

## The New York Public Library Statuary– Marble Deterioration & Conservation

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### Abstract

Created by 4 different sculptors, the marble sculptures at the New York Public Library's east façade demonstrate how a variety of styles (Classical, Impressionist, Baroque, and idiosyncratic) and diversity of marbles (Vermont, Georgia, Tennessee and Carrera) could unify within the program of a well-designed Beaux Arts building. The different stones and exposures lead to different degrees of deterioration and, ultimately divergent treatment goals.

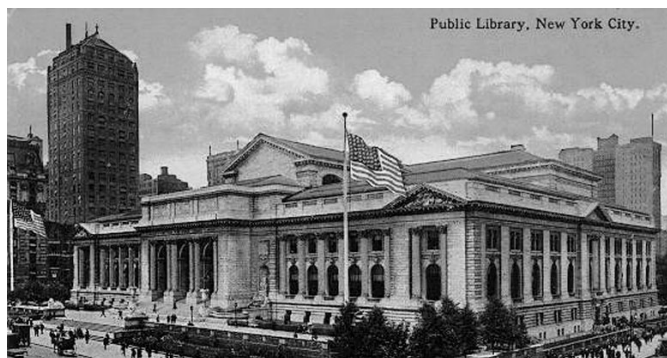
While initially the most deferential conservation plan targeted to maximum preservation of existing materials and minimal intervention was planned, the dramatically different conditions, ranging from modest weathering to catastrophic loss, led to introducing a more restoration oriented approach for some of the treatments. These variations in treatment goals were accomplished using high standards in collaborations between several conservators and cleaning specialists. The session will present some history of the sculptures and their creators, the initial survey and study methods, implementation of the laser and other specialized cleaning methods, innovative stone repairs, and how the conditions of the pediment statuary lead to the choice for substantial reconstruction over the more modest stabilization of the statuary applied elsewhere.

Ultimately, theoretical questions of where and how these choices should be made, and why they may differ dramatically even at the same site, will be discussed.

**Keywords:** Marble cleaning, biocide, consolidation, sculpture conservation, stabilization

### 1. Introduction

The marble sculptures at the New York Public Library's east façade were treated during a major restoration campaign on the building envelop. The different stones from which they were carved and variations in exposures lead to different degrees of deterioration and,



**Figure1.** Historic postcard showing statuary on NYPL 5<sup>th</sup> Ave. façade.

ultimately divergent treatment goals. Work was accomplished in a fruitful collaboration between conservators, contractors, conservation scientists and the project architects. While initially the most deferential conservation plan targeted at maximum preservation

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of existing materials and minimal intervention was planned, the dramatically different conditions, ranging from modest weathering to catastrophic loss, led to introducing a more restoration oriented approach for some of the treatments.. Ultimately, theoretical questions of where and how these choices should be made, and why they may differ dramatically even at the same site became an interesting aspect of the collection of treatments.

## 2. History

The stone sculptures at the New York Public Library were conceived and created as integral elements of the overall design of the Beaux Arts building by the firm of Carrère and Hastings. The architects considered the sculptural program so essential to the design integrity of the building that they tried to have the sculpture contracts assigned under the sidewalk contractor in an attempt to avoid the constraints of the City's competitive bidding process and better control the selection and design. They intended that the creation of each should be assigned to the best younger American sculptors and created in overall harmony with their classic design. The main 5<sup>th</sup> Avenue elevation clearly is incomplete without these works.



To that end, they turned to sculptors who shared two crucial defining aspects of their own training and esthetics. All of the sculptors attended the *École des Beaux-Arts* (or the related art studio, the *Académie Julian*) before contributing to the *World's Columbian Exposition* in Chicago in 1893 just as the architects themselves had. Following Beaux Arts dictates, the sculptor's work at the *White City* were integrated into the architecture and site planning in the same manner that they do at the New York Public Library. The success of this contextualization is clear as the image of Library is defined now by its signature Lions; Patience (south) and Fortitude (north), which have become emblematic of the Library building and, in fact, the institution, who use them in its logo.

