying a shell-shaped bowl of fruit. The next Eros is lost. The third Eros seems to repeat the third Eros in band No. 6 except that he is carrying a peacock. The last Eros on the right is the best preserved. He is flying to the left and his head is turned to face the spectators. In his left hand he carries a sprouting branch and in his right hand he apparently held a shell-shaped bowl.

11. This band repeats No. 3.

12. This band repeats No. 2.

13. This band repeats No. 1.

We thus see that the design of the curtain was intended to be more or less symmetrical as regards the vertical arrangement of the horizontal bands and that the bands themselves were designed to re-

<sup>19</sup> Pfister-Bellinger, *Excavations at Dura-Europos* IV, pl. XXI and Frontispiece. Compare Kendrick, *op. cit.* I, pl. XXIV (177).

<sup>20</sup> *Jahreshefte* XXXIX (1952), p. 113 f.

<sup>21</sup> Met. Mus. N.Y., Negative 2722.

peat.<sup>22</sup> The textile is definitely a curtain because the patterns are planned to be seen one way up only, i.e. from top to bottom. There is a clear top and an equally clear bottom. It obviously was not intended to be seen from all sides like a rug. The whole pattern of the curtain is not of course absolutely symmetrical or uniform. There are many minor variations, but this was perhaps intentional so as to avoid monotony.

For the flying Erotes in the sixth and tenth horizontal bands many parallels can be found in late Roman art.<sup>23</sup> It is just possible that they may typify the seasons, for Erotes often figure as representing seasons on late Roman monuments.<sup>24</sup> The symbols, however, associated with these Erotes can hardly be regarded as indicating the seasons. That these Erotes have haloes does not necessarily mean that they are Christian. Haloes on figures definitely pagan occur in other Late Roman textiles from Egypt.<sup>25</sup> The damage to the inscription is most unfortunate because it is impossible to say whether the characters are Greek or Coptic. Most probably they are Greek, but again there is no possibility of determining whether the inscription is pagan or Christian. The subjects of the textile hanging are certainly pagan, but pagan subjects can occur in early Christian art.<sup>26</sup> From a purely subjective point of view the textile seems to be pagan. We may thus imagine it to have hung in some important private house or in a public building in Egypt in Late Roman times.

Its date is also hard to determine for very few of the Roman (so-called Coptic) textiles from Egypt can be dated with any approach to accuracy. According to the usual methods, mainly stylistic, of dating such textiles, this textile would be placed between the end of the third and the beginning of the sixth century A.D.<sup>27</sup>

Tapestry-woven fabrics could of course be used for floor coverings and it is possible that many mosaic pavements such as those from Antioch imitate the designs of rugs either pile or tapestry-woven. The textile before us, however, does not show patterns suitable for a floor covering such as the Antioch mosaics display.<sup>28</sup> On the other hand the decoration of parallel bands in the present curtain finds many analogies in Late Roman art. Curtains with horizontal stripes are to be seen in several of the ivory diptychs<sup>29</sup> and in the illustrations of the Calendar of the year 354 A.D.<sup>30</sup> Curtains also appear in other ivories and diptychs.<sup>31</sup> In the resist-dyed textile in Berlin,<sup>32</sup> illustrating the story of Daniel, similar curtains appear in the doors of shrines. It would thus seem that horizontal stripes were a favorite method of decorating curtains. From the purely technical point of view it would be easier to weave parallel horizontal bands which would in addition hang well in a doorway or colonnade.

The dates of the diptychs it will have been seen agree well with the date already suggested, mainly on stylistic grounds, for this curtain. We may, therefore, provisionally assign this curtain to the fifth century A.D., but we must allow that fuller study of this most interesting piece may enable us in the future to be more precise as to its date. If the inscription could be deciphered or some closely related object come to light a great advance could doubtless be made.

So far as its style goes this curtain could have been woven almost anywhere in the Hellenistic Near East during the Late Roman period. It could be assumed that it was made in Egypt since it was found in Egypt. This does not necessarily follow and so far as design is concerned it could equally well have been woven in Syria or perhaps in Asia Minor. The technical analysis of the material and of the spinning will help greatly in this question. At all events we have before us the best example, so far known, of a Late Roman curtain of fine polychrome late antique style. It is typical of the art of the Near East at that period which was a phase of Hellenistic art domiciled outside Greece and subject to alien influences both Near Eastern and Roman.

<sup>22</sup> Compare the fragment in the Victoria and Albert Museum, Kendrick, *op. cit.* I, pl. VI (20).

<sup>23</sup> e.g. Kendrick, *op. cit.* I, pl. V 19; Vollbach-Kühnel, *op. cit.*, pl. 35.

<sup>24</sup> Hanfmann, *Season Sarcophagus in Dumbarton Oaks*.

<sup>25</sup> Kendrick, *op. cit.* I, No's. 52, 53, Hermes and Apollo; Pfister, *Tissus coptes du Musée du Louvre*, pl. 21, Dionysus and Ariadne (?).

<sup>26</sup> See Weitzmann, *Greek Mythology in Byzantine Art*.

<sup>27</sup> Swoboda, *op. cit.*

<sup>28</sup> Doro Levi, *Antioch Mosaic Pavements*, pls. XCVIII-CI.

<sup>29</sup> Delbrueck, *Consulardiptychen*, pls. 3 (Felix 428 A.D.), 51 (c. 500 A.D.), 52 (c. 500 A.D.), 64 (Patricius c. 425 A.D.), 65 (Probianus c. 400 A.D.).

<sup>30</sup> Strzygowski, *Calenderbilder des Chronographen vom Jahre 354*, pl. IV, XXXIV, XXXV.

<sup>31</sup> *Ant. Denkmäler* IV, pl. 7, 8; Kollwitz, *Lipsanothek von Brescia*, pl. 2.

<sup>32</sup> Strzygowski, *op. cit.*, pl. IV.

## PATTERNED STOCKINGS: POSSIBLY INDIAN, FOUND IN EGYPT

Louisa Bellinger, Curator - Analyst  
The Textile Museum, Washington, D. C.

In the Near East we know that the craft of knitting was practiced at least as long ago as the 2nd or 3rd century A.D. for several pieces of knitting were found in the Yale University Excavations at Dura-Europos on the Euphrates and must, therefore, have been made before the town was abandoned in 256 A.D. Two fragments showed a rib of knit 3, purl 2, and had bands of tan, red, grey, purple and green wools, one color being used at a time in place of the natural buff ground. The largest fragment, made entirely of undyed wool, had an intricate striped pattern, the directions for which are given in the catalogue.\* These fragments are made with the Crossed Eastern stitch shown in Figs. 43 and 44 of *Mary Thomas's Knitting Book*. Socks of this same crossed eastern knitting have been found in Egypt, also made of wool. Examples in the Victoria and Albert Museum with a division for the big toe are dated 4th-5th century. Mary Thomas shows a pair in Fig. 209. In Fig. 82 she shows a 7th-9th century fragment with Arabic inscription knitted of colored silks. This also is probably part of a sock since the pattern is knitted upside down as it would have to be if the sock was being knitted from the top down like the other specimens. It should be particularly noted that all these examples with the crossed eastern knitting are knitted from the top down as we do today and that the heels are turned in a similar manner.

