



CHAPTER 14

Conserving the Rotunda Frescoes

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Brumidi's frieze and canopy in the Rotunda were the two most challenging and dramatic of the fresco conservation projects undertaken in the Capitol in recent years (fig. 14–1). This conservation makes a full appreciation of Brumidi's artistic techniques and achievement possible. The intent of this chapter has been to make complex restoration processes understandable, including the kind of research and debate that is necessary in professional conservation, with technical information included in the notes for those who are interested in more detail. The illustrations provide samples of the kinds of photographic documentation and diagrams that are included in the full conservation reports.

The Frieze

Executed between 1877 and 1953, the frieze on the belt at the base of the dome in the Capitol Rotunda incorporates the work of three artists: Constantino Brumidi, who began it in 1877 and worked until 1880; Filippo Costag-

Fig. 14–1. Bernard Rabin inpainting losses. *The conservators used archival photographs to guide the reconstruction of damaged forms. The water-based paint they used can be easily removed if so desired in the future.*

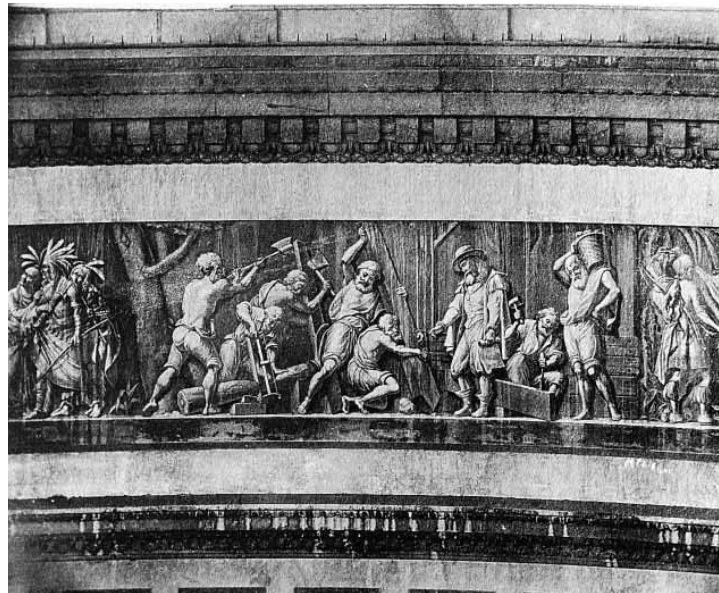


Fig. 14–2. Early photograph showing water damage to the frieze. *Major leaks had disfigured “Colonization of New England” and other scenes by the end of the century.*

From Glenn Brown, *History of the United States Capitol*, 1902.

gini, who continued it from 1880 to 1889; and Allyn Cox, who completed it in 1953 (see chapter 11.) All three artists worked in true fresco, although each artist executed his section in a slightly different technique and style, presenting an unusual conservation problem (see foldout).

The frieze begins 58 feet above the floor, in a shallow cove 8 feet 3 inches high and slightly over 303 feet in circumference. The Rotunda to this height is composed of the original masonry walls built in the 1820s with brick and rubble fill. The structure behind and above the frieze, begun in 1856, is brick and cast iron.

It was clear, even before inspection at close range was possible, that the frieze was in serious need of conservation. Leaking rainwater had left unsightly streaks and white deposits on several areas as early as the 1880s. A photograph published in 1902, only twenty-five years after Brumidi began painting, showed that almost one-third of the existing frieze had already been streaked and marred by extensive leaks (fig. 14–2). Several areas were disfigured by white patches, thought to be salts transported by moisture in the plaster. Documented recurrence of leaks in certain locations prompted growing concern. Recently, in 1994, the gutter system was modified to prevent future damage.

Once the scaffold was in place, the problems could be assessed more fully. So heavy had the infiltration been at