**Figures 2,3:** Half scale plaster mock-ups of proposed sculptures by Barnard (above) and Bartlett (right) from New York City Art Commission archives.



The sculptures were created by four different sculptors; Paul Wayland Bartlett, George Grey Barnard, Edward Clark Potter, and Frederick MacMonnies, in a variety of styles; Classical, Impressionist, Baroque, and Idiosyncratic, and diversity of marbles (Vermont, Georgia, Tennessee and Carrara). Despite this, the sculptures at the New York Public Library's 5<sup>th</sup> Avenue façade demonstrate how such variety could be unified within the program of a well-designed Beaux Arts building.

By the time of the commission for the Library, each of these sculptors had already completed or was engaged in implementing works like those required at the Library for other great public buildings, particularly in the nation's or state's capitals. The sculptures themselves took years to create and several were not installed until a decade after the completion of the building. Only the Barnard pediment groups were carved on site of the same Vermont Danby marble used elsewhere on the building, to unhappy results then as

now. A miscommunication with the builders, who did not leave adequate rough stone on the building to fit the sculptor's designs, resulted in the carvers truncating the upper parts of the figures to fit the blocks, leaving an anguished sculptor to sue unsuccessfully for damages over his distorted figures. The stone also proved inadequate to the challenges of the exposure and were the most deteriorated of any of the works at the building.

At the commencement of the project to restore the building in preparation for its centennial, Conservation Solutions, Inc. (CSI) was contracted by Wiss Janney Elstner, to assess the sculptures, document the conditions, and make recommendations for treatment. After contract award, CSI collaborated with the Milner + Carr Conservation, LCC, now Materials + Conservation Co. (MCC) the conservators who implemented the work. The assessments commenced in 2008 and work was substantially completed in 2010.

### 3. Condition Assessment

A condition assessment was performed from the ground and man lifts. A glossary of condition was developed which was consistent with the terminology of the ICROM stone condition glossary. CAD drawings were prepared and the observed conditions noted on them in detailed colored overlays that were transferred from field annotations on photographs. As no preliminary cleaning had occurred some conditions were difficult to discern in the muddle of soiling, gypsum crusts, extensive losses, failed previous repairs overlaid with bird dropping, particularly on the Barnard pediments, leading to the need for some modifications in scope that became apparent as work progressed. This was one of the factors that influenced a later modification of the treatment goal regarding these pieces that will be expanded on later.

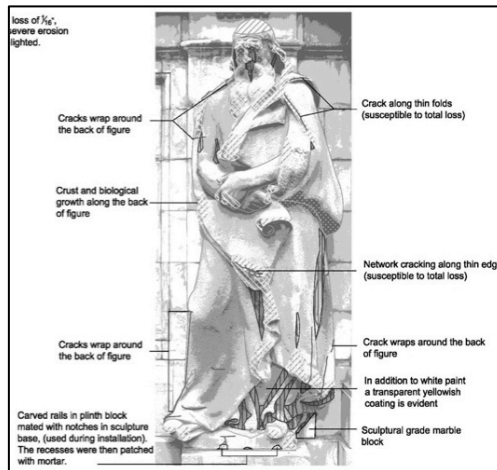


**Figure 4 (above):** Barnard pediment group detail showing extent of deterioration prior to treatment.  
**Figure 5 (below):** Condition were noted on assessment drawings prior to treatment implementation.

Potter's lions, carved by the Piccirilli Brothers firm

from Tennessee marble, have survived relatively well even with the full exposure and regular climbing and other regular use. A conversion treatment may have contributed to their preservation however the Tennessee stone is very dense and not subject to crystalline disaggregation like a true marble. They received only gentle maintenance treatments to clean them and preserve existing fills.