The subject of this paper, a somewhat later group of stockings probably dating in the early 12th century, is quite a different product. The fiber used is cotton, the spinning is Z and the stitch is stockinette. In other words the fiber is vegetable instead of animal, the spinning is non-Egyptian and the stitch is not the one found previously in Egypt and on the Euphrates. If these were the only differences it might be argued that they could be accounted for by the passage of time. Even the novelty of carrying two yarns at a time to create a pattern might be so explained. But the fact that the stockings were begun at the toe instead of at the top demands a better explanation. It is hard enough to end off a stocking with four stitches, one on each needle; it is much harder to start that way with nothing to hold on to. That people who were accustomed to the easy way suddenly began to use the harder, seems curious. Some other solution should be sought.

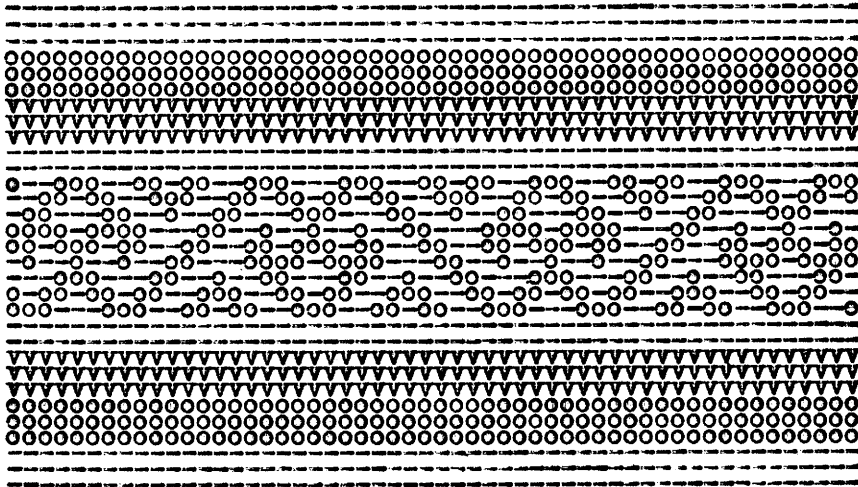
The most likely possibility, though it may seem revolutionary at first glance, is that the stockings were made in India for the export trade. Indian cotton prints from this period are found in numbers at Fostat. The stockings also are made of cotton, the chief fiber of India, the spinning is the usual spinning of India and the patterns like those of the contemporary prints are white against a blue ground. It seems quite possible that the Indians may have evolved stockings with patterns that would appeal to the Arab trade without being acquainted with the Near Eastern methods of manufacture. Later examples in this tradition, which will be discussed in a future paper, not only simplify the working of the toe but also attempt, rather unsuccessfully, to parallel the working of the Near Eastern heel.

In order to understand the specific points of this particular group let us study the work in detail. The stockings were begun at the toe. Apparently two needles were held parallel and a stitch was cast first on one then on the other as shown in Fig. 1. The first round was knitted plain as were all the odd rows. Increases were made in the even rows. In row two an increase was made after each stitch by knitting the loop from the previous row, thus making eight stitches. The same thing was done in row four, making sixteen stitches. Thereafter eight stitches were added in each even row until the proper number for the width of the foot had been reached. In our examples the increases were made at more or less regular intervals but followed no exact rule. The pattern was begun when the proper number of stitches for the foot had been reached.

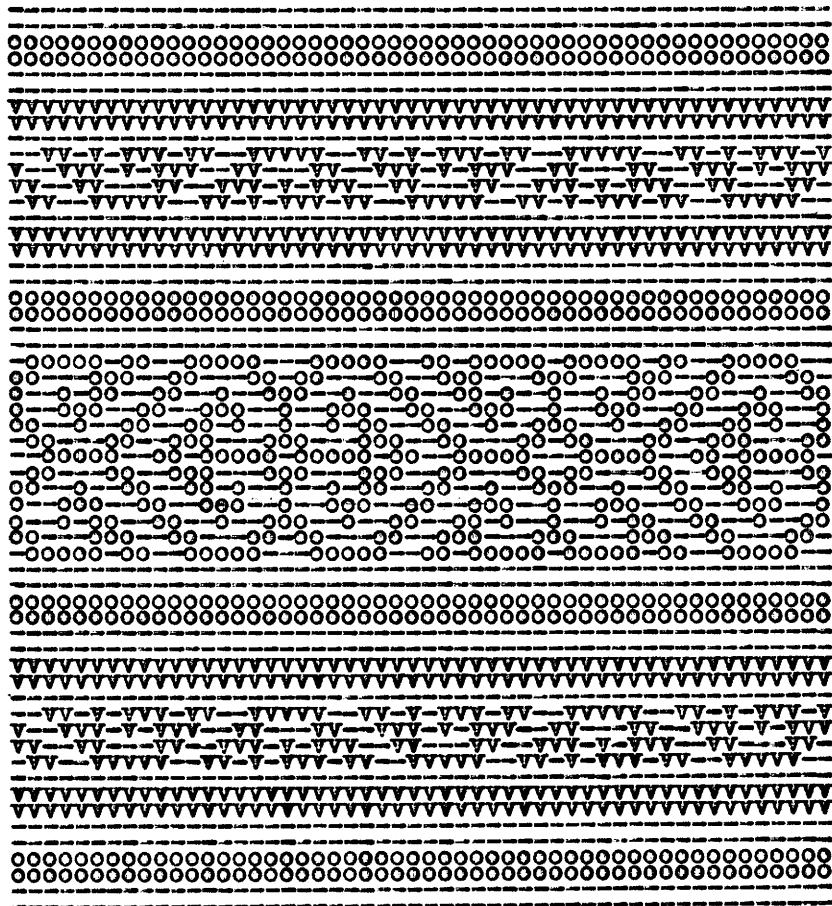


Fig. 1 Casting on.

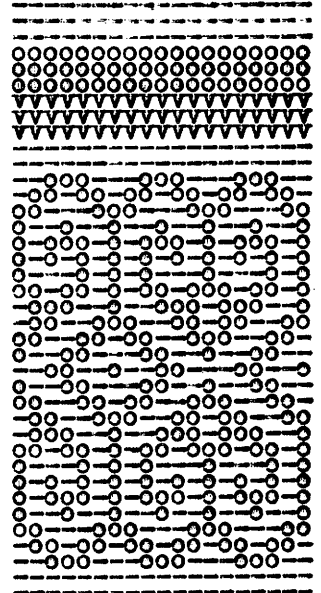
\* *The Excavations at Dura-Europos, Final Report IV: Part II, The Textiles*, R. Pfister and Louisa Bellinger, New Haven (1945), p. 54.