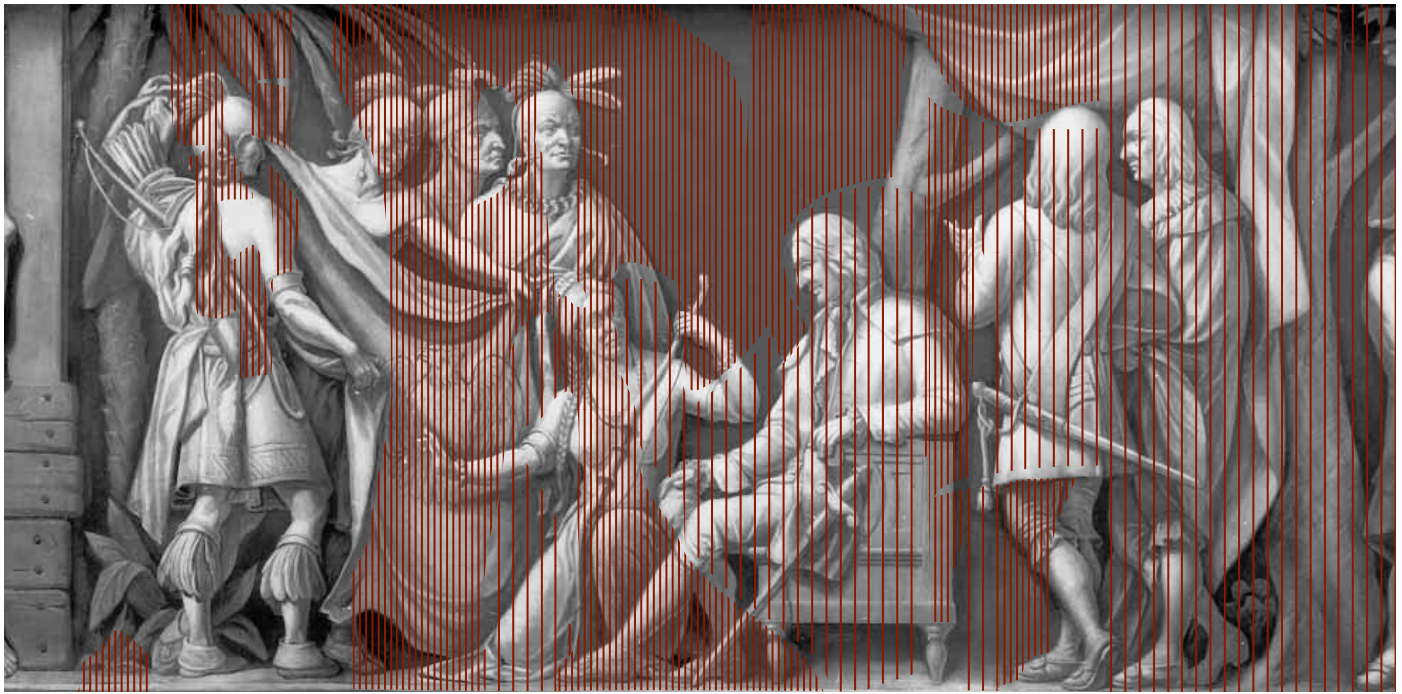


Fig. 14–3. Diagram showing the deterioration of the painted surface of “Oglethorpe and the Indians.” Before conservation treatment was begun, existing conditions were carefully recorded.

Etching Streaks

times that both the paint and the surface of the plaster had been etched, probably because the first leaks had occurred before the fresco had thoroughly cured. Fortunately, we found that the plaster remained well adhered to the wall of the cove. However, we saw considerable deterioration of the painted surface, indicative not only of water but also of some inherent weaknesses in the techniques of execution, of ill-advised human interventions, and of ambient agents (fig. 14–3).

For reasons not clearly understood, the brown pigment of the background, especially in Brumidi’s sections, was powdering or poorly bonded to the *intonaco*, the top coat of plaster. In other frescoes in the Capitol, such earth tones, made of naturally occurring minerals, also suffer from this lack of adhesion. We also observed two unusual features of the paints Brumidi and Costaggini had used. Many areas that should have been white highlights were rather gray, while other areas, primarily in the dark shadows, had become milky. We hypothesized that the gray areas were actually details applied *a secco* after the plaster was dry, with lead white in oil paints. When used on plaster, lead white can darken over time. We also hypothesized that the milky areas in the dark paints were dark oil paints applied to the dry fresco, which had cracked and turned opaque in the presence of water.

To understand the composition of the frieze, we removed fourteen small samples for laboratory analysis.¹

The results confirmed our hypotheses. The frieze was basically executed in a true fresco technique with a limited but characteristic palette composed of earth pigments, such as naturally occurring iron oxides. However, as we suspected, some details were added after the plaster was dry. Lead white in an oil medium was identified in the now gray highlights, and oil paint was found in many of the painted shadows. Visually, it was clear that the *a secco* details are integral to the composition and consistent with the artists’ styles and not elements added by a later restorer. An additional cause of discoloration discovered only during the course of treatment was a gray deposit on the surface of the fresco. Historical research confirmed that from 1866 to 1906 the dome had been lighted by 1,083 gas jets, some of which were placed directly under the frieze.² The gray deposit was very likely a residue from the burning coal gas, which contains sulfur pollutants and deposits a particularly tenacious and potentially damaging grime.

In addition to these problems, we saw that some alterations were made in 1953 by Allyn Cox when he cleaned and overpainted parts of the frieze prior to executing the final three sections. He correctly assessed that the frescoes had become obscured by grime and that it would be ill-advised to match the final three sections to darkened adjacent surfaces. Although not a trained conservator, Cox carried out a remarkably safe cleaning method, and he left



Fig. 14-4. Group of Native Americans in “Oglethorpe and the Indians” shown before conservation. *In badly damaged areas, Allyn Cox used his imagination to reconstruct forms.*



Fig. 14-5. Group of Native Americans in “Oglethorpe and the Indians” shown after conservation. *The professional conservators consulted historic photographs of the frieze for accuracy.*

a detailed report of the methods and materials he used. Cox cleaned the fresco with water, which removed considerable surface grime. However, he was not able to remove the tenacious oily gray deposit, which visually obscured and weakened the precise relationship of dark shadows and light highlights that make the frieze appear to be three-dimensional. To compensate for this, he reinforced many of the darks and lights. He also repainted the brown background completely and created his own details in areas where the fresco was badly damaged. He sprayed areas of flaking paint with a casein medium in an effort to stabilize them, but this consolidant apparently contracted over time, adding to the instability of the fresco.

Treatment

One of our primary objectives was the physical conservation of the frieze, such as the stabilization of the flaking surface. Removal of accretions was equally important for the frieze to be legible both as a pictorial narrative and as an integral component of the Rotunda's interior architecture. Our treatment had to incorporate cleaning methods that were effective and safe for the work of each artist and to maintain harmony and continuity from section to section. These goals were complicated by the three distinct artistic styles and the varying aging properties of the materials.

We learned as we worked our way around the frieze, and we stopped to reassess after the treatment of the first five scenes. We began by removing heavy surface dust with a soft brush. The figurative areas were then cleaned with water and the highlights were further cleaned with a special dry, eraser-like Wishab sponge. Cox's repainted brown background was left in place, but streaks and uneven areas were feathered and blended with gouache, high-quality poster paint to which an acrylic emulsion was added to provide binding strength. This served to consolidate and make the background less sensitive to any future leaks. Stains, discolorations, and losses in the figurative areas were inpainted with reversible acrylic paints.

As discussed above, we learned that the fresco did not look as bright as we had expected because the oily gray deposit from the old gaslights remained on the surface. Cleaning tests proved that highly diluted aqueous ammonium hydroxide, gently applied through Japanese tissue, could safely remove the deposit. Care was taken to ensure uniformity from section to section. After conserving the whole frieze, we returned to Brumidi's first five sections and treated them with this cleaning method to ensure visual continuity.