The MacMonnies Carrara works also remained generally intact, possibly helped by having had an undocumented conversion treatment that may have



occurred and resisted erosion of the marble. The pieces have the pasty look of the converted surface although no records of any treatment have been found. They too only required modest cleaning and repairs.

Losses were more evident on the Bartlett attic figures, which are fully exposed to weathering and suffered modest loss from erosion and crystal disaggregation at vulnerable water run off areas. However, the durable large-grained calcitic Georgia Cherokee White remained generally sound and losses were concentrated on exposed elements. The exposure limited the dry deposition and bird infestations were not an issue.

The Barnard groups were the most severely compromised. Caked bird guano, black gypsum crusts, friable fissured stone, and major and minor losses were endemic. A substantial amount of detailed carved surfaces had been lost, leaving the complex compositions disfigured and illegible. Due to the extreme vulnerability of these surfaces it was decided to clean them with lasers, which was carried out by Giancarlo Calcagno using Nd:Yag Q-switched *Michelangelo* units by Quanta after an initial removal of loose soiling.

#### **4. Conservation Treatment**

As a subcontractor to Nicholson and Galloway, Inc., Milner + Carr Conservation, LLC (MCC) implemented the following treatments on the façade sculptures of the New York Public Library. These treatments were largely established by Wiss Janney Elstner Associates, Inc., sub-consultants CSI and A. Elena Charola, Conservation Chemist and based on extensive investigation, analysis and testing. Once work began, some unanticipated conditions required modification of proposed treatments and/or establishment of new treatment methods and materials. In such cases, proposals for new or revised treatments were submitted to the design team, client and review agencies for approval. In addition to the statuary, the fountain basins and monumental urns were treated during this campaign.

##### **4.1 Bartlett Attic Figures**

Six colossal attic figures are situated within the central frieze above the main entrance on the east elevation of the Library. The figures, each carved from a single block of coarse-grained Georgia white marble, were found to be in more stable condition than other façade sculptures. All exhibited moderate atmospheric soiling and localized areas of biological growth. Areas of the figures that face skyward and are exposed to direct weathering had suffered erosion and granular loss. Recessed areas which had remained protected such as folds in the drapery are more heavily soiled and developed gypsum crusts that had been subsequently coated with white paint. At some locations, this white paint was associated with a transparent yellowish coating. Other conditions included various size cracks, minor incipient and actual losses, previous repairs, minor blistering, and open joints.

Removal of generalized atmospheric soiling was accomplished by a combination of steam and detergent cleaning using a Goodway Backpack Vapor Steam Cleaner. A 25% solution of Vulpex Liquid Soap and water was then spray applied and allowed to dwell for approximately 20 minutes. Soft bristle nylon brushes were used to agitate the detergent during the dwell period. The masonry surface was then steam cleaned at 72 psi. All statues were then thoroughly rinsed with warm water at low pressure (approximately 20 psi). Biological were treated with D/2 Biological Solution, 50% solution spray applied to the masonry surface in conjunction with the Vulpex Liquid Soap as part of the generalized cleaning procedure. The D/2 was allowed to dwell for approximately 20

minutes and then gently scrubbed using a soft bristle nylon brush. The masonry surface was then thoroughly rinsed with warm water at low pressure (approximately 20 psi).

Gypsum encrustations proved to be multi-layered and extremely tenacious. Removal required a multi-step process which included water misting, application of a carbonate gel and mechanical removal. Affected areas were first treated with cycled water mist. The cycle for misting was established as a sequence of spraying at intervals of two hours on and one hour off for a total duration of eight hours. The water misting helped to soften the crusts and caused them to blister away from the surface of the stone, allowing for gentle mechanical removal between cycles. Due to the tenacity of the gypsum crusts, it was necessary to repeat water misting over the course of two months. During this time, misting cycles were interspersed with the application of Ammonium (Bi)Carbonate Gel Poultice manufactured by FTB Remmers. The gel was mixed into finely shredded paper pulp which was applied to affected areas, covered with plastic to prevent drying out and allowed to dwell for approximately 24 hours. Poultices were reapplied as necessary to help soften the crusts. The combination of water misting, carbonate gel poultice and mechanical removal eventually resulted in complete removal of the gypsum crusts.

