UP ON THE ROOF: LIGHT BLEACHING OF LARGE TEXTILES, TWO CASE STUDIES

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ABSTRACT—The use of daylight to bleach textiles is a well-known traditional method. Using aqueous light bleaching for historic artifacts of paper has been extensively documented in the paper conservation literature. However, in the textile conservation literature there is little discussion of the use of light bleaching for textile artifacts. This paper will present two case studies in which aqueous light bleaching was chosen as the treatment option for two severely discolored quilts. The discussion will include: the pros and cons of bleaching historic textile objects and the rationale for this option over more widely used bleaching methods; a brief review of the mechanism of light bleaching and what was learned from the paper conservation literature; and how the bleaching was carried out—on the roof of the Research Building at the Winterthur Museum.

INTRODUCTION

This paper presents two case studies in which, after careful consideration, it was decided to light bleach large textile objects. Both of these objects in the collection of the Winterthur Museum had severe aesthetic problems that wet-cleaning did not rectify.

The use of light to bleach textiles is a method that has been used for centuries. The repeated sequence of scouring with an alkali, souring with an acid, then bleaching in the sun, is believed to have originated before the 1st century AD (Easton 1971, 3). During the height of the bleaching fields in Haarlem (16th to mid-18th centuries), in addition to being laid out on the grass and being oxidized, the linen was "was never allowed to dry altogether, but was constantly sprayed during the day by means of watering-cans or long narrow shovels, while remaining exposed to the dew at night" (Driessen 1944, 1733). In effect, this made the procedure an aqueous one.

As bleaching was such an important part of the processing of many textiles, there are certain expectations of just how white a textile object should appear. At times, the yellowing and greying of degradation products and soiling plus prominent staining is found to be too much to visually bear as "patina". In this state it may be felt that the piece cannot be properly interpreted.

Bleaching has been a treatment option for undyed cellulosic fiber that has been used with caution by textile conservators for many years. Since Poot's study and publication in 1964, much of the bleaching has been carried out using stabilized hydrogen peroxide, an oxidative bleach. In recent years, little has been written about textile conservation bleaching. There has been concern about the long-term detrimental effects of these treatments. Bleaching is a chemical reaction in which the breaking and reforming of bonds occurs. The question of whether this is just a short term "cosmetic" fix that will be subject to color reversion, is also of concern.

Aqueous light bleaching was chosen over more traditional chemical bleaches, such as stabilized hydrogen peroxide (oxidative) or sodium borohydride (reductive). It was felt that the required degree of lightening could be achieved without the extensive use of these chemicals. With light bleaching, it is relatively easy to stop the procedure by simply blocking the light source. Where the bleaching occurs can be greatly controlled, and there is no worry of seepage from capillary action. The color, unlike the bright white that can occur with peroxide bleaching, is a creamy white. And finally, the extensive testing and literature from paper conservation indicates that this is a relatively safe, effective means for bleaching cellulose.

LIGHT BLEACHING

The only mention of the use of light to bleach cellulosic textiles in conservation found by these authors is Annis and Reagan's article in which the use of sunlight to bleach dry samples was tested. In this study, the authors were getting promising results in visual improvement

and lack of acceleration of fiber degradation (Annis & Reagan 1979, 176).

In paper conservation, much has been written about this topic (see references) after Keyes introduced the idea of aqueous light bleaching for paper artifacts in 1980. Aqueous light bleaching has been used in numerous treatments of paper artifacts. Much of the literature discusses the effects of this procedure on 100 percent cotton fiber papers (Schaeffer et al. 1992) and therefore can be transferred to cellulosic textiles.

As in all bleaching, if one of the double bonds in the conjugated chain of the chromophore is attacked, the conjugation will be broken and the compound will become colorless (Crafts Council 1983, 115). These colorless products may or may not be removed depending on the details of the treatment procedures, and on whether the products are still covalently bound to polymeric material (Burgess 1988 in Schaeffer et al. 1992). The bleaching reaction begins when the light energy is absorbed by a chromophore, which converts to a reactive peroxide or free radical (Phillips 1985 cited in Schaeffer et al. 290). Either of these products react to cause a chemical change, usually an oxidative process. This makes light bleaching mechanically similar to chemical bleaching, but without the chemicals that need to be added and then removed to stop the reaction (Schaeffer et al.).

Placing the object in a water bath allows for the degradation products of the process to be rinsed away. This also provides a medium in which the pH can be raised. In Schaeffer et al.'s study done with modern 100 percent cotton paper, it was found that the pH of all of the papers fell with artificial aging (1992). The greatest decrease was found in those papers that were exposed to light while dry, as opposed to those that had been wet.

The raising of the pH of the bath or buffering has been found to improve the light bleaching of paper in various ways: it provides oxygen to assist the oxidation bleaching mechanism; it neutralizes acidic products as they are rinsed from the object; and there appears to be less color reversion in items light bleached in buffered solutions rather than in untreated water (Duhl and Baker 1986, Lepage and Perron 1985).

Studies have found that there was little effect on the tensile properties of cotton paper samples bleached by light as compared to prewashing alone (van der Reyden et al. 1988). Annis and Reagan found no detrimental effects on the structure of the cotton fibers in textile samples with dry sun bleaching or hydrogen peroxide bleaching (1979).

Procedure

In aqueous light bleaching, a bath of water is prepared of a sufficient depth to cover the object. The pH of the water is usually raised to 7.5–8.0 (Dulh, Baker 1986, 5) often with calcium hydroxide or magnesium bicarbonate (Schaeffer et al. 1996). The object is placed in the bath and exposed to the light source, either daylight or an artificial source. A UV filter may be used, but this must be either placed above the bath to allow air circulation and prevent a raising of temperature from a greenhouse effect, or be placed under the water but not touching the object (Dulh, Baker). Cross linking of cellulose or its derivatives can be induced by light irradiation below 360 nm (Ranby and Rabek 1975 cited in van der Reyden 1988, 75).

Opaque paper templates can be used to limit the light exposure of certain areas of the object. These areas may either be light sensitive, or those that do not need bleaching. The bleaching is monitored and the object removed when a sufficient degree of lightening has been achieved. This usually occurs in the first two hours of the process (van der Reyden, 84). The amount of degradation products that are released into the water may require that the water be changed during the bath, and that the object be rinsed at the end of the procedure.

CASE STUDY I: A WHITEWORK QUILT

The first treatment to be discussed is of a large (120 inches by 101 inches) whitework quilt, 1825–1845, maker unknown (Fig. 1). This piece is well designed and shows very good craftsmanship. Unfortunately, the quilt was so visually uneven that the curator of textiles would not accept it as a donation unless there was a good possibility that it could be made presentable for exhibition.

The top is made from a fine, plain-woven white cotton, and the back from a coarser, plain-woven white cotton. The design has a central motif of a basket of flowers surrounded by a