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THE RESTORATION OF OUTDOOR STONE SCULPTURE: TRADITIONAL METHODS REVISITED

Peter Champe

Conservation of outdoor stone sculpture is particularly challenging because of the uncontrollable forces of the outdoor environment and of human activity. Exposed to these conditions, treatment solutions must be chemically stable, durable, reversible and inconspicuous. The specific challenge of loss compensation in outdoor stone sculpture is that the same requirements met in a protected museum environment must be made viable in a harsh outdoor setting. Some of the destructive forces which challenge the conservator of outdoor sculpture include: weathering (acid rain, wind erosion), guano deposition and human vandalism.

The treatment criterion of inconspicuosness listed above is more than an esthetic consideration, but actually plays a broader role protecting the sculpture from future vandalism. We have observed that areas of obvious restoration can actually serve as beacons for further vandalism. Sociologists refer to the "broken window" theory to describe the fact that if an object or structure is not maintained and is allowed to decay, subsequent vandalism increases. If, however, a baseline good condition is maintained, with restoration blending relatively seamlessly into the original, the occurrence of vandalism can be greatly reduced. This observation has led to a treatment approach which has as one of its goals to render loss compensation as inconspicuous as possible.

Bethesda Terrace

The sandstone carving at Bethesda Terrace in Central Park offers an excellent example of the effects of conspicuous restoration. The exquisitely carved New Brunswick sandstone panels depicting birds amidst scrolling foliage, designed by Jacob Wrey Mould in the 1870's, are a frequent target for vandals. The damaged elements, usually the heads and wings of the birds, have been replaced over the generations with finely carved dutchmen[1] only to be frequently broken off again. It was clear that a contributing factor in the vulnerability of the panels was the fact that the newly carved New Brunswick sandstone stood out against the original soiled and weathered stone, with a distinct join line between the two.

A toning material for the newly carved stone must exhibit chemical stability, be insoluble in water and render a flat stone-like appearance. Of the various paints we tested, including, acrylics and oils, the most suitable material was Keim Granital potassium silicate paints [2]. The liquid potassium silicate binding medium of the paint, also known as "water glass," is a mineral which forms a durable chemical bond with mineral substrates such as sandstone. The paints employ mineral pigments which are chemically stable and unaffected by UV light.

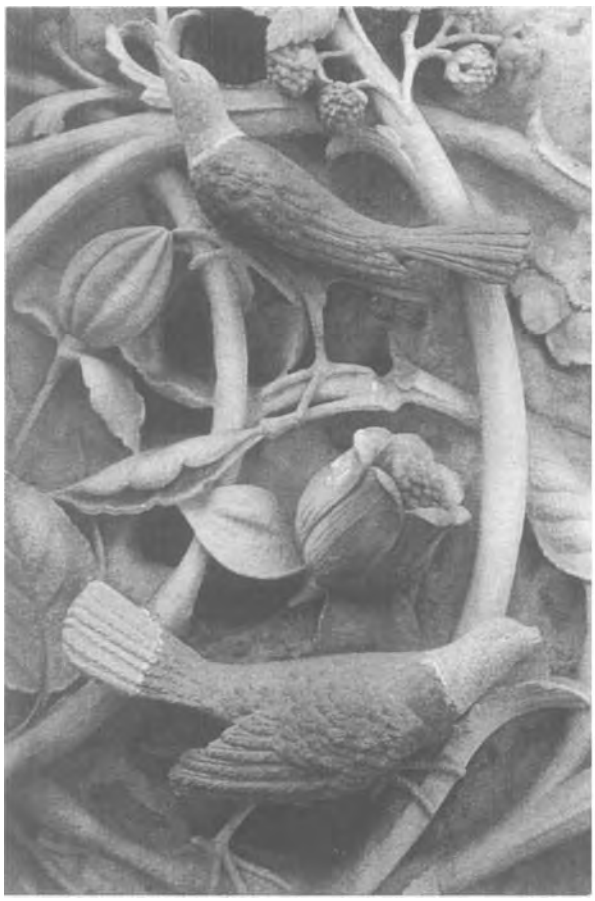

Figure 1. Bethesda Terrace.
Before Treatment.

Figure 2. Bethesda Terrace.
After Treatment.

In addition to toning the carved stone restoration, we concealed the epoxy join-line by carving a channel with a small diamond burr on a flexible-shaft drill. We filled the resulting channel with Jahn M1003 mortar to blend the join-line and applied Keim paint as with the stone.

One year after the application of the Keim paint, some fading of the color had occurred. The reason for this is not clear, but it could be due to lack of sufficient protection from rain during the critical cure-period (7-10 days) so that the paint actually washed away. Despite this, the stone restoration blends significantly better with the original stone than before the treatment. In a one year period, no subsequent vandalism has occurred to the stone carving where previously, birds' heads were being lost due to vandalism at a rate of approximately 2-3 per year. While this success cannot be attributed solely to the treatment, as conditions in Central Park in general have improved, there is no doubt that the treatment not only restored the appearance of the carved panels, but increased their chances of survival in a harsh urban environment.