73.722

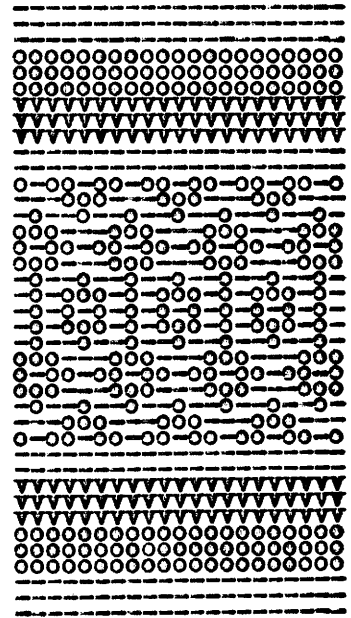


73.718



73.720

- = dark-blue  
v = light-blue  
o = white



73.701



Pl. I Patterned stockings: possibly Indian, found in Egypt.



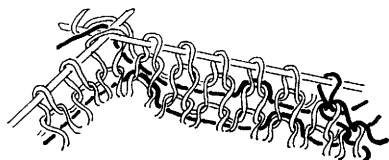


Pl. II Modern copies with ribbed top showing method of preparing for the heel.

It seems probable that the patterns in this group were knitted by holding one yarn in each hand, the ground yarn in the left hand, the pattern yarn in the right, for the floats are not crossed as they might be if one color was put down when the other was in use. The patterns are all carefully designed so that the yarn not in use will make short floats which would not be likely to catch the toes while putting on the stockings.

As the heel was approached from below instead of from above, the solution for that feature was unlike the Near Eastern method, and was in some respects more sensible, for the heel was knitted after the rest of the sock was finished and could be replaced easily if it wore out. When the heel position was reached a new piece of yarn was knitted in on the first half of the stitches of the round. This new yarn was immediately reknitted by the stocking yarn in its regular course, see Pl. II. The knitting then proceeded up the leg with proper increases for the calf and the final row was bound off by slipping one loop over the next. Most of the widenings in the leg were made like those in the toe—by knitting a loop from the row below—but occasionally when an increase was made in a row where two colors were being used for the pattern, the increase was made at the end of a color area by knitting one stitch first with one color, then with the other. In the next row the two colors were knitted separately, making the increase permanent.

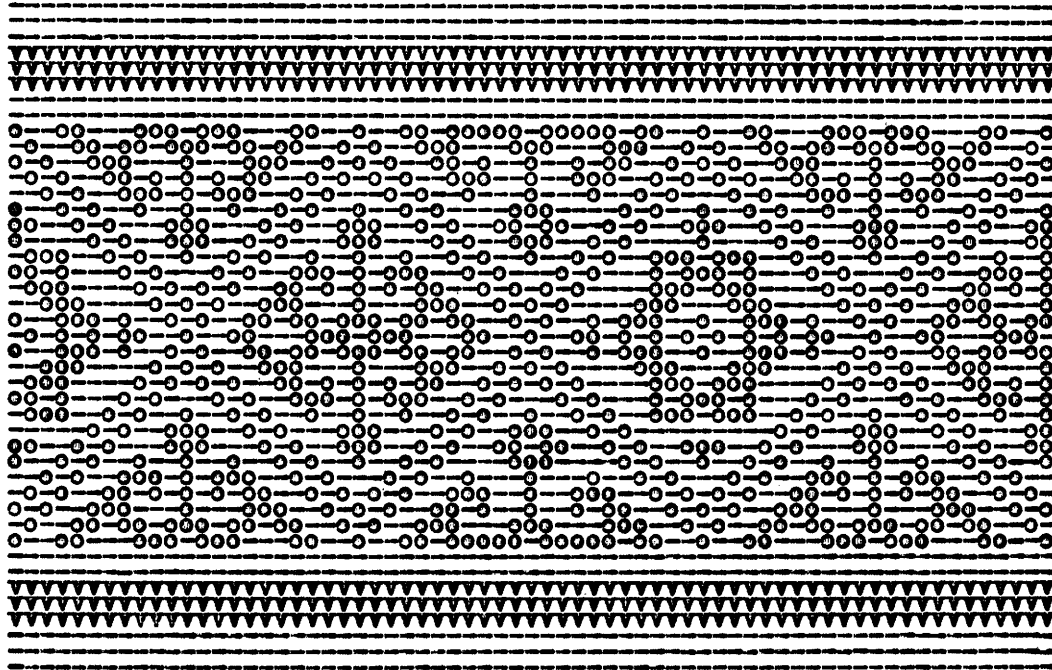
When the leg was finished the knitter returned to the heel. The extra yarn knitted in on the way up was removed, leaving open loops on both sides. These were picked up, giving the knitter the same number of stitches to start the heel as he had had for the foot. The first fifteen or twenty rows were knitted without decreasing; therefore, as it was well to strengthen the heel by using two yarns, it was the habit to work a pattern in these rows. Sometimes a narrow section of the pattern from the stocking proper was used, sometimes a new one. After the pattern was finished the narrowing began. In the first round all the stitches were knitted with white except four at each side which were blue. In order to carry the blue from one side to the other without making too long a loop, every fourth white stitch was knitted around the blue yarn as shown in Fig. 2. The last white stitch and the first blue stitch were knitted together with the blue yarn which then knitted two blue stitches and finally the first white stitch together with the last blue one. The white yarn was carried at the back of these four blue stitches and came into play again to knit the white stitches across to the other side of the heel, carefully knitting around the blue yarn on every fourth stitch. When the white stitches had all been narrowed off, the blue stitches were woven together to finish the heel. It should be noted that all the narrowings were made by knitting two stitches together. They did not slip a stitch, knit the next and pull the slipped stitch over the knitted one on one side while knitting two stitches together on the other in an effort to balance the two sides. Consequently the side of the blue strip with the blue stitch on top does not match the side with the white stitch on top.



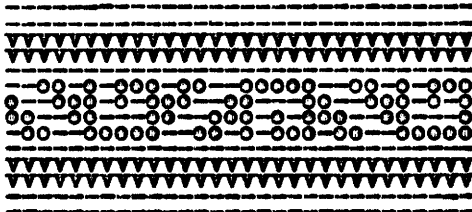
**Fig. 2** Knitting the fourth white stitch around the blue yarn.

When the sock was finished it looked much like any other except that what we would call the “seam stitch” today—the first stitch of a new round—ran up the side of the stocking instead of up the back, and as there was no ribbing at the top the edge tended to roll over and must have been kept in place by some type of string or garter.

On Pl. I, we show fragments of six stockings of this group and as the patterns themselves are interesting we append typings for the use of other knitters. The “—” is dark-blue, “v” is light-blue and “o” is white. The stockings shown on Pl. II were knitted of nylon. Ribbing was added at the top to make them more comfortable for present day wearers, otherwise they follow the knitting methods of this group of cotton stockings, the question of whose provenance merits further study.



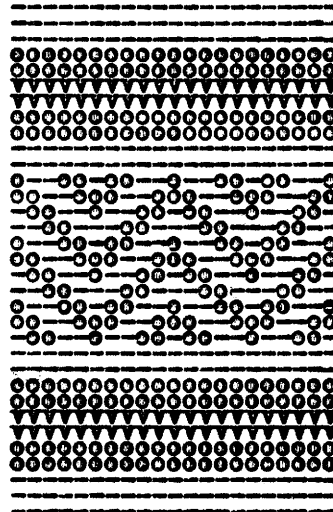
73.698 Note: The small figure at the top in the right hand diamond is composed of five stitches whereas the figures in the other three corners have only four stitches. The five stitch figure looks like a bird when it is knitted.



