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COMPENSATING LOSSES: TISSUE PAPER FILLS FOR SCULPTURE

Pamela Hatchfield* and Michele Marincola**

Since antiquity, losses or voids have been filled in objects of value. A break or loss to a utilitarian object such as a ceramic vessel or basket prevents its intended use; the vessel is either repaired to restore function, put to another use, or discarded. The loss itself may retain specific spiritual function, as in some examples of native American ceramics where a ritual hole is found in the bottom of bowls used for funerary purposes.

As conservators, our focus for sculpture is often on losses which can create aesthetic rather than physical dysfunction. Many of the materials used in the reintegration of surfaces were initially employed for their physical strength, their structural effectiveness and/or their similarity to original materials. In the examples we illustrate in this paper, some questions are raised about the best types of fills to use under different conditions, dictated by the nature of the objects themselves as well as the intended function of the fill itself. We hope to highlight several different approaches, some that may be appropriate to the fine and decorative arts, and others perhaps more appropriate for the treatment of archaeological materials.

The use of tissue paper fills at the Museum of Fine Arts, Boston evolved as part of a treatment program whose primary aim was consolidation of extremely fragile archaeological polychromes, the previous treatment of which had been generally unsatisfactory. Our collection includes more than 100 Egyptian polychromed wood models from the tomb of Djehuty-Nakht alone. Discovered in 1915 in the limestone cliffs on the east bank of the Nile at Bersha, this cache dates from the Eleventh Dynasty, around 2000 BC. The models typically comprise a carved wooden substrate, gesso ground (usually calcium carbonate or sulfate mixed with an organic binder such as animal glue) and painted surface (ground inorganic pigments bound with extremely low levels of organic binders). In addition, we find on the surfaces of later examples a variety of resins generally related to pine resin or mastic but usually somewhat sensitive to water and many organic solvents. The condition of these models did not improve during seventy years of storage near the Museum's furnace. Many of them had been treated with a variety of materials ranging from plaster to cellulose nitrate, wax, emulsions, and plastic resins. The extreme sensitivity of these materials to water and their lack of stability after these early treatments led us to explore the cellulose ethers as an option for consolidation treatment.

We recognized that our difficulties in treating these objects arose not so much from their innate fragility, but from the intractable materials with which they have been traditionally treated. While it is true that archaeological materials are often allowed to show their age and true condition, surface losses are often found to be quite distracting (fig. 1). Areas where white

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gesso (and sometimes even the bare wood) are revealed become a focus for the viewer to the exclusion of everything else. We certainly had so-called reversible materials available to us, but just as we knew we would never be able to extract a consolidant from these friable surfaces, we also knew that barrier layers and fills would be nearly as damaging and difficult to remove. Furthermore, a link has recently been made between contact with the alkaline environment that a plaster or gesso surface might provide and certain kinds of deterioration found in archaeological wood (Blanchette et al. 1994).

Information on cellulose ethers as consolidants has been presented previously and will not be reviewed in detail here (Hatchfield 1988; Hatchfield 1990). The benign qualities that made the cellulose ethers successful as consolidants for this fragile material also made them appropriate for the application of tissue fills. The use of these materials would not impede future treatment, and would provide very low concentrations of stable adhesives that are compatible with wood, original ground layers and paint media.

Cellulose ethers are derived from alkalai-treated cellulose whose hydroxyl groups (-OH) are substituted with methyl (-CH_3) and other groups (fig. 2). Figure 2 illustrates the chemical structure of methyl cellulose and hydroxypropyl cellulose. Hydroxypropyl cellulose is completely soluble in alcohols as well as water, while methyl cellulose is soluble in water but precipitates out of aqueous solutions with more than about 50% alcohol. Although most of the polychromes in our collection are initially too water sensitive to treat with water-based consolidants or adhesives, once consolidated with hydroxypropyl cellulose, water-based materials could then be applied without disrupting paint or gesso layers. It might seem that avoiding aqueous-based materials would be preferable, and for that reason hydroxypropyl cellulose presents an attractive option. However, it is much less stable than methyl cellulose. The long side chain present in hydroxypropyl cellulose makes it completely soluble in alcohols but also makes it prone to deterioration. In industry, they are intended for use in materials such as paint strippers, rather than for long-term use. Recent aging studies bear this out (Feller and Wilt 1990), and although it is particularly tempting to use it in the application of paper fills, it cannot be recommended for the long term. Methyl cellulose on the other hand can be relied upon as an extremely stable material with excellent aging properties.