We were successful in removing Cox's casein-based overpaint from the figures and from the background. Although streaked and abraded in some areas, the original

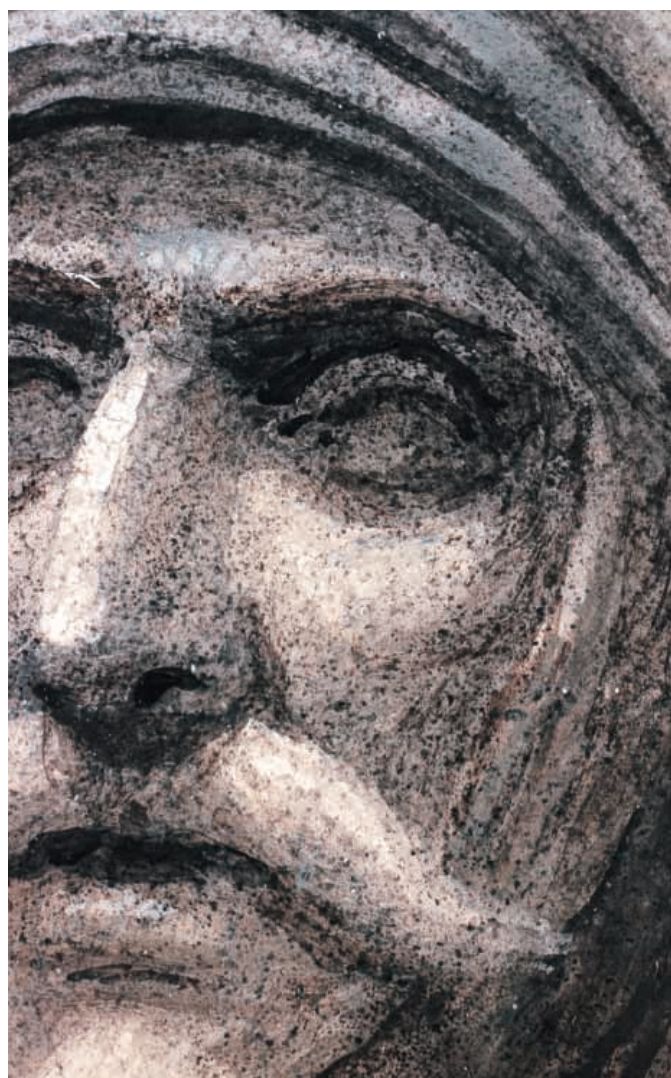


Fig. 14-6. Detail of face in "Pizarro Going to Peru."
Brumidi's use of impasto white highlights gives the frieze an added sense of depth. Photo: Rabin & Krueger.

paint was generally intact. The lighter tone of the original brown background and its many natural irregularities actually enhance the trompe l'oeil effect, making the cove appear more realistically as a three-dimensional architectural surface. The deeply etched streaks in the brown background were inpainted in high-quality poster paint with added acrylic medium.

Extensive reconstruction was required only at scene 10 (see fig. 14-3). Here Cox had reconstructed some damaged areas by extrapolating from the fragmentary forms that remained (fig. 14-4). By consulting archival photographs, we were able to restore more correctly Brumidi's original details (fig. 14-5).

The disfiguring efflorescence in some areas, particularly in scene 16, proved to be calcium sulphate dihydrate, a soluble salt, which caused some loss of paint and friable



Fig. 14–7. Diagram of the *giornate* in “William Penn and the Indians.” The number and configuration of the sections of plaster on which Brumidi painted each day were recorded as part of the conservation treatment. In this section, Brumidi’s small sections to the left contrast with Costaggini’s larger ones to the right.

plaster. We softened and removed the deposits with water, consolidated the plaster, and inpainted the small areas of loss.

At scene 16, Costaggini’s final section, and at scene 17, Cox’s first section, the scaffold was placed so that the frescoes of both artists could be examined and treated simultaneously to evaluate the contrast between the nineteenth- and twentieth-century frescoes after cleaning. We concluded that Cox had executed his three scenes in tones that are somewhat darker and grayer than Brumidi’s and Costaggini’s frescoes because he had matched his paints to the appearance of the nineteenth-century frescoes as obscured by the grimy gray film. Removal of heavy dust from Cox’s section and a modified cleaning of Costaggini’s final figures produced a harmonious transition.

Discovery

Brumidi’s sections are executed in a classic high Baroque technique. The plaster is rough and sandy; the pigments, with additional lime, applied in a noticeable impasto. Brumidi also employed transfer techniques that had become common in the Renaissance and Baroque periods in Europe. Nail holes, some with nails still in them, indicate where he had tacked his cartoons to incise outlines in the damp *intonaco*. He employed the transfer techniques

called *puntini* and *spolvero*, which produce dotted lines (see chapter 3), especially in areas with complex elements such as the intricate Aztec calendar. He generally painted the heads and hands, the most complex and expressive components of the body, on individual *giornate*. Transfer techniques are less numerous on the bodies. Close examination reveals the work of a secure and spontaneous artist, who boldly painted shadows and highlights (fig. 14–6).

Both technically and artistically, Costaggini departed from Brumidi’s richer and more spontaneous Baroque style and sculptural approach. His plaster is smoother, mixed with less sand. Costaggini’s style is linear, detailed, and rather hard-edged, the pigment thinly applied on a very white, smooth, and rather brittle plaster.

Costaggini also relied heavily on a variety of transfer technique—incisions, *puntini*, and *spolvero*—to ensure the precise and somewhat rigid execution of a myriad of details. Thus his *giornate* tend to be rather large and predictable, most probably laid out in precise relationship to the cartoons (fig. 14–7).

In the final three sections of the frieze, Cox imitated Costaggini’s more illustrative style. His *intonaco* is quite smooth; his *giornate* are large and predictable in form. Cox used the *spolvero* technique of transfer. To create an appropriate backdrop for the Wright brothers’ airplane he reconstructed as clouds the first element of Brumidi’s composition, a mountain intended to be at the end of the scene showing the Gold Rush.



Fig. 14–8. First area on the canopy cleaned. *Bernard Rabin is dwarfed by Freedom, whose vibrant colors were uncovered beneath heavy layers of grime.*

Once the conservation treatment was completed, the work of the three artists appeared to be an integrated whole, and Brumidi's intended illusion of relief sculpture in light and shade was greatly enhanced. In addition to knowing that all loose areas were consolidated and damage correctly repaired, we had gained a new appreciation of Brumidi's skillful technique and mastery of form.