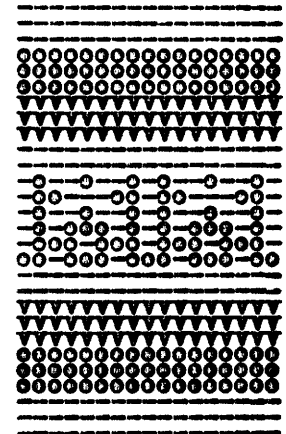
73.698 heel pattern

Note: This heel pattern is the same design as the guard pattern on 73.718 but the color scheme is different.

- = dark-blue  
 v = light-blue  
 o = white



73.695



73.695

## NOTES ON SOME OF THE BASIC REQUIREMENTS FOR A TERMINOLOGY OF ANCIENT AND PRIMITIVE FABRICS

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Problems of nomenclature, although admittedly omnipresent, are especially vexatious in those fields of study in which the need to be definite has not yet become sufficiently obvious to enough people to ensure a sustained, thoughtful, and determined effort in the direction of a definite terminology. The problems are recognized and wrestled with, with varying degrees of energy and success in different fields of intellectual endeavor. It would be possible to quote verbatim from volumes on any of a considerable variety of subjects and, by simply replacing the terms which denote their special subjects with fabric terms, have the case for systematizing and standardizing the nomenclature of fabrics eloquently stated. Most publications devoted entirely to the subject of textiles include some statement of the problem in its specific relation to that subject. There can be no doubt that anyone who attempts to discuss and describe fabrics quickly discovers the inadequacy and confused state of the terminology he must use. It is no wonder that he so frequently resorts to coining expressions or stating flatly that when he uses a certain word it means such and such – often with little justification for his usage. The over-all problem seems clear and has been frequently and fairly adequately stated. Analysis of the problem, on the other hand, and organized attempts at solution have been less frequent and something less than successful. There has been little analytical consideration of the problem as a whole and most attempts to overcome the difficulties have been too limited in range to do much except to add more and more individualized or specialized meanings to terms already being used with a bewildering array of variant connotations. Terms defined only in relation to a limited group of fabrics, or a single aspect of fabric study, are frequently wrenched from familiar and widely accepted meanings and their sense distorted for the sake of immediate convenience and special use. In recent years, a certain recognition of the fact of this problem without adequate analysis of its nature has resulted in a great burgeoning of dictionaries, encyclopedias, and glossaries of weaving, fabric terms, textiles, etc., etc. Useful as they may be, each in its own way, these compilations generally prove far less helpful than might be supposed; each is of necessity pretty much limited to an individual's choice of meanings and selection of interpretations and yet each reaches the reader enhanced by that aura of authority which seems to accompany dictionary definitions. The result of more and yet more compilations of definitions is not greater standardization of meaning and use as is undoubtedly hoped and expected; it is, rather, increased variety of definition and the illusion of increased authorization for each variant meaning.

Clearly the situation is not being improved; the confusion is only being increased; and further effort along the same line seems quite futile. It is time for everyone concerned to stop and think the problem through carefully; to scrutinize the whole range of use and definition of fabric terms; to consider carefully, to determine, and to state, the most urgent needs in fabric terminology; and then to try to work out a reasonable use of the terms deemed essential to meet those needs. This should be done with as little violence as possible to any widely accepted usages while still fulfilling the urgent need for terms which can be used with the utmost definition without undue overlapping and befogging of meanings. Such a basic terminology must be made available to those who seek it – and at the same time, many knowledgeable people who speak and write about fabrics must either be persuaded to forsake their Through the Looking Glass (when-I-use-a-word-it-means-just-what-I-choose-it-to-mean-no-more-no-less) approach to the nomenclature of their subject or else tacitly admit that they are content to acquire and store their information without communicating it – or making it communicable.

The field of fabric studies has many specialized areas more or less extensively cultivated, with a broad common ground underlying them all. The essential terms of this common area must have generally accepted meanings and implications before the terms of the separately specialized fields can be related to them and to each other. This aspect of the problem of fabric terminology has been given too little consideration. As long as workers in each specialized field seek agreement only on their own special word groups there will be little chance of eliminating the widespread confusions which result from the appropriation of *basic* textile terms for various special uses with consequent destruction of meaning. The fundamental terms must be agreed upon first. They will then, with the addition of properly qualifying words or phrases, be useful for special purposes.

The basis of fabric development is to be found, of course, in its earliest stages and simplest forms; and a general or fundamental terminology will of necessity include words (and phrases) for the diverse forms which fabrics have taken in the course of their development. When we restrict our quest for adequate terms to the areas of ancient and primitive fabrics we do not eliminate the need for terms for any fabric structures; we only eliminate the need for terms for such developments and elaborations as highly mechanized processes of construction, special finishes developed in recent times, man-made fibers, etc. There are many ancient fabrics which represent a stage of development at which manipulation of materials and equipment had already become highly elaborated (although not highly mechanized), but as we push back toward the beginnings of fabric development in any culture we encounter the simpler forms, the primitive antecedents – which may or may not be ancient in relation to the total history of textiles but may be old within the society in which they are found. There are primitive fabrics being made today – authentically primitive in that they represent early stages in the manufacture of fabrics, surviving in less advanced cultures. The many close parallels to be found in the primitive fabric forms of different cultures are of great value in tracing the antecedents of those fabrics which, although ancient in terms of centuries, represent a high or late stage of fabric development. Surely the terms which designate specific structures should be the same when the structures are used for highly refined and elaborate effects as when they are used with the greatest simplicity. By tracing the structures back to their simplest forms we provide ourselves with a basis for classifying them – a means of identifying the fundamental forms from which the others developed, of distinguishing type-structures, for which we need specific terms, from the variations, for which we may frequently use qualifying words and phrases.

It is not enough, however, to have terms for distinguishing fabrics or even fabric structures. There are many other terms necessary for intelligible discussion of fabrics. It seems that if we are to agree on and establish a terminology of fabrics we must first understand the basic relationship of the kinds of terms we will be needing, i.e., we must classify the terms. Toward that end we suggest the following general grouping—

- 1). Terms for the *tools, implements, machinery*, of fabric construction, i.e., for looms and loom parts, for shuttles, bobbins, and thread carriers of all kinds, and for other implements and attachments.
- 2). Terms for the *materials* of fabric construction, i.e., names for the various fibers and filaments which may be used; terms for yarns, threads, and their make-up; terms for spinning, plying, twisting, etc.
- 3). Terms for the construction and make-up of the *fabrics*, i.e., the *fabric structures*.<sup>1</sup> The fabric terms fall into three general groups:

<sup>1</sup>The primary classification of the *structure* of fabrics is on the basis of the number of elements or sets of elements involved. The term *element* is used to denote a structural component of a fabric. It refers to yarn, thread, strand, cord, sinew, thong, or whatever natural or constructed forms of fiber, filament, or fibrous material are interworked to produce the fabric. A *set of elements* is a group of such components all *used in a like manner*. Whenever certain elements are differentiated from other elements in the same fabric, either in the direction they take or in the part they play in the construction, they constitute a separate *set of elements*.