For archaeological applications in particular, the application of tissue paper fills allows visual integration of a surface so that the eye makes the transition between areas of original surface, while those parts which are filled can remain visible due to differences in texture, color, or the level of the fill. Just as with inpainting, one can decide how far to go in mimicking the original surfaces.

The process of preparing and applying these tissue fills is straightforward (fig. 3, a-d). Green's lens tissue is usually used, although other high wet-strength, neutral pH tissues may be used.[1]

Strips of the tissue are tinted to the shades needed by applying diluted mixtures of acrylic paints in water by brush and hanging to dry. Losses are sized with a 1/2% solution of Klucel G, hydroxypropyl cellulose, in ethanol.[2] The tissue is torn to approximate the shape of the loss and applied with a 1/2% solution of Methocel A, methyl cellulose, in deionized water and ethanol 1:1[3] (fig. 4). Multiple layers of tissue may be built up and overlapped as required. The use of tissue fills allows losses in both the gesso and paint to remain recessed, and permits bare wood and gesso to be toned without inpainting directly on a barrier-coated substrate. In the case of matte polychromes, the texture of the painted tissue more closely approximates the original surface than does inpainting over a barrier, where wood grain might still be pronounced.

Tissue paper fills have also been used on very different types of materials, including stone. The technique was used to compensate losses on a late twelfth-century sandstone and limestone portal from a small town in the Spanish Pyrenees. The tympanum, characterized as a siliceous limestone (40% silicates), was severely powdering beneath a crusty grey coating material that was peeling and flaking away from the substrate in many areas. This substance comprised calcium sulfate and charcoal; small amounts of pine resin and non-drying oils were also detected by X-ray fluorescence.

The tympanum had been coated after a significant degree of weathering had taken place, apparently while it was still in situ. Although probably applied in an attempt to prevent ongoing spalling, this coating peeled away with whatever it contacted of the design surface itself. Quantities of chloride and sulfate salts were present, the latter at much higher levels (possibly due to contamination). Before compensation, the treatment of this monument required setting down and facing of these areas; this was done both with Klucel in ethanol, which softened the brittle grey coating, and methyl cellulose, which remained insoluble in the subsequent consolidation treatment with ethyl silicate. The uneven appearance of the tympanum caused by spalling of the surface over the years was considered to be disfiguring and distracting; however, the grey coating could not be removed or lightened without damaging original material. Rather than inpainting all of the coating, and because it was closer to the appearance of the stone itself in areas where spalling had not occurred, we decided that compensation of the losses was preferable. After consolidation, the facing was removed and, wanting to introduce as little additional material as possible to the surface, it was decided that tissue fills would be an appropriate solution. The portal is viewed from a distance, and the texture of tissue fills was appropriate for the stone (fig. 5). Figure 5 illustrates a portion of the acanthus leaf molding in the process of integrating areas of surface loss by means of tissue paper fills.

Tissue fills are clearly appropriate for certain archaeological applications and other instances where the character of the surface allows it or the sensitivity of the material requires it. In most cases, we have applied them to rough, uneven, or variegated surfaces, but we have found the technique to be useful in a variety of other ways. For the purposes of a didactic exhibition, an area of overpaint was removed from a Greek kalpis and highlighted with temporary outlines of red-painted tissue paper using the same methods described above (fig. 6).

The use of this technique on other types of polychromed surfaces has both advantages and limitations. The compensation of loss in Medieval polychromed sculpture at The Cloisters is usually completed with traditional materials sympathetic in nature to the original. Losses in the gesso ground of painted wooden sculpture are most often filled with a gesso made from kaolin or calcium carbonate and rabbitskin glue. Fill materials used for stone are also unremarkable: plaster, or synthetic resins mixed with inerts like stone dust or glass microballoons. These materials offer familiar working properties and surfaces suitable for the imitation of a range of textures and colors, while usually affording an acceptable level of reversibility.