The Giuseppe Verdi Monument

Figure 3. Giuseppe Verdi Monument.
Historic Photo circa 1908.

The restoration of the Giuseppe Verdi Monument at West 72nd Street in New York City, sculpted by Pasquale Civiletti in 1906, presented several challenges in the area of loss compensation and required a reexamination of previous treatment approaches. The Verdi Monument is composed of two types of stone, Carrara marble is used for the sculpture depicting Verdi, Aida, Falstaff, Leonora and Othello while the steps and pedestal are a Monte Chiaro brescia limestone. The Carrara marble had suffered significant loss due to acid rain erosion and breakage: the finely carved details of the figures (particularly the faces) were eroded and several of the hands were broken. In examining the archival photographs of the monument from circa 1908, we were surprised to find that at some point in the sculpture's treatment history, the form of the hands had been altered: Falstaff's right hand was transformed from its original open and expressive gesture to a closed fist and Leonora's individually articulated fingers had become joined to form solid block-like hands.

Figure 4. Figure of Leonora. Detail of circa 1908 photo showing articulated fingers before 1945 restoration.

Figure 5. Figure of Leonora. After restoration of hands employing polyurethane composite material.

Past treatment reports indicated that during the last major restoration in 1945, the hands had been recarved as solid masses, presumably to compensate for the inherently fragile nature of the marble. While this solution is understandable and indeed, was partially successful (while Leonora's hands were broken, Falstaff's fist was still intact 51 years after treatment), it was clear that this treatment solution had sacrificed the expressive function of the hands for the sake of durability. Our intention in this treatment was to restore the hands to their original expressive form using historical photographs, while achieving a sufficient durability. This would necessarily exclude any restoration method employing carved stone, and forced us to explore appropriate cast materials.

Materials suitable for casting the hands would be required to have significant tensile strength, chemical stability and a marble-like appearance. Polymer-modified mortars and gypsums were rejected as they did not significantly exceed the tensile strength of the marble they were to

replace. Thermoset resins with internal armatures seemed to offer the best combination of strength with potential to simulate a marble-like appearance. However, thermoset resins have the major drawback of UV instability, which we hoped to control by use of chemical stabilizers and bulking with inert material in the form of marble dust. The resin which we chose for casting the hands was a two-part polyurethane, Ciba-Geigy RP64054 which combined the required characteristics of exceptional strength with an opaque white color.

To stabilize the polyurethane, the following chemical stabilizers were used as recommended by Ciba-Geigy: Tinuvin 765 (free radical scavenger), Tinuvin 328 (UV absorber) and Irganox 245 (thermal stabilizer)5. To determine the UV stability of the material, we exposed it in the Xenon Arc Fadeometer at the Metropolitan Museum of Art to 20 million lux (approximately 200 hours)6. Accelerated aging was calculated to correspond to nine months to a year of actual outdoor exposure. The stabilized polyurethane displayed slight yellowing after exposure in the fadeometer but yellowing was negligible in the samples which were mixed with 90% by weight marble powder which we intended to use as a face-coat

The method devised for fabricating the hands is outlined below:

1. Missing hands were sculpted in clay on the basis of historic photographs.

2. Two-part flexible molds of the clay models were made.

3. A putty composed of the liquid polyurethane and 90% by weight marble powder was pressed into each side of the two-part flexible mold, to a thickness of approximately 1/8" to establish a "face-coat". This proportion of resin to marble powder was found to offer the best balance between strength and the simulated appearance of marble.

4.Quarter-inch stainless-steel rods were laid into the fingers of each hand to serve as structural reinforcement.

5.The two halves of the mold were closed and polyurethane poured in to fill the remaining void and form a solid mass.

The resulting cast hands possessed exceptional strength and a convincing marble-like appearance. A cross-section of the fingers of a fabricated hand would appear as below:

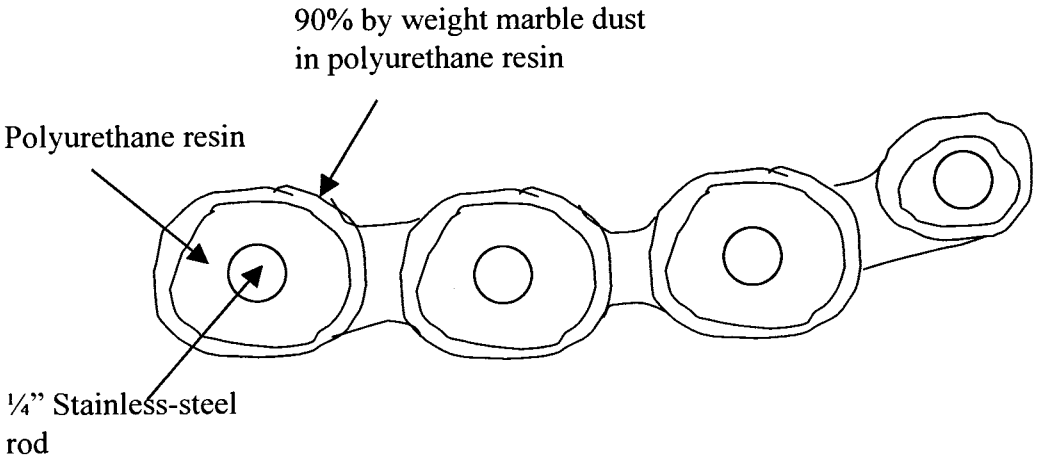

Figure 6. Cross-section of fingers of cast replacement hand.