- 1st, those which designate the actual *structure* or *weave*, i.e., the order and nature of the interworking of elements (such as twill, satin, gauze, braids, etc.);
- 2nd, those which designate component parts of the structure (warp, weft, ground warp, pattern weft, single element, etc., etc.) or describe the way in which they are related in the structure (float, binding, wrapped, etc.);
- 3rd, those which describe *attributes* or *characteristics* of the structure (such as warp-faced, double-faced, reversible, etc.).<sup>2</sup>

With these categories of terms to use as a guide in listing words which need definition, we can see that the subject matter in each category must itself be classified in order to provide a framework on which to build a logical nomenclature and as a basis for determining what purpose each proposed word can best serve and how wide or restricted its meaning should be to make it most useful. Unfortunately, although it is an essential preliminary to any fruitful discussion of specific terms, comprehensive classification of the subject matter is far beyond the limits of this paper.<sup>3</sup> Perhaps, however, by attempting to disentangle the meanings of one or two groups of terms we may be able to point out in specific instances some of the considerations which we feel must enter into any determination of nomenclature.

One example is to be found in the use of the terms *fabric* and *textile* which can be far more effective if the distinction between them is made use of instead of their being considered entirely interchangeable, i.e., if *fabric* is recognized as the general term for the large group which includes nets, laces, braids, felts, in fact, all non-woven structures as well as the *woven* structures to which the term *textile* refers specifically. *Cloth* is a term of wide general reference to *pliable* stuffs no matter what the fiber content (although one individual may define the term so as to exclude silk, and another so as to include only wool). The term is not usually used with any implication of quality or ultimate use but is generally assumed to refer to woven rather than non-woven materials, and serves to distinguish pliable fabrics from any of the more rigid forms of woven or interworked fabrics. Its use as a synonym for *plain weave* (simple over and under interlacing) unfortunately leads, on the one hand, to such an expression as *plain cloth weave* which is certainly redundant, and, on the other hand, to such as *fancy compound cloth* which, if *cloth* refers to plain weave, is self-contradictory.

Another group of terms which will serve to illustrate the problems involved in establishing a useful nomenclature is one which includes the terms *lace*, *net*, *netting*, and *gauze*, all of which relate to openwork of one sort or another. In order to demonstrate more fully some of the methods used in trying to assess the breadth of application and of implication in the use of specific terms, the remainder of this paper will be devoted to more detailed discussion of each of these terms in relation to the others in this group – and to exploration of the possibilities of definition and delimitation needed to give them all more specific usefulness. *Lace* is undoubtedly the most inclusive and least definitive of the group. It is nearly always defined as an openwork fabric, usually with the additional specification that it be ornamental or decorative. That qualification is the one most frequently used as a distinction between lace and net but, as will be seen below, there is a more clear-cut structural line to be drawn between them. Some definitions go further and specify that the term lace implies the simultaneous production of fabric and decoration. This, of course, would eliminate cut-work, drawn-work, darned net, etc. Curiously enough, fineness and delicacy are almost never mentioned in definitions and yet they are qualities firmly imbedded in even the most casual concept of lace as a fabric; in fact, students of the art of lace-making as developed since the 15th century are sometimes much disturbed by the use of the term in reference to those primitive ancestors of fine laces which,

<sup>2</sup> To understand a fabric structure it is essential to know whether the two faces are structurally dissimilar or identical; but beyond that there is great need for concepts and words to express the relationship between the two faces of a fabric. Many a carefully detailed and otherwise excellent description of a structure loses much of its value through lack of any indication of the structure of the reverse when the description of the face shows clearly that there must be more to the weave than is described.

<sup>3</sup> The comprehensive (illustrated) *classification of the structures of ancient and primitive fabrics* on which this paper is based will be published in the near future. It encompasses work done over a period of years under the auspices of the Laboratory of Anthropology in Santa Fe, New Mexico, with the aid of a grant from the Wenner-Gren Foundation of Anthropological Research and a Guggenheim Fellowship, and now under the sponsorship of the Textile Museum.

although structurally very similar, may be of considerably coarser material and less intricately contrived design. However, the forerunners of lace, constructions which eventually developed into what would now be termed lace in the strictest sense of the word, were probably among the very earliest fabric constructions, predating woven fabrics in many if not all cultural developments. Many forms of openwork were developed in *single element* constructions, looped, or looped and knotted, and also in structures composed from a *single set of elements* interlinked (plaited)<sup>4</sup> or interlaced (braided) with each other. Lace as known today is the result of development, refinement, and elaboration along these two general lines and so-called “real” laces are frequently defined as being of only two kinds: *needle or needlepoint laces* (the single element constructions), and *bobbin or pillow laces* (from a set of elements). This classification is on a structural or constructural basis; each class has many further divisions on the basis of design as well as structure, but the two main lines of development were based on two distinct types of construction:

*Needle or needlepoint* lace is made with a needle and thread by a sewing process and is largely based on the buttonhole stitch, sometimes the simple form of the stitch (fig. 1), sometimes with an extra twist (fig. 2), sometimes with the simple stitch worked over a foundation thread (fig. 3).

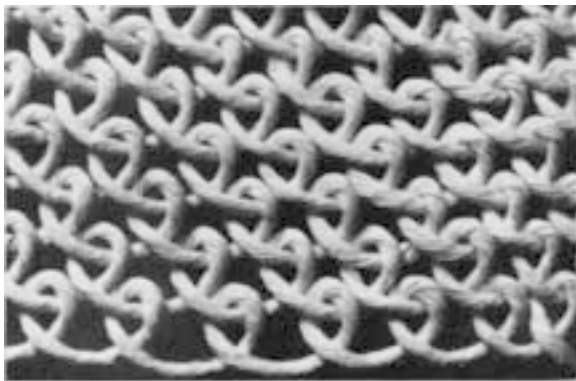


Fig. 1

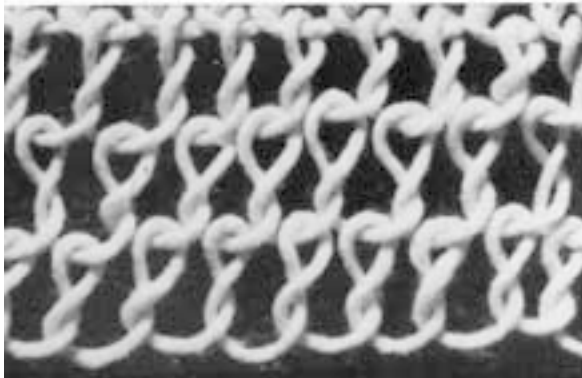


Fig. 2



Fig. 3

<sup>4</sup>The term *plaiting* is sometimes used to designate any interweaving of undifferentiated elements and in that sense is said not only to include, or be synonymous with, *braiding* but even to be synonymous with *weaving* (usually referring to weaving-without-a-loom but seldom so defined). But the term (plaiting) is also used to designate constructions produced from a single set of elements. If the term *plaiting* is used for all structures made from one set of elements in which the elements, trending now to the right, now to the left, *interlink* with adjacent elements (fig. 4), then the term *braiding* will be preserved to distinguish those structures in which the elements (one set) *interlace* without linking or twisting about one another (fig. 5). These two ways of interworking elements of a single set are used separately but may also be found combined in the same fabric—notably in bobbin-lace and in that two-way braiding and plaiting technique best known as *sprang*.