There are instances, however, when these materials do not supply the characteristics required in a specific treatment. When determining the extent of compensation necessary for the sculpture, it is sometimes helpful to try a few fills. None of the traditional materials or methods offers a rapid and reversible fill to help in this situation. The creation of gesso fills for polychromed sculpture is a lengthy process and can require more time than is available for an experiment, or indeed for the project. The compensation materials themselves may sometimes pose other problems; for example, wooden substrates can be so tunneled by wood-boring insects, that gesso fills would be difficult to reverse without damaging the object. Plaster, of course, is unacceptable as a compensation material for stone that contains soluble salts. Synthetic resins, widely used as compensation materials for stone, may have undesirable properties such as excessive gloss or hardness, or the propensity to yellow with aging. In these cases, tissue paper fills may offer an alternative method.

Two case studies of treatment illustrate the application of tissue paper fills to polychromed wood sculpture and present some of the limitations of the technique. Both treatments were executed on a single sculpture, an over-lifesize, twelfth-century Spanish polychromed wood crucifix in the collection of The Cloisters, that underwent an examination and treatment in preparation for loan (fig. 7). The question of compensation of loss in the torso area was raised during discussion of the treatment of the figure. Since the dating of this sculpture rests in part on the carving of the torso of the corpus, it was felt that the large, discolored losses in the stomach that reveal the wood were visually disturbing. The scattered damages impose a two-dimensional pattern of dark blotches on the shallow three-dimensional form, making it difficult to "read" the carving, especially from the viewing distance of the crucifix. In addition, the pale tonality of the flesh tones is distorted by the discolored losses. The compensation of these losses would entail a significant intervention; those involved in the decision wanted to be sure that filling the holes would add enough information to the sculpture to justify the effort. We were also concerned that the compensation of these damages could emphasize the vertical split in the wood, requiring that the crack be filled, a treatment we wanted to avoid. Temporary fills in the form of color compensation would be of great usefulness in deciding whether or not to fill the losses.

Double layers of tissue paper were adhered as part of this process to several of the losses (figs. 8-9). In an effort to approximate the faint shine of the original lead paint of the skin, a Japanese tissue known as wet strength paper was selected.[4] This paper, used at The Cloisters as a facing tissue because of its superior strength when wet, has a slight gloss to its surface. Losses to the wood were brushed with a barrier coat of Acryloid B-72;[5] the tissue fills are attached to each other and to the substrate with a 1/2% solution of hydroxypropyl cellulose, Klucel GF, in ethanol.[6] The more stable methyl cellulose would be less desirable in this instance because of the sensitivity of the gesso ground to water - the emphasis on this temporary fill was reversibilty. The tissue fills were then tinted with a very dilute solution of dry pigments and Mowilith 20 in denatured alcohol.[7] To further mitigate the possibility of staining the gesso layers below, it is preferable to pre-tint the tissue paper before adhering it to the wood. The entire process took only two hours of working time, whereas experimenting with gesso fills would have taken considerably longer. The overall appearance of the figure was significantly improved, permitting an understanding of the sculptural form. Although this process made the vertical split more apparent, it did not become much more distracting than it already was. It was decided, then, to fill most of the losses in the torso that extended to bare wood.

We considered continuing the fills with tissue paper, but ultimately rejected this approach in favor of gesso fills. Tissue paper provides good color compensation but does not fill the depth of the loss. The adhesive-charged tissue easily conforms to the loss, leaving a visible shadow (fig. 10). If the point of the compensation is to restore contour and allow the eye to pass over the surface, the hard edge of the recessed fill will disrupt this process.

Another important consideration of this technique is the loss of retouching detail that results from inpainting directly on very porous tissue paper. This can be an advantage where the surface to be imitated (for example the torso) is a mixture of layers and colors. Impressionistic renderings of color are possible, but any imitation of the kind of detail that can be found on painted sculpture - such as cut-gold work on Medieval Japanese polychromed wood sculpture, or the realistic flesh tones of late-Medieval German painted sculpture - can only be hinted at. Furthermore, much of the material illusion of European polychromed sculpture relies on a contrast of surface textures, from polished flesh tones and matte gilding to burnished gilding and velvety azurite drapery linings. This wide range of textures would be difficult to imitate with tissue paper.