All existing mortar surrounding each figure block was removed using a combination of an angle grinder with a fine diamond blade and small masonry chisels. These voids were backfilled using backer rod and NHL 3.5 pointing mortar as manufactured by Virginia Lime Works under the name Mix&Go Pre-Mixed Natural Hydraulic Lime Mortar. All joints were then pointed with the same mortar.

All surfaces of the Attic figures were treated with ammonium oxalate. A significant amount of deterioration on the marble statuary has been caused by weathering and the effects of acid rain. When applied to marble, ammonium oxalate chemically reacts with the calcium carbonate of the stone and produces a protective layer of calcium oxalate. This calcium oxalate layer consolidates deteriorated stone and is more resistant to acid attack than calcium carbonate. Being a sacrificial coating, the treatment will offer protection from exposure to the elements but will weather over time. The ammonium oxalate – as manufactured by FTB Remmers in a pre-diluted 5% solution – was applied to all surfaces of the clean Attic figures. The ammonium oxalate was applied using a natural-bristle brush until surface saturation and then allowed to dry for 24 hours before any further treatments were performed. Finally, lead “T” caps (as manufactured by Weathercap) were installed on all upward facing perimeter mortar joints bedded in Sikaflex® - 1a elastomeric sealant.



**Figure 6 (above):** Barnard Pediment Group Art in historic photo detail

**Figure 7 (below):** Conditions of same figure after laser cleaning showing extent of erosion and loss.



Incipient spalls were pinned using alumina ceramic pins with B-72 adhesive. To increase viscosity the dissolved adhesive solution was bulked with ultra-fine precipitated calcium carbonate at 40% by weight of the dissolved adhesive solution. Once the adhesive was set, the holes were patched using Lithos Arte composite patching material. Small cracks were filled with DHL-IM Injection Grout as distributed by US Heritage Group. The injection grout was delivered through a syringe.

More extensive cracking was observed on both the *History* and *Philosophy* figures. WJE carried out NDT (nondestructive testing) to confirm the depth of cracks and determine whether the cracks needed local stabilization. Test results determined that three cracks in *Philosophy* and one crack in *History* needed to be stabilized. Stabilization was carried out by MCC by installing stainless steel threaded rod set in Cintec Presstec Standard Micro Injection Grout at specified locations.

Areas of loss or existing previous repairs were re-sculpted using Lithos Arte, a zinc oxide patching mortar manufactured by FTB Remmers. The Lithos Arte was custom matched and formulated for the project. Only one area on the actual Attic figures (the right cheek of *Romance*) required patching. The remaining patching was done at the base of each sculpture where holes – originally created to aid in the installation of the sculptures – had had previously been patched with mortar. This mortar was removed and Lithos Arte patches were installed.

A custom matched lime shelter coat by Virginia Lime Works (a modified NHL 3.5 formulation) was applied to all areas of grain loss and erosion including local fissures. The concept of a “sacrificial layer” is well known in the field of conservation and is primarily based on the application of a surface finish that will protect the existing substrate while giving the surface a more uniform appearance. Lime shelter coats help smooth and fill irregular surfaces and open pore structures thereby improving water shedding abilities of the marble and reducing the surface area of the stone. The lime shelter coat was also used to cosmetically treat localized stains that could not be removed during cleaning procedures. The lime shelter coat was applied wholesale to each of the Attic figure at a ratio of 1:10 (shelter coat: water). The lime shelter coat was also applied locally to heavily disaggregated areas at a ratio of 1:5 (shelter coat: water). The shelter coat was applied using a natural-bristle brush and allowed to dry for a minimum of 72 hours.