**Bobbin** or pillow lace is made on a pillow from a set of threads each of which is wound on a bobbin. They are interworked mainly in combinations of plaiting and braiding (see note 3). Fig. 4 shows the simplest form of plaiting, fig. 5, the simplest form of braiding, and fig. 6, a very simple combination of interlacing and interlinking of threads.

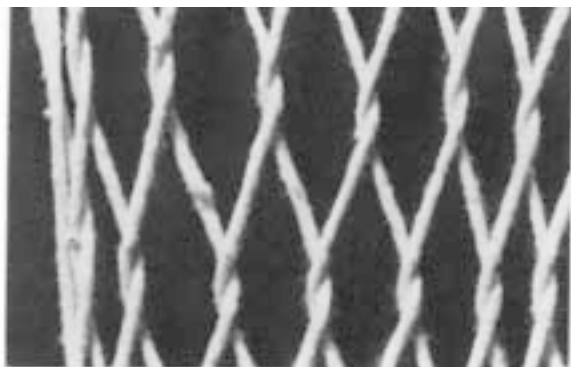


Fig. 4



Fig. 5



Fig. 6

Crochet, macramé, tatting, and filet are some of the other forms of decorative openwork which are frequently but not consistently included under the term *lace*.

**Crochet** lace, which is produced by interlooping or chaining a single thread with itself by means of a hooked needle, is not usually considered one of the main (or perhaps not one of the elite) forms of lace, but rather, a special use to which the crochet technique may be put. It is interesting to note that definitions of lace do not exclude crochet except by omission—not by definition. Fig. 7 shows a simple way of using the chaining which is the basis of crochet to form both meshes and more solid masses by means of which design elements may be worked out.<sup>5</sup>

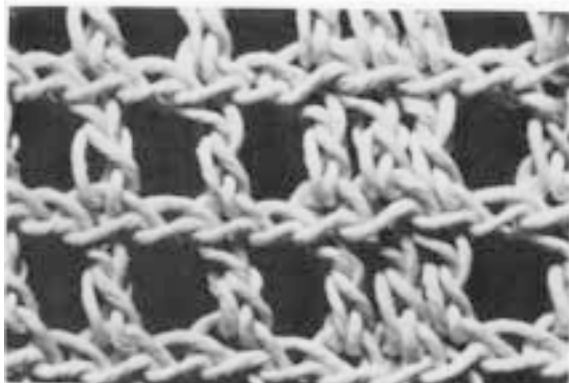


Fig. 7

<sup>5</sup> Knitting, another type of interlooping, is also used on occasion for openwork effects and patterning which can be made reasonably lacy, although it is not as commonly used in that way as is crochet.



*Macrame* is frequently designated as a form of lace especially in countries (such as Spain) where it happens to have been developed in great variety and intricacy. It is basically a working of *one set of elements*, being to a large extent an elaboration and development of fringe techniques for finishing the warp threads left unwoven at the ends of a piece of cloth. It is usually developed in knotting, the chief knot being essentially the *square* or *reef* knot (fig. 10) enclosing two other elements, sometimes called the *Solomon's knot* (fig. 8). The half hitch is also used in a variety of ways to elaborate the texture. Being a construction worked from one set of elements macrame is sometimes considered a forerunner of bobbin lace.

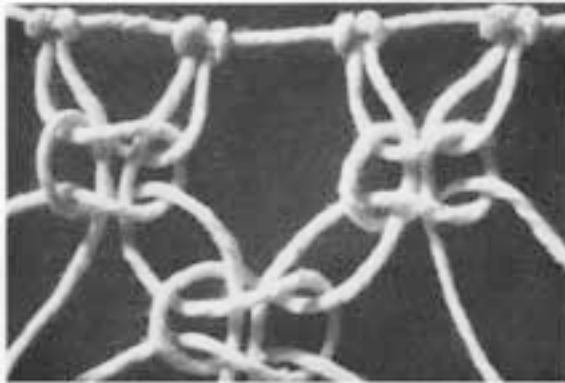


Fig. 8

*Tatting* is another form of knotted lace work. It is based on the cow-hitch or lark's head knot (fig. 9) and is worked with a small shuttle from a single thread or element, the knotting used to form circles, half-circles, and picots.

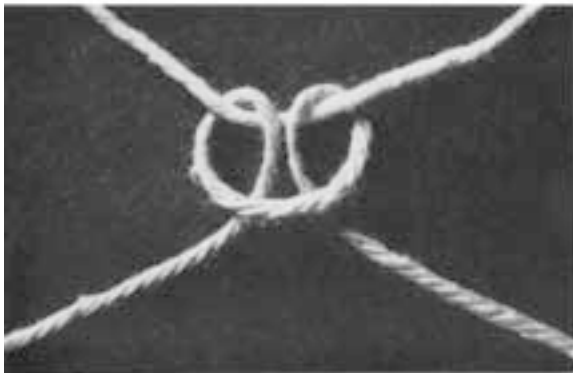


Fig. 9

*Filet* is a single element construction which is a true *knotted netting*. It may have square or diamond shaped meshes<sup>6</sup> secured by either the square knot (fig. 10) or the sheet-bend (fig. 11). The first of these is

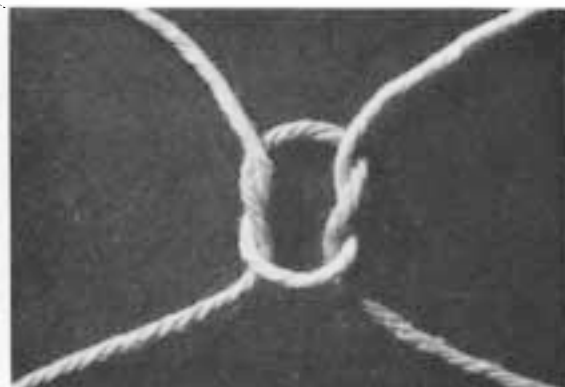


Fig. 10

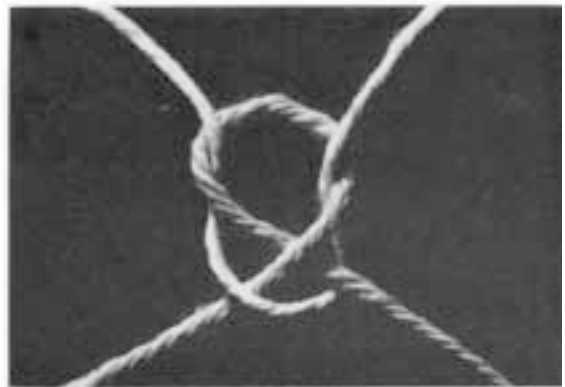


Fig. 11

<sup>6</sup>A variety of knotted netting, frequently very fine, made with diamond shaped meshes and diamond shaped areas of solid knotting has a wide distribution among aboriginal fabrics, ancient and modern. The method of knotting varies more than the general patterning; simple overhand knots, slip knots (knotted buttonhole stitch), square knots, and perhaps others are used for the same general effect.

sometimes called the Chinese filet knot, the second, the European, although with how much justification we have been unable to determine. Pattern may be worked in as the netting is tied, or darned in afterward. If the production of pattern is simultaneous with production of the network it would seem to fulfill all the conditions included in definitions of lace. If the pattern is added after the netting has been completed, the netting itself would be called *filet net* and we are brought to the question of the distinction between *net* or *netting* and *lace*.