Figure 7. Figure of Falstaff showing fist from 1945 restoration.

Figure 8. Figure of Falstaff. After restoration of hand employing polyurethane composite material.

The hands were attached to the statue using threaded stainless-steel rod and Sikadur 317 epoxy. This method has application in any situation where restoration of fragile sculpted stone elements requires greater strength than the original stone can provide. While accelerated aging tests in the laboratory suggest that the material will remain stable in high UV environments, this material is untested in outdoor conditions and only actual weathering will determine its stability.

Composite Repair

The problem of loss compensation due to erosion is more complex than that due to breakage. Whereas damage due to breakage is clear and the element can be recarved or cast and reattached, erosion results in a gradual overall diminution of surface detail. The question then arises at what point the loss is no longer acceptable so that restoration must be chosen as a course of action? The figures of the Giuseppe Verdi Monument had suffered significant loss of carved detail due to erosion, particularly in the faces, resulting in a highly disfigured appearance which compromised the function of the monument.

Composite repair in this case is defined as a cementicious material applied directly to the surface of the marble and modeled in situ. Composite restoration was chosen over the dutchman method as the overall erosion did not call for the unit replacement as much as a minimal, localized build-up of the surface. Furthermore, the composite restoration affords a much greater degree of reversibility than the dutchman method which requires preparation of the stone and insertion of pins.

The composite repair material developed here was based upon a traditional 1:1:5 type "N" mortar and modified in the following way for this application:

1. One part white Portland cement, one part lime and five parts marble powder were ground with a mortar and pestle and passed through a sieve stack to achieve a particle size no greater than 250 micrometers. The reduced particle size increases plasticity and adhesion.

2. Fumed silica to a proportion of 25% by volume was added which further reduced the average particle size and rendered the material lighter and increased thixotropy, thus reducing the tendency of the mortar to sag while being modeled on vertical surfaces.

3. A proprietary acrylic emulsion Edison Custom 458 (3% solids in water) was added to the composite mortar to increase plasticity and adhesion.

Figure 9. Figure of Falstaff displaying severe erosion.

Figure 10. Figure of Falstaff after Composite repair treatment.

The entirely reversible composite repair succeeded, with only minor intervention, to significantly revitalize the sculpture.

Conclusion

Treatment decisions in the conservation of public monumental sculpture should take into consideration not only the work of art itself, but the community in which the monument resides. The decision to pursue a composite repair of the faces of the Verdi Monument was based upon a thorough discussion of the relevant issues with the curator, the Director of Art and Antiquities for the City of New York. These discussions weighed the physical impact of the treatment on the sculpture against the function of the monument. The primary function of public monuments is to honor the person or group for whom it is erected. A secondary function is to serve as a source of civic pride and a focal point for the community and finally the monument provides esthetic enjoyment (optimally) of its sculptural form. Because of the extremely deteriorated state of the sculpture, there was a consensus that none of these basic functions were being achieved and so restoration in the form of composite repair was pursued.

The Conservation of the Verdi Monument was symbolic of the revival of a neighborhood. Until recently, Verdi Square was known as Needle Park due to the rampant drug trade in the area. Since then, the Upper West Side has experienced a rebirth and the conservation of the Verdi Monument is a strong reflection of that. The conservator is entrusted to find the balance between the ethical guidelines of the profession in the treatment that is best, not only for the sculpture, but for the community to which it belongs.

Acknowledgements

I would like to thank Mark Rabinowitz, for his leadership on this project as well as Vallessa Monk for the contribution of her fine technical abilities. Also, John Griswold for his encouragement to address the ethical issues involved.

Endnotes

1. Anecdotal evidence has it that the term "dutchman" to refer to a unit stone repair, was coined in the 18th century by British craftsmen to describe what they felt was a questionable method of repair rather than replacing the entire block. The term no longer carries a derogatory connotation.

2. Keim Farben GMBH &Co KG. Georg-Odemar-Str. 4-6 D-8902 Neusass b. Augsburg American Distributor: The Cohalan Company #62 Port Lewes, Lewes, DE 19958; 302-644-1007

3. Jahn Mortar Products. Cathedral Stone, 8332 Bristol Court #107, Jessup, Maryland 20774; 202-832-2633.

4. Ciba-Geigy Corporation. Three Skyline Drive Hawthorne, New York 10532 ; 800-431-1900

5. As #4

6. Thanks to Mr. Christopher McGlinchy, Conservation Scientist in the Department of Paintings Conservation at the Metropolitan Museum of Art for providing the use of the fademoter.

7. Sika Corporation, 201 Polito Avenue Lyndhurst, NJ 07071 Tel: 800-933-7452

8. Edison Chemical Systems, Inc. 25 Grant Street, Waterbury, Connecticut 06704; 203-597-9727

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