#### **4.2 Barnard Pediment Groups**

The north and south pediment groups are carved in-situ from coursed Vermont marble ashlar. The pediments sculptures were found to be in extremely poor condition with heavy soiling, severe disintegration of the stone and significant loss of carved features. In contrast to the Attic figures, the shelter provided by the pediments had exacerbated deterioration of these sculptures. The overhanging cornices interfered with regular rainwater washing, which both allows for dry deposition of pollutants and provides protected surfaces for birds to roost. The guano and retained pollutants resulted in gypsum crusts on the underlying disintegrated stone that were measured to depths of an inch in places. The pediment groups exhibited the most severely deteriorated conditions of all the façade sculptures. Other conditions included displaced stones, blistering, cracks, open joints, previous repairs, caulked joints, and isolated cement parging, failed previous repairs including pinning and patching and isolated areas of heavy biological growth.

Prior to laser cleaning, all existing mortar and caulk were removed from the joints using an angle grinder with a fine diamond blade along with small masonry chisels. After completion of laser cleaning, all joints were repointed as noted above.

Although laser cleaning removed all of the black gypsum crusts on the surface of the pediment sculptures, removal of the crusts revealed areas of yellowish-orange staining. In many areas, the staining extended beneath the surface of the stone, sometimes reaching depths of 6 or more inches. Attempts were made to mobilize and draw out this staining using various techniques including water poultice and Arte Mundit, a latex based poultice. Ultimately, Ammonium (Bi)Carbonate Gel Poultice manufactured by FTB Remmers applied repeatedly for 24 hour dwell periods was successful at removing the majority of the staining. Removal of biological growth, consolidation, and the application of the lime shelter coat were similar to those implemented for the Attic Figures. However, the condition of the pediment sculptures required additional treatments and a reexamination of the expectations of this project.

Areas of loss or existing previous repairs were re-sculpted using Lithos Arte, a zinc oxide patching mortar manufactured by FTB Remmers. The Lithos Arte was custom matched and formulated for the project.

Project specifications originally called for minimally sculpting patching mortar repairs to re-establish essential sculptural legibility. As it turned out, the overall level of deterioration was far more extensive than originally anticipated and many areas could not be stabilized through application of the consolidant, which did not penetrate more than 2 inches beyond the stone surface. It was therefore determined that more extensive patching was required for structural stabilization. After much deliberation, it was further decided that the “readability” of these allegorical figures (especially from street



**Figure 8 (above):** Fitting replica casting at Barnard Pediment Group

**Figure 9 (below):** Same figure after treatment.



level) would be optimized if all losses were fully recreated to their original appearance. To ensure accuracy of the newly sculpted elements, historic photographs were referenced, remaining physical features and detailing was carefully examined, and comparable works by Barnard were scrutinized. In order to ensure a sufficient bond between patching material and the stone substrate, it was often necessary to remove a portion of deteriorated stone before installation of the patching material. It should be noted that in many cases, the extent of deterioration was far more extensive than originally understood. Oftentimes, areas of stone which appeared to be sound on the surface were actually completely sugared just below the stone’s outermost layer. This

condition required removal of significantly more material than originally anticipated. Where necessary, stainless steel threaded rods and/or fiberglass rod set in Sikadur® 31 Hi Mod Gel epoxy were installed before the application of the patching material to provide structural support.

For large areas of loss – either elements missing at the start of the project or areas where extreme deterioration require removal of extensive material – it was decided that new elements would be cast out of Lithos Arte. Dutchman repairs were ruled out largely because the weight of stone compared with Lithos Arte and because installation of new stone would require even more removal of original material. Casting of new elements was accomplished through a specially designed mold making and installation process based on the principle that cured or partially cured Lithos Arte successfully bonds to wet Lithos Arte.