If, however, tissue paper seems appropriate for the treatment, there are other factors to consider, including the concentration of the cellulose ether, the condition of the surface (whether it is grime-laden or powdery), and the type of substrate. The concentration of the adhesive should be low, around 0.5%, to insure long-term adhesion of the tissue paper to the substrate. Pre-consolidation of grimey or powdery surfaces may be desirable.

A long-term application of the tissue paper method was applied to another area on The Cloisters' crucifix. In order to help disguise the mortise and tenon joints between the arms and the torso, the sculptor had covered the joins with patches of parchment that were glued directly to the wood and then covered with gesso and paint. These served as an invisible bridge between parts with opposing grain directions and helped cover the gaps that inevitably opened at the joins. A section of this parchment is missing from the proper left arm, revealing a wide, discolored gap at the shoulder. Any solid fill would, of course, be out of the question, but we did want to approximate the appearance of the opposite shoulder. A section of new parchment was considered inappropriate as a replacement material because of the its highly hygroscopic nature; it would be difficult to hold the section in place in the desired shape. Tissue paper seemed a more practical solution. Several layers of wet strength tissue paper were feathered into the desired shape and adhered together with a viscous solution of methyl cellulose in water. They were laid to dry and take form over the shoulder joint itself, which was protected with a barrier layer of plastic film. When dry, the tissue paper was toned with watercolor to match the surrounding area. The dried and hardened tissue was then spot-glued to the arm with Acryloid B-72, and left free to move on its top and left edges (fig. 11).

In conclusion, tissue paper fills offer an alternative to traditional compensation materials for the treatment of objects. They are particularly appropriate for certain archaeological applications, and in other instances where the sensitivity of the material or the character of the surface demands a readily-reversible, non-invasive color compensation. Although recessed fills and impressionistic retouching sometimes may be considered a disadvantage for non-archaeological objects, tissue paper also has potential in certain instances as a compensation material for polychromed sculpture - in cases of material imitation, for example, or for very shallow losses or where the viewing distance is great. Tinted tissue paper is useful as a material for temporary fills for photography, exhibition, or in decisions of whether to compensate for loss.

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Feller, R.L. and M. Wilt. 1990. *Evaluation of Cellulose Ethers for Conservation*. Research in Conservation Series 3. Marina del Rey, California: The Getty Conservation Institute. 93-94.

Endnotes

1. Green's lens tissue is available from Talas, 213 West 35th Street, New York, N.Y., 10001, (212) 219-0770; neutral pH tissue is available from Archivart, 301 Veterans Boulevard, Rutherford, N.J. 07070, (800) 631-0193.

2. Klucel G is manufactured by Aqualon, 1313 North Market Street, Wilmington DE 19899-8740, (800) 345-0447.

3. Methocel A is manufactured by Dow Chemical and available from the company, 2040 Dow Center, Midland, MI 48674, (800) 232-2436.

4. Japanese wet strength paper is available from Talas, cf. Note 1.

5. Acryloid B-72 is manufactured by Röhm and Haas Company, Independence Mall West, Philadelphia, PA 19105, and is available from Conservation Materials Ltd., 1395 Greg Street, #110, Sparks, NV 89431, (702) 331-0582.

6. Klucel GF is a food-grade hydroxypropyl cellulose manufactured by Aqualon Company and available from the manufacturer or from Conservation Materials Ltd, cf. Notes 2 and 5.

7. Mowilith 20 is a polyvinyl acetate of low glass transition temperature, close in viscosity and refractive index to PVA-AYAB, and manufactured by Hoechst, Frankfurt (Germany); it is available in this country from (among others) Kremer Pigments, 61 East 3rd Street, New York, N.Y. 10003, (212) 995-5556.