The term *lace* seems to have emerged as a term descriptive of qualities but not definitive as to structure since it includes many different structural types and since no mention of technique or construction is to be found in definitions of lace – only distinctions between different types of lace. Even if use of the term is limited to reference to *needle* and *bobbin* laces a variety of looped stitches as well as braided and plaited constructions would be included. If a wider interpretation is allowed, the term will encompass many types of structure: single element and two-element looping and knotting; braiding, plaiting, and knotting of a single set of elements. We will find, presently, that there are structures, worked with two differentiated sets of elements (warp and weft) which are so similar to the lace forms already discussed that it is difficult to find a logical basis for calling one and not another, lace. Before discussing them, however, it would be well to determine the practical uses of the terms *net* and *netting* for fabrics related to, or differentiated from, those designated by the term *lace*.

By consensus of definition, both *net* and *netting* (and to some extent the less commonly used *network*) carry connotations of *knotting*, *meshes*, and *openwork*. In contrast to lace, net is not necessarily ornamental or patterned. Being patterned does not, however, keep it from being properly termed netting. Similarly, netting is usually defined as having the thread intersections *knotted* to form *meshes* of fixed dimension, but the knotting in macrame, tatting, filet, etc., does not make them netting rather than lace. In other words, the terms are not mutually exclusive – nor are they synonymous. Lace, in its wider sense, may include fabrics which are properly termed netting, as well as many which are not. Netting includes many fabrics not in any way related to lace (except in the one quality, openness) as well as those which are recognized as lace forms. Netting is more specifically a term of structure whereas, as already noted, lace is a term of qualifications covering many types of structure.

Use of the term net without the implication of knotted meshes should be noted. Such fabrics as *maline* and *tulle* are delicate openwork fabrics with diamond or hexagonal meshes which are not knotted but formed by twisting or plaiting of threads into a structure actually more related to bobbin laces than to netting. They are unpatterned and commonly referred to as *nets*, the term being used to describe fabric

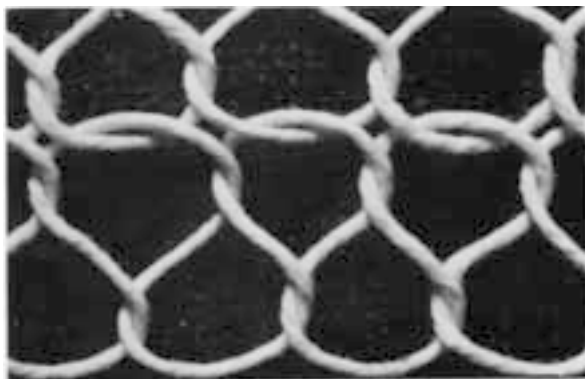


Fig. 12

qualities rather than structure. There are also many looped constructions (some identical with those diagrammed in figs. 1, 2, and 3, and other more elaborate forms such as that in fig. 12) which, when open enough to suggest the use of the term net to express the openness, are commonly referred to as *knotless netting* with the evident intention of defining their deviation from the accepted idea of *knotted meshes* in *nets*. Although to the technician the term netting will imply knotted meshes, it may still be practical to specify *knotted netting* when it is important to ensure accurate communication of an exact idea. On the other hand, when the quality of openness is lacking but the technique is clearly that of knotted netting, i.e., when the knots

are set close together to form a nearly solid fabric, the term netting may seem inappropriate; but since the only structural difference lies in the length of the mesh bars in relation to the size of the thread and the knots, it seems best to use the accurate structural term for the construction and, if thought desirable, describe the discrepancy in appearance and the reason for it.

Often of similar appearance, but quite different structurally, are loom-made meshes (decorated or plain), i.e., meshes formed by the manipulation of two differentiated sets of elements—warp threads and weft threads.

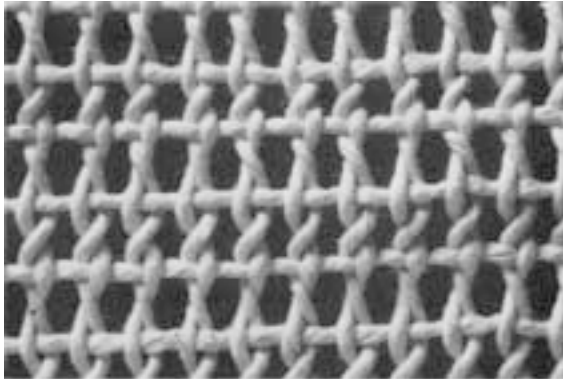


Fig. 13

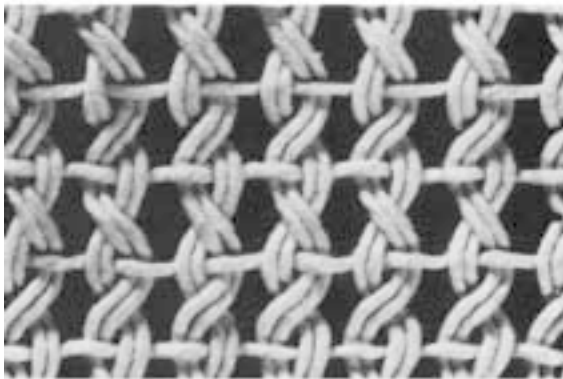


Fig. 14

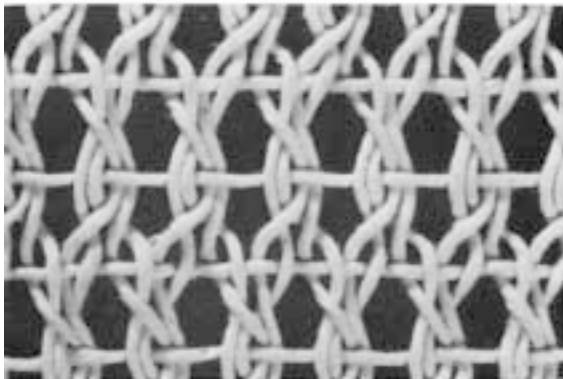


Fig. 15

Here again we find that openwork effects are achieved in a number of different ways—by the use of a number of different structures. A meshed or openwork effect may be produced by crossing alternate warp threads over adjacent ones, securing the crosses by a passage of the weft, crossing the warps back to their original positions and again securing the cross by a weft shot. This (fig. 13) is the simplest form and the essence of *gauze weave*.<sup>7</sup> There are uncounted possibilities of variation and elaboration but as long as the construction makes use of the principle of the warp cross secured by passages of weft, the variation should be identified as a form of *gauze weave*. The problem of classifying the types of possible variation is one which will require more space than is available here. However figs. 14, 15, and 16 indicate some of the possibilities: fig. 14, of using paired instead of single warps but in the same manner as the simple two-warp cross; fig. 15, of pairing warps for one series of crosses and separating them for the next; fig. 16, of crossing a warp thread first with the one to the right then with the one to the left of its original position.