Before casting, all stone adjacent to treatment areas was protected with 3 mil plastic sheeting. Additionally, cyclododecane (dissolved to a 30% solution in Naphtha) was brush applied to all treatment surfaces. Once re-crystallized, cyclododecane provides a protective barrier which lasts for several months until eventually sublimating into gas form. For elements which required removal due to instability beyond repair, molds were then taken using Resilpom putty followed by a burlap and plaster mother-mold. Missing elements were first sculpted *in situ* out of oil-based clay; the mold was then taken of the newly created element. Where necessary, molds were created in sections to allow for ease of installation of the cast elements. Once cured, molds were removed and used to cast the elements out of Lithos Arte at an average of 1” thickness. Fiberglass armatures were textured with epoxy and installed at areas to receive cast elements; in some cases, preliminary forms were created on the armatures using Lithos Arte. Cast elements were then installed, using wet Lithos Arte to fill any voids and secure the cast pieces to the armatures.

A number of extremely deteriorated or else entirely missing elements were re-carved out of Vermont marble which matched the color and texture of the surrounding stone. Historic photographs were referenced to ensure accuracy of the newly carved element. Dutchman repairs were secured in place with threaded stainless steel rod set in Sikadur® 31 Hi Mod Gel epoxy.

### **4.3 McMonnies Fountain Figures**

Flanking the main entrance steps are large fountain statues situated within niches in the building façade are two figures carved from monolithic blocks of Carrara marble by Frederick William MacMonnies between 1914 and 1920. Both statues were in good condition with only minor erosion, localized deterioration of features, minor cracks, and light atmospheric soiling. Thin gypsum crusts had formed in protected areas and it appeared that a white coating had possibly been applied in an attempt to mask staining on the backs of the figures.

Portions of the both fountain figures exhibited a “chalky” white appearance, suggesting that a inorganic consolidant or other coating may have been applied to the surface of the masonry at some point. MCC submitted two samples of stone to a laboratory for analysis. Samples were analyzed by FTIR (Fourier-transform infrared) microspectroscopy and X-ray fluorescence (XRF) spectrometry. Neither analytic technique detected the presence of an organic or inorganic coating on the surface of the fountain statue stone.

Treatment procedures for removal of soiling, biological growth, and fills for losses were similar to those applied elsewhere. Several missing elements such as the turtle’s heads



were re-carved out of Vermont marble which matched the color and texture of the surrounding stone. Historic photographs were referenced to ensure accuracy of the newly carved element. When appropriate, new stone elements were carved to match the level of erosion of detail which was exhibited by adjacent elements. Dutchman repairs were secured in place with threaded stainless steel rod set in Sikadur® 31 Hi Mod Gel epoxy.

#### 4.4 Potter Lions

At the completion of the main restoration scope, maintenance of the two iconic Tennessee marble lions was performed by CSI. They had been treated and maintained several times over the last decade and were in generally good condition. Nevertheless, localized areas of gypsum crust in areas protected from water run off,



Figure 10; One of the Edward Clark Potter Lions.

overall soiling and biological growth existed. Work, including detergent washing, water misting, steam cleaning, biocidal treatments and injection fills generally followed that detailed above with the following modifications. Triton X-100 3% solution was used for detergent cleaning and Prestór gel was selectively used to reduce tenacious black biota found on skyward facing areas after treatment with D/2.

#### 5. Conclusion

Within the overall context of the building restoration, the statuary conservation was a small item which nevertheless had an outsized effect on the visual impact of the project. Treated as individual works of arts, with appropriate caution and goals of minimal intervention, the treatments were consistent with the overarching project goals of bringing best practices on marble treatment to the preservation of the building at its centenary. While treatment of most of the statuary could be achieved within these goals, it became clear that a higher level of intervention was required on the Barnard pediment groups. This was warranted by their advanced degree of deterioration and feasible because of the availability of adequate historical documentation. The collaborative nature of the project, which entailed on-going review and discussions amongst the parties over a multi-year effort, ensured that goals could evolve and be refined as new and different conditions

were revealed while retaining a consistent standard throughout.



Figure 11; Barnard pediment group *Life* after treatment

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