The Canopy

The Capitol Rotunda is a magnificent symbolic space for which Brumidi's canopy fresco is the climax, demonstrating his mastery in merging monument with monumental art. Viewed today after conservation, the dome is alive with color, movement, and drama. Before treatment, however, darkening from grime, disfiguring heavy dark lines between the sections of plaster, extensive overpainting, and inconsistencies in the fresco's surface destroyed the intended effect of three-dimensional space. Thus, conservation was a high priority.

Facing us was a complex web of possibly interrelated factors, including the mechanical structure of the canopy, variations in technique or materials, alterations made by the artist, accretions of dirt and grime, and the effects of cleaning and restoration work carried out by Allyn Cox in 1959. Archival research, scientific testing, examination of current conditions, and the conservation skills of our team all contributed to the comprehensive treatment program. Work began in July 1987 once the enormous scaffold was constructed.

The first step was to carry out cleaning tests. The amount of grime darkening the fresco was even greater than we expected. Even with the first simple water cleaning, the sky changed from dark gray to yellow white (fig. 14–8). As on the frieze, we found a layer of tenacious grime from the burning of the coal-gas jets that illuminated the dome for forty years.

To identify possible mechanical causes for the fresco's deterioration, we studied the structure of the dome. The canopy, which provides the fresco's structural support, consists of a curved framework holding cast-iron laths suspended from the cast-iron structure of the outer dome. A core sample showed that the first rough plaster coat (*arriccio*) was pushed between the slots, creating a wedgelike plug that holds the plaster in place. This rough coat has sand of large particle size and at least three types of fibrous fillers to enhance its tensile strength.³ Analysis of the finer top coat (*intonaco*) confirmed that Brumidi used the traditional true fresco mixture of lime and sand in a 1:3 ratio.⁴ The composition of the plaster appeared to be consistent and therefore not a cause for the deterioration of the painted surface in the lower areas.

We hypothesized that the deterioration was caused by fluctuations in humidity, pollutants from the gas jets, and moisture that may have collected in the past at the base of the dome. Documentation indicated that the condition of the dome and the interior climate of the Rotunda had been unstable from the beginning. As early as 1870, the dome required constant maintenance to prevent corrosion and leaks.⁵ Until approximately 1940, when the clerestory was sealed during the installation of air conditioning, the base of the dome remained open, exposing the fresco, especially its lower registers, to extreme changes in temperature and humidity. During the conservation project, temperature and humidity were monitored and found to be generally stable, thanks to the air conditioning.

During the conservation treatment, we analyzed Brumidi's working methods by recording and studying the *giornate* that we identified (fig. 14–9). Brumidi transferred his full-size cartoons to the wet plaster by incising the outlines of the figures. As in the frieze, many holes from the tacks or nails he used to hold the paper can still be seen at close range. In some areas, we could tell by the way the plaster overlapped which section was done first. A fresco painter logically begins at the top of the composition and works to the bottom to avoid damage to and drips on finished sections. Brumidi started near the apex of the canopy, above the face of George Washington. At first his *giornate* were small and consistent, with divisions occurring right at the figures so that he had adequate time to paint all of the details while the plaster was still curing. At the lower edge of the canopy, as the figures themselves became larger, and, perhaps in a rush to finish, the *giornate* became larger, the quality of the drawing and painting broader and less detailed. The poor adhesion of the pigment could have been caused by the plaster having cured too much before it was applied. Brumidi's technique of transferring his cartoons also changed from incisions to pounces.

The central circular section of plaster at the apex appears to have been inserted after the surrounding areas were completed; it overlaps the other sections with ragged edges, and its color does not exactly match the adjacent areas. One of the last *giornate* reworked outlines a figure removed from the grouping of "Commerce," now known to have been a portrait of Montgomery C. Meigs. At Meigs's request, his face was partially scraped off and painted over, but its location is still slightly visible. Brumidi signed and dated the fresco 1865 at the bottom of this group (see fig. 9–19).

The many dark lines around the *giornate* appeared inconsistent with what we knew of the fresco tradition and of Brumidi's other work. Typically, it would be the artist's intent to have the joins between *giornate* appear