Figure 1. Late Ramesside mask from anthropoid coffin. Before treatment. (MFA 72.4774)

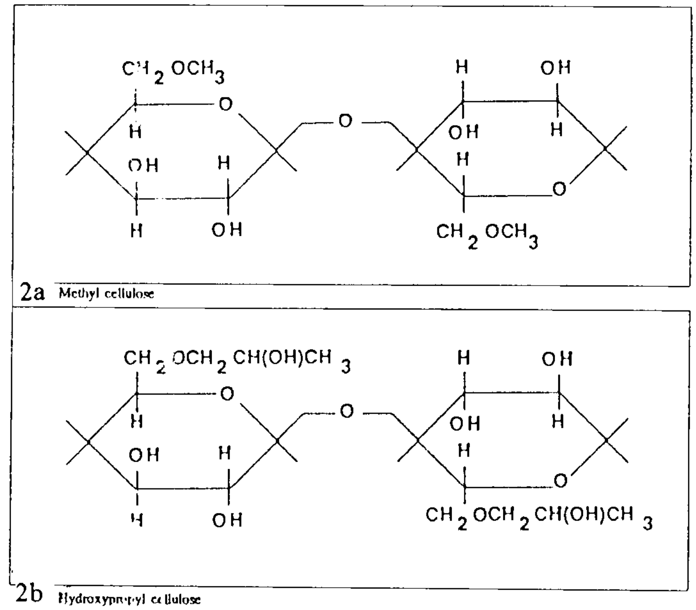
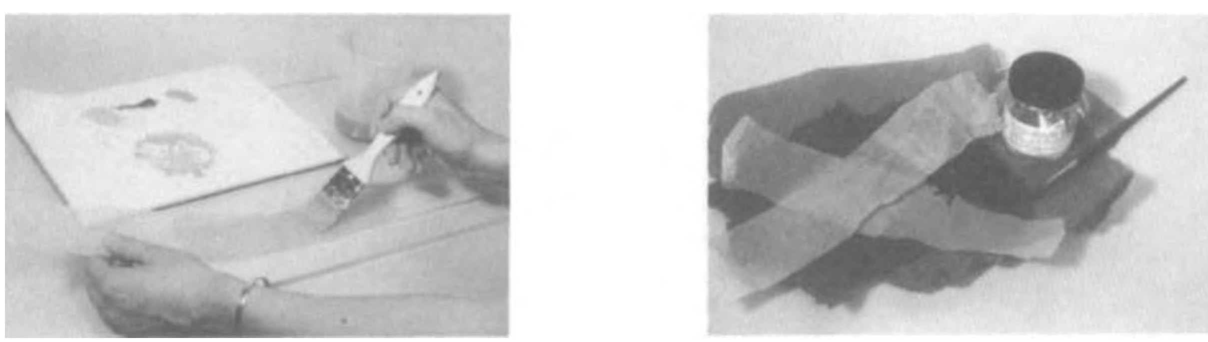


Figure 2. Structure of (a) methyl cellulose (b) hydroxypropyl cellulose.

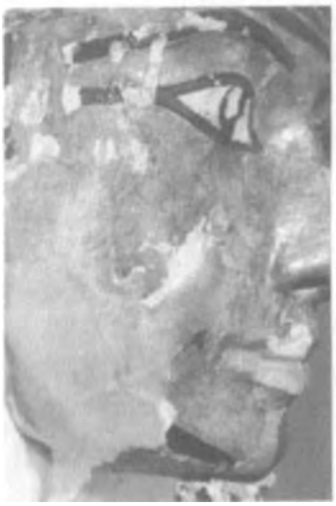
Figure 3. Preparing tissue paper fills.



(a) painting tissue paper.

(b) tissue paper prepared for fills.

Figure 3 (cont.). Preparing tissue paper fills.