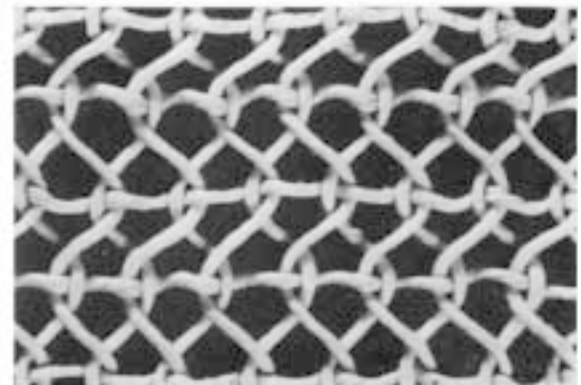


Fig. 16

<sup>7</sup> The term *leno* is frequently used as a synonym for *gauze*. However, it seems to be used quite as frequently to designate the combination of gauze weave with some other (usually plain) weave; and again, although less frequently, to indicate any variation or elaboration of the simple two-warp gauze. In view of the marked inconsistency of the use of the term *leno*, it seems wiser to maintain *gauze* (which has the advantage which *leno* lacks of having equivalents in many languages) as a definitive term to designate a specific type of structure.

Patterned gauzes may be produced by manipulation of variations of gauze weave or by combining gauze with another weave, using one for the pattern, the other for background, and this raises the question of the extent to which gauze should be considered as a form of lace. The quality is frequently *lacy* in the extreme, the fabric is ornamental, and the pattern is produced simultaneously with the fabric.<sup>8</sup> It seems that *gauze*, like *net*, is most useful as a term of structure. There are many gauzes and gauze constructions quite unrelated to lace, others closely related. The term lace describes and defines certain qualities which the gauze construction may be used to produce. The use of the term gauze in a purely qualitative sense to indicate a fabric of a gauzy or gauze-like texture is an everyday use and not technically valid, but here again it is possible to ensure accuracy by specifying *gauze weave*.

In loom-made knotted meshes we have another type of knotted construction used effectively for lacy fabrics. It is neither true knotted netting, which is made from a single element, nor like any of the knotted structures found in fringes (macrame) which are formed from single sets of elements. It is like gauze in

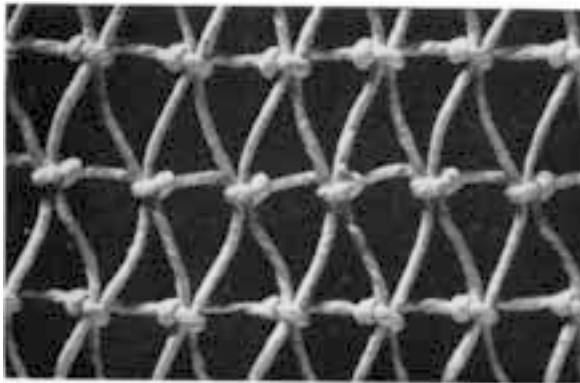


Fig. 17

being made on a warp with a horizontal (weft) element but it is distinguished from gauze by the use of knotting and by the fact that although the warps may be pulled out of line to form the meshes, they are not crossed; the weft does the knotting (fig. 17) or wrapping, the warp plays a passive role. (These lacy mesh fabrics were made in Peru with pattern worked in another weave as the mesh was constructed and also with design contrived by means of color changes in both warp and weft.)

Without attempting elaboration of details of the subject, brief note may be made of *embroidery* and its relation to lace. Beside the already noted instances of the addition of embroidery to nets and gauzes there are such techniques as cut-work and drawn-work which are sometimes considered and classified as *embroidery*, sometimes as *lace*, sometimes – more accurately – as both. We may note general agreement on the use of the term embroidery to refer to *ornamental stitchery with a needle on a woven or other ground*, and the fact that such stitchery used to finish and ornament fabrics from which threads have been drawn or holes cut may produce the close relatives and forerunners (if not technically forms) of needle-laces, i.e., cut-work and drawn-work. Again, in *embroidery*, we have a term of structure or construction – one with a wide field of reference but definite connotation. A great variety of stitches may be included in the field of reference but there are always stitches of some sort – and always a base fabric on which they are worked. Embroidery, then, is related to lace by the fact that certain *embroidery* stitches may be used in the production of fabric forms closely allied to, if not actually to be considered, *lace*.

It is hoped that this brief discussion of a few related and interrelated terms may perhaps explain the conviction, reached after much study, that it is no longer practical for each individual to decide which of many possible meanings of a word best suits his immediate needs and then define his terms accordingly. We are convinced that it has become necessary to deal in a more comprehensive way with terms which are to be used for accurate description and designation; that accumulated means must be considered; that elements common to all or to a majority of definitions or usages should, if possible, be retained; that terms considered synonymous (or partially so) should be studied with particular care so that fruitless overlapping of meaning

<sup>8</sup> Pattern may also be added to finished gauzes by means of embroidery – as it is in *buratto* and in many Peruvian gauzes.

may be avoided and distinctions which serve useful purposes emphasized; that qualitative terms must be clearly distinguished from the more definitive terms of structure and indiscriminate use of the two types scrupulously avoided. A fabric may be defined and described in both qualitative and structural terms but one described in terms of qualities cannot be compared with one described in terms of structure to any advantage. We believe, further, that *fabric names*, i.e., terms which designate a particular combination of qualities and characteristics in a fabric, are inevitably specialized terms. Specific combinations of certain qualities and characteristics (of fiber, weave, texture, pattern, color, use, weight, finish, etc.) will seldom be found in more than a few comparatively limited groups of textile types; whereas, since every fabric has a specific and determinable structure, the terminology of structure is applicable in any field of fabric study. Fabric names, in contradistinction to terms for the designation of fabric structures have many admitted and legitimate uses but for the purpose of definitive description, identification, and comparison, they are not only too limited in application to be useful but much too flexible to be definitive. Since *structural* distinction between fabrics can be made in more accurate detail than any other it seems the best basis for fundamental classification and terminology. Qualitative terms cannot and need not be as definitive. They are useful for assessing groups of similar fabrics and for rounding out descriptions of specific examples but not for clear-cut distinctions or for establishing or stating facts. The primary need, now, is for words for the facts.