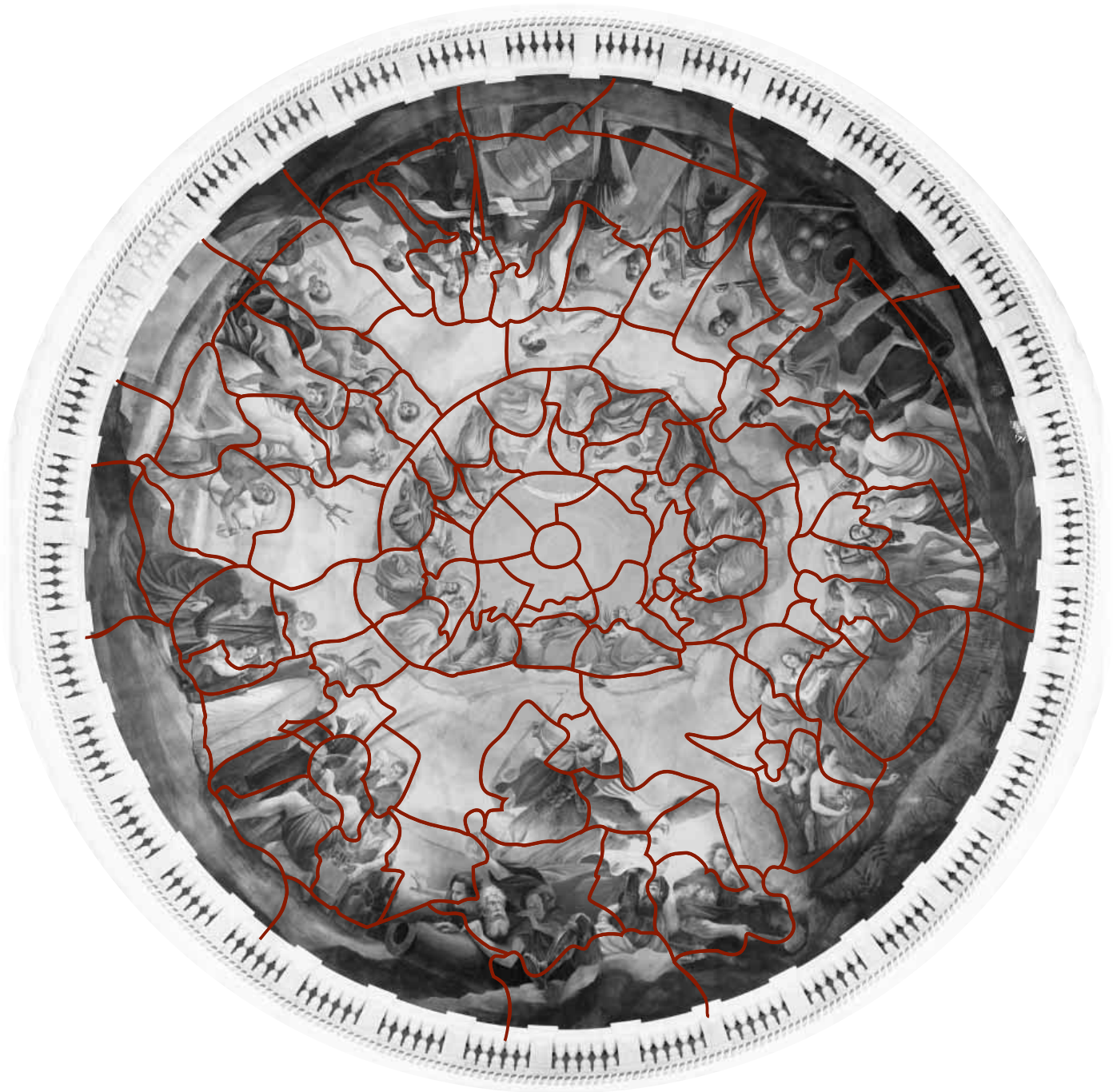


Fig. 14–9. Diagram of the *giornate* in the canopy. *The conservators discovered that Brumidi painted the Apotheosis of Washington on 120 sections of plaster.*

invisible. Before the treatment began, archival research was undertaken to compile graphic and written records that might provide evidence of Brumidi's original intentions for the fresco and of its appearance as actually painted. This research encompassed the artist's original oil sketches, correspondence, and reports (as described in chapters 9 and 10). We also relied on maintenance

records for the Capitol and Allyn Cox's report on his work in 1959.⁶

Brumidi's final oil sketch (see fig. 10–5) shows that he intended an expansive atmospheric sky at the top of the canopy. Archival photographs from 1866, 1881, and 1904 confirm his fidelity to this design, although some dark lines at the *giornate*, especially in the central sky,



Fig. 14–10. Brumidi’s hatch marks. *The artist tried to reduce the prominence of some of the joins by scratching lines across them in the plaster.* Photo: Rabin & Krueger.

were already evident in the earliest photograph (see fig. 9–14). During the treatment, we observed that Brumidi attempted to tone or blend the lines between *giornate* in some places (fig. 14–10). In other places, he may have channeled the joins out in preparation for filing them later. These observations are consistent with the artist’s letters and the Architect of the Capitol’s annual reports, which reveal that Brumidi intended the *giornate* to be invisible and that he planned to blend them further.

Brumidi wrote on September 19, 1865, to Architect of the Capitol Edward Clark:

... I am working at present the last group, and for the next week I have finish to put in color every figure upon the fresh mortar.

That remain to do for the completion of it will require only five, or six weeks, but must do it in the proper time, when the mortar will be perfectly dry, and the colors do not any more chengement.

This last work will cover the connections of the pieces of plaster, put up in sections at every day, and giving more union to the colors at the said junctions, for obtain the artistic effect.

It is general rule in doing this kind of work to avoid the damp atmosfere [*sic*] of the winter season, but I will do this last finish as soon as the weather will permit, early in the spring, as alway [*sic*] I have done in every other painting in real fresco in the Capitol, and everywere [*sic*].⁷

Two entries from the annual reports of the Architect, one year apart, further confirm Brumidi’s intention to minimize the visibility of the joins between the *giornate*:

(1865) The picture over the eye of the dome is all painted in, but the artist is unwilling to have the scaffolding removed until the plastering is thoroughly dry, and the picture toned. As it will be at times viewed by