(c) fitting tissue paper fills. (MFA 72.4774)

(d) after filling. (MFA 72.4774)

Figure 4. Coffin mask after treatment. (MFA 72.4774)

Figure 5. Portal, San Miguel de Uncastillo, Spain, second half of the 12th century; acanthus leaf molding during compensation. (MFA 28.32)

Figure 6. Red-figure kalpis, South Italian, late 5th century; red tissue line indicates area of overpaint removal. (MFA 41.56)

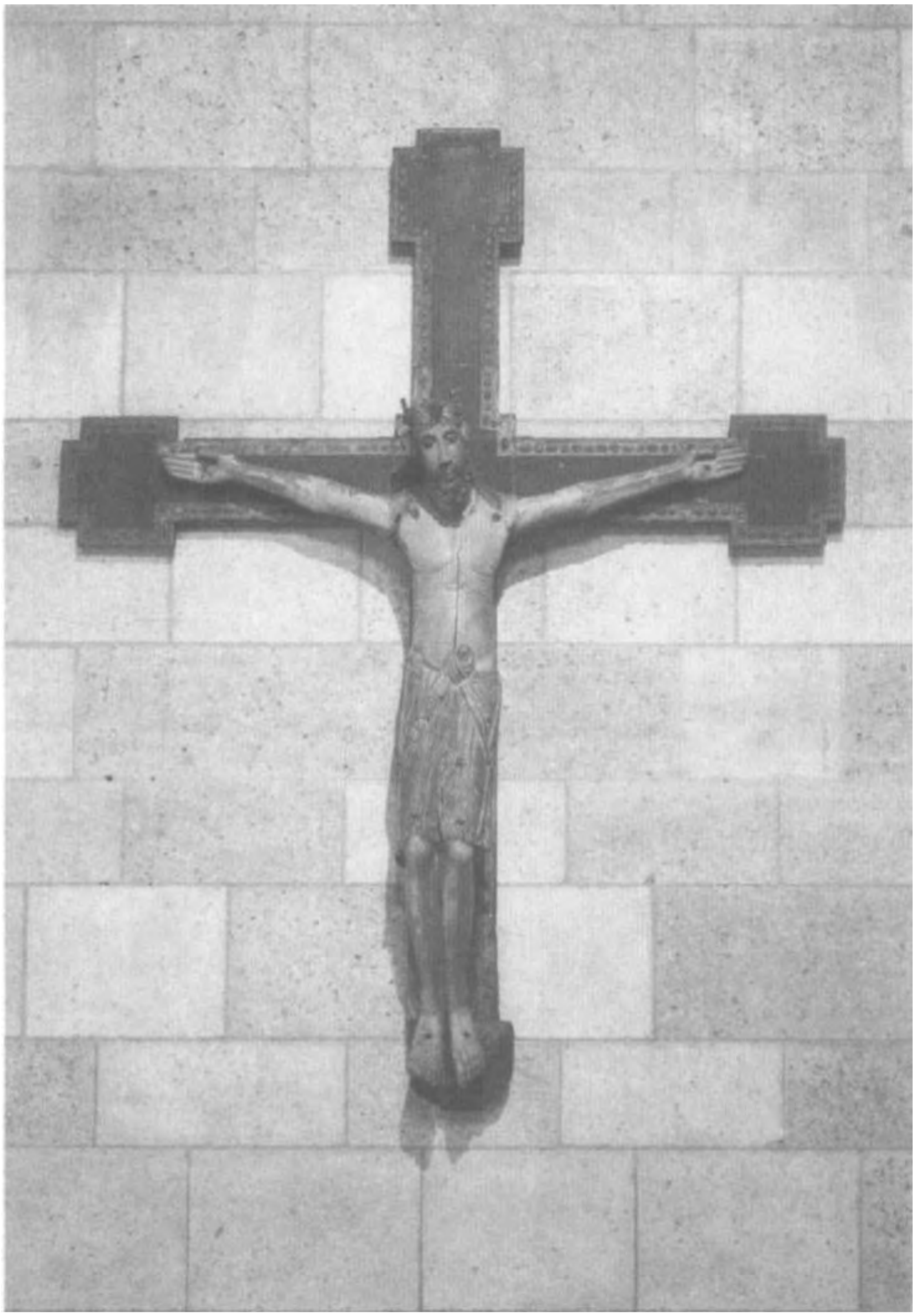


Figure 7. Crucifix, Spain, Convent of Santa Clara de Astudillo (Palencia), second half of the 12th century, polychromed wood; after treatment. (MMA, The Cloisters Collection 35.36ab)

Figure 8. Crucifix, detail of torso with tissue paper fills in place. (MMA, The Cloisters Collection 35.36ab)