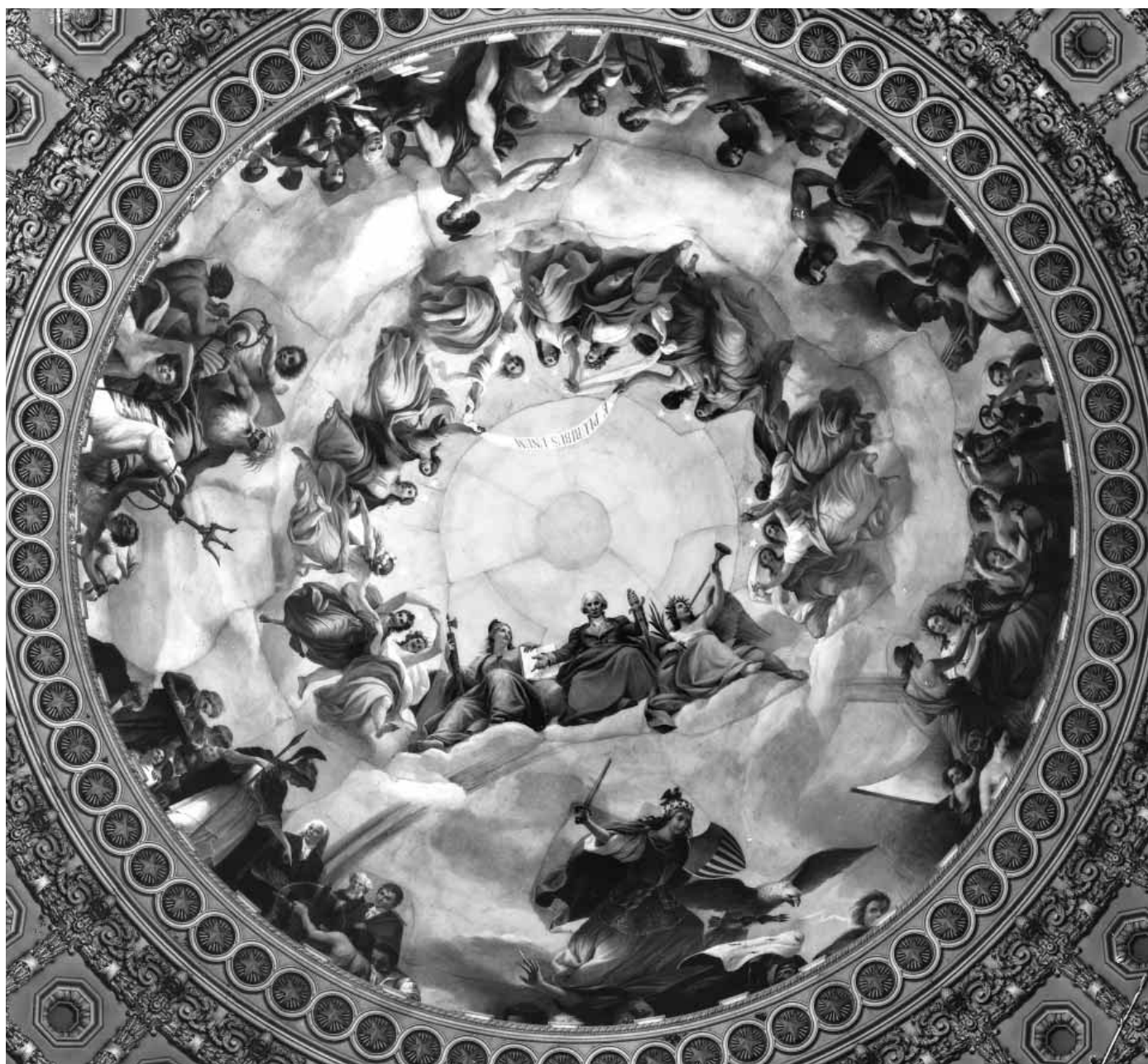


Fig. 14–11. *The Apotheosis at the turn of the century.* *Over time, grime accumulating in the joins made the giornate more prominent.* Photo: Detroit Photographic Co., 1904.

gas-light, he wishes to have the opportunity of trying it by this light before dismissing it from his hands.⁸

(1866) Although the fresco picture over the eye of the dome has been exposed to view by taking away the scaffolding, it is not finished, as the artist intends to soften down the harshness at the joinings of the plastering. He was under the impression that these imperfections would disappear when the surface became dry. He holds himself in readiness to do the proper toning and blending whenever the scaffolding is in place for the painting of the vault of the rotundo.⁹

As explained in chapter 9, Brumidi was never provided a scaffold in order to do this work. By 1904, the *giornate* had become even more visible throughout the fresco (fig. 14–11). Photographs taken after the 1959 restoration offer a radically changed image. The *giornate* lines in the central sky had been painted out, thus appearing lighter at first, but they subsequently darkened even more with time. In addition, a sun, darker yellow than the sky, occupied the apex (fig. 14–12).

The archival and visual evidence clearly showed that Brumidi did not intend the *giornate* to be dark and ob-



Fig. 14–12. *The Apotheosis* before conservation. By 1987, the forms and colors were dulled by grime, and the paint applied between the *giornate* in 1959 had darkened and become extremely disfiguring.

trusive. High-magnification examination of samples taken from the dark joins between the *giornate* provided further confirmation. They showed four distinct layers: the *intonaco*, Brumidi's frescoed pigment layer, Brumidi's retouching, and Cox's 1959 overpaint.¹⁰

Allyn Cox was a muralist, not a trained conservator. He did what many painters do best, and that is to paint. No professional guidelines for conservation existed in his time. By today's standards he repainted much more than was necessary, covering large areas of undamaged original surface. He believed it was not safe to clean the fresco, and his

colors were mixed to match those darkened by grime. Where he found Brumidi's paint to be flaking and the plaster in the central section friable, Cox brushed off the loose material and repainted areas as he thought best, evidently without reference to archival photographs. Fortunately, the overpaint he used was water soluble, rather than oil-based, and he left a detailed written report of the steps he took.

As we have seen, tests showed that the plaster remained perfectly adhered to the structure of the canopy, but Brumidi's pigments were not adhered in some places, a condition not normally found on true frescoes.

An important question to resolve was the medium, if any, in which Brumidi mixed pigments he applied *a secco*, that is, after the plaster was dry, which would be more fragile than the true fresco. To answer this question, nine microsamples of the layers of *intonaco* and paint were examined by autofluorescent staining to test for the presence of proteins, carbohydrates, and oils. Unfortunately, because much of the original fresco had been sprayed with a casein and lime mixture by Cox in 1959, the samples showed evidence of protein: casein is derived from milk. It was therefore difficult to draw firm conclusions about Brumidi's medium.

There were, however, two significant findings. First, flaking green paint from one figure untouched in 1959 showed no evidence of any organic media, suggesting that Brumidi did not paint any major areas *a secco*. In this case, the flaking surface appeared to be due to an inherent flaw in the fresco technique, possibly because of the use of an unstable, clay-containing pigment. Second, Brumidi's paint on the joins between the *giornate* gave a positive test for protein that was distinctly different in comparison with that for the 1959 overpaint. This is a strong indication that Brumidi toned at least some of the joins *a secco*, that is, with an organic binder.

Pigment analysis confirmed Brumidi's traditional fresco palette of earth colors, largely based on hematite, ocher, and terre verte, with anhydrite white. The blue is ultramarine, presumably synthetic. The analysis also revealed in some samples titanium white, a pigment that was not commercially available until about 1920, thus clear evidence of areas repainted by Cox in 1959.

Finally, we analyzed the pollutants from the ring of gas jets, which, combined with moisture, would have been particularly damaging. The coal gas released large amounts of particulate matter and incompletely burned hydrocarbons, which were deposited as a thick and tenacious blue-gray soot on the fresco similar to that found on the frieze below.¹¹ Sulfur oxides, produced by the combustion of most hydrocarbon fuels, can produce sulfuric acid in the presence of water, such as condensation. The resulting sulfuric acid will react with the plaster, weakening it.¹²



Fig. 14–13. Area where loose plaster had been brushed off. The conservators found numerous areas, especially in the brown and green drapery, where little original pigment remained, leaving white plaster. Photo: Rubin & Krueger.

Armed with these data, we developed a course of treatment. Fragile surface areas were consolidated. The disfiguring surface grime and sooty deposit were removed with a diluted solution of ammonium bicarbonate after several cleaning tests were carried out.¹³ Then Cox's 1959 overpaint, which had matched the uncleaned fresco, was removed with dampened natural sponges. However, it could not be cleaned off in areas where removal would damage Brumidi's surviving original paint. The restoration also in-

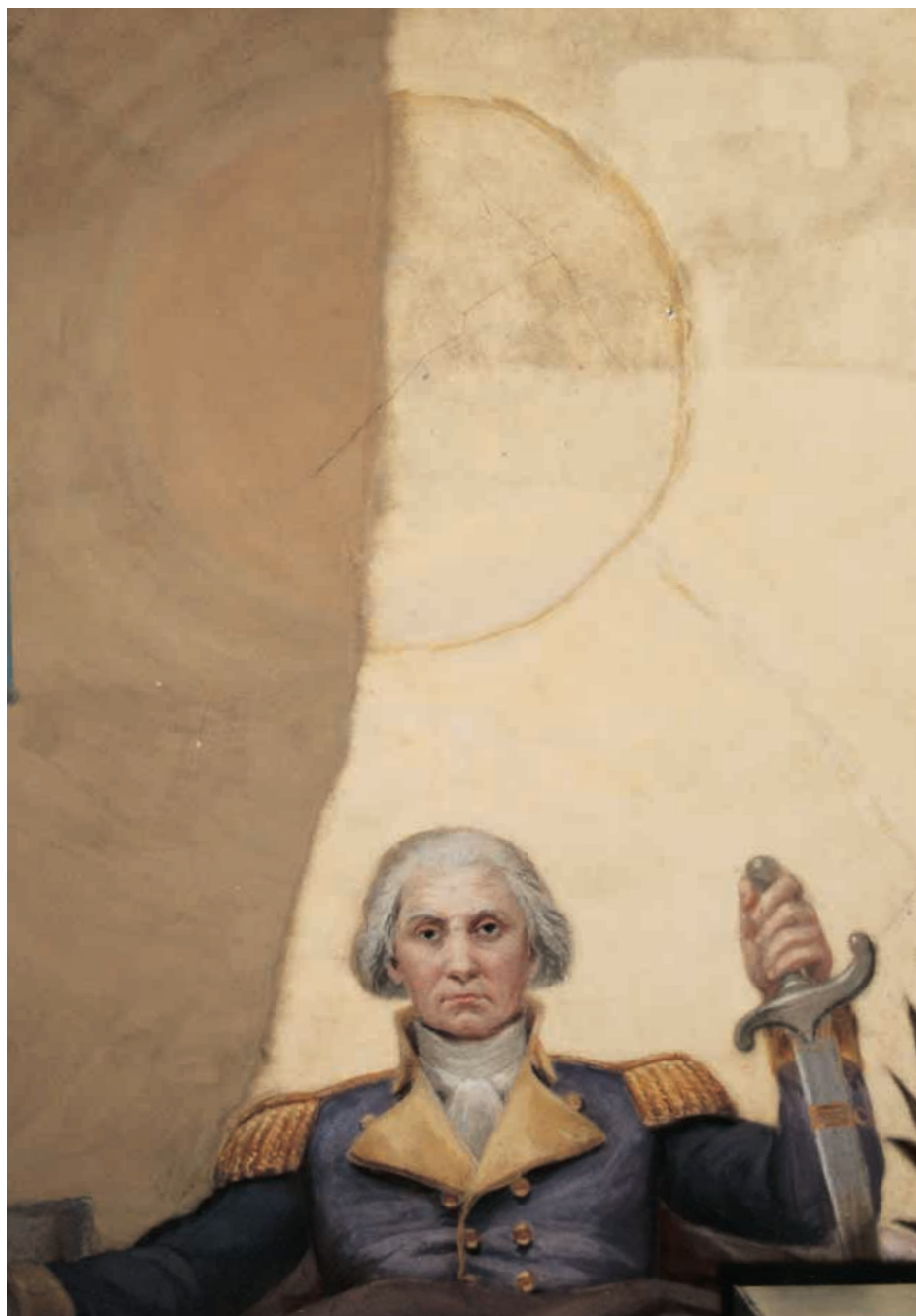


Fig. 14–14. Apex of the canopy in various stages of cleaning. *The surface of the fresco was cleaned as many as three times in order to gently remove various types of grime and overpaint. Here, the false sun is partially removed.*

involved careful cleaning of the fragments of original surface in the most damaged areas, which provided the key to Brumidi's original colors for the inpainting of these areas of loss (fig. 14–13). When confronted with Cox's overpaint of the fragile Brumidi color beneath, we had to search creatively for a successful cleaning method. By first applying mineral spirits to the affected areas and then delicately removing the overpaint with water, we were able to preserve Brumidi's original work.

Most areas were cleaned at least three times. One of the most dramatic moments of treatment was the removal of the sun that Cox had mistakenly created at the apex of the canopy. As we removed the dirt, the water-soluble dark yellow overpaint came away as well (fig. 14–14). It was startling to have the sun disappear. Our consultant, Paolo Mora, who was certain that Brumidi's first section of plaster at the apex of the dome had been entirely misinterpreted in the 1959 restoration, looked up and exclaimed, "Ah! At last we see the true sky." There is always a thrill of discovery when a conservator uncovers the original intent of the artist.