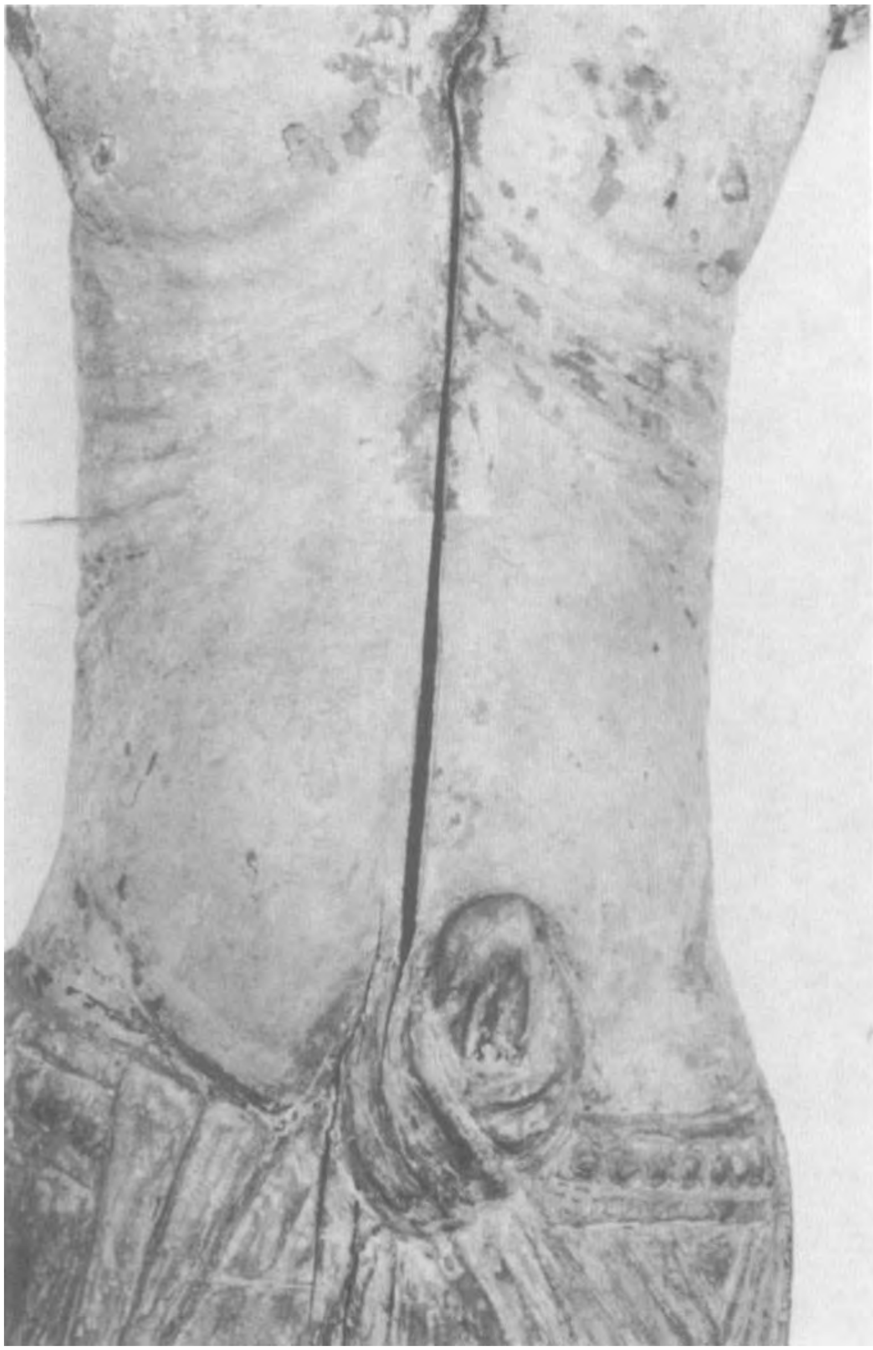


Figure 9. Crucifix, detail of torso with tissue paper fills toned. (MMA, The Cloisters Collection 35.36ab)

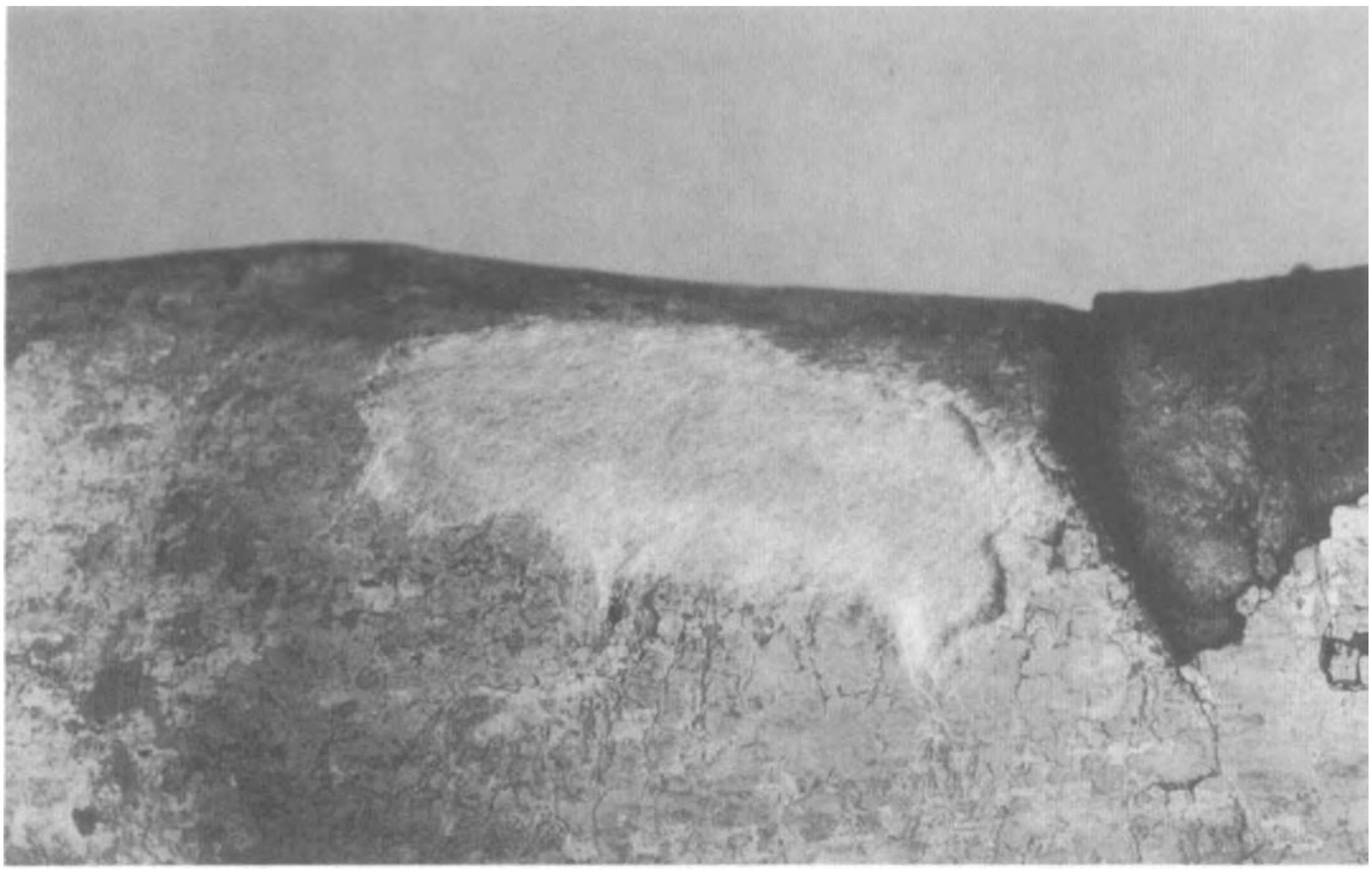


Figure 10. Crucifix, detail of arm, tissue paper fill conforming to contour of loss. (MMA, The Cloisters Collection 35.36ab)

Figure 11. Crucifix, detail of upper body, tinted tissue paper used as imitation parchment at join of left arm (see arrow). (MMA, The Cloisters Collection 35.36ab)