With guidance from archival photographs, the damaged areas were inpainted with watercolors (see fig. 14–1). Where passages of original color proved water-soluble, they were reintegrated with colored artist's chalk, which could be easily removed if necessary but which blended well with the fresco. Harmonizing the monumental figures, which measure up to 16 feet in height, required that we step back frequently to gain perspective on our work. We noticed that Brumidi slightly elongated the lower part of his figures so that they would look in proper proportion when viewed from below. Each area, and indeed each figure, had different conservation problems. Some figures, such as Washington, were almost perfectly intact. Other areas, such as Victory/Fame's green drapery, were intact but fragile and could not be completely cleaned. Where removal of the overpaint was not possible in the most damaged areas, it was retouched with materials that can be clearly distinguished from the original and easily removed in the future.¹⁴

Visual reintegration was the most challenging problem of this conservation project because so many figures had been seriously damaged and inaccurately reconstructed during the 1959 treatment. Brumidi himself inadvertently complicated our problems because he often deviated from his own incised outlines during the actual painting of the figures. Consequently, pre-1959 photographs, especially a set located in the photo archives of



Fig. 14–15. “Science” before conservation. *The legibility, three-dimensionality, and beauty of each scene were marred by dark grime, the darkened overpaint outlining the giornate, and stiffly repainted drapery.*



Fig. 14–16. “Science” during conservation. *Cleaning, mainly with water, revealed Brumidi’s vibrant colors, especially in the delicately painted rainbow. The contrast with the uncleaned areas, at left, was striking.*



Fig. 14–17. “Science” after conservation. *The figures seemed to come alive after treatment, when the entire fresco regained its clarity and harmony.*

the National Geographic Society, were invaluable for the visual reintegration of damaged figures.

As the cleaning progressed, we no longer saw dark gray skies and muddy colors (fig. 14–15). The fresco became luminous and bright, section by section, layer by layer (fig. 14–16). Even after inpainting damaged areas, the lines between the *giornate* remained aesthetically distracting. However, extensive overpainting of an artist’s original work, even to cover up his original mistakes and difficulties, is not an ethical solution. Working with Architect of the Capitol George White and Curator Barbara Wolanin, we arrived at a balanced approach. Mr. White suggested we retain the physical evidence of the *giornate*

while reducing the amount of contrast. To achieve this end, the joins in the light sky areas were slightly blanché and blended with chalk. As a result, the fresco can be read as a whole, as Brumidi intended (fig. 14–17).

Until the scaffold was removed and the fresco viewed under normal light conditions, we could not be sure that the retouched and repaired areas would be invisible. To our gratification, our treatment was successful, and we were thrilled to see the integrity of the composition was restored, from the grandeur of the entire composition (see frontispiece) to the mastery evident in the individual bold brush strokes (fig. 14–18).



Fig. 14–18. Detail of “Science.” *A close-up view of the cleaned fresco leads to an appreciation of the varied types of hatched strokes Brumidi used to enhance the sense of space and three-dimensional forms.*

Notes to Chapter 14

1. The analysis was carried out by McCrone Associates in 1986.
2. A vivid description of the gaslight system is provided by Dr. John B. Ellis, in *The Sights and Secrets of the National Capitol* (Chicago: Jones, Junkin & Co., 1869), p. 77:

Descending as we came, we pause in the gallery under the fresco to notice the ingenious arrangements of the gas-lights. Four hundred and twenty-five burners are arranged in a circle around the base of the canopy, at distances of one inch apart, and over each one passes an incombustible wire connected with an electrical battery placed between the outer and inner shells of the dome, near the stairway, on our right as we go down. . . . A pressure on one of the knobs opens a valve, and allows the gas to flow up to the burners, and a touch upon an adjoining knob causes an electric current to flash along the copper wire over the burners, and in an instant the whole dome is a blaze of light. The effect of this illumination is very fine. The light falls brightly over every object, and when seen from without the dome seems almost on fire.
3. The sample contained two hair-like fibers, apparently horsehair, and the chaff of grain.
4. X-ray diffraction analyses were carried out by Gregory Cavallo, American Museum of Natural History, New York City, June 1987.
5. "Such painting as was necessary to keep the joints tight and prevent corrosion has been done, and the inner portion kept clean by laborers paid out of the appropriations for repairs. Some comments have been made on the continual expenditures of money to keep in repair a dome made of such indestructible material as iron, but when the expansion and contraction of that material, between heat and cold, is considered, it may be easily understood why constant care and watchfulness is necessary." 1870, AOC/AR, p. 5.
6. Allyn Cox, "Technical Report on the Condition of the Canopy Fresco in the Rotunda of the National Capitol, and the Restoration Work Carried out there in 1959." July 14, 1959, AOC/CO.
7. CB to Edward Clark, September 19, 1865, AOC/CO.
8. *Annual Report, Architect of the Capitol Extension*, November 1, 1865, p. 5.
9. *Ibid.*, November 1, 1866, p. 2-3.
10. The stratigraphy of the dark joins of the *giornate* was studied by the highly sensitive techniques of scanning electron microscopy (SEM)

and energy dispersive x-ray spectroscopy (EDS). The analyses were carried out by Dr. Robert Koestler in August 1987.

The elements detected in each layer were as follows: (1) *intonaco*: Ca, S, Si, Fe (each less than 5%), Mg (less than 1%); (2) Brumidi pigment layer: Si, Ca, S, Fe (each less than 5%), Ti (contamination from Cox overpaint); (3) Brumidi's retouching: Ca, S, Si, Mg (each less than 5%); (4) Cox's overpaint: Ca, S, Ti, Mg, Si (each less than 5%), Fe (less than 1%).

11. Color infrared photographs of the surface following cleaning tests provided some indication of the concentration of sooty accretions that had become fixed on the fresco. Scanning electron microphotographs of small samples from the same areas before and after cleaning revealed the nature of the surface accretion, small particulate matter that is consistent with sooty pollution. Most of this accretion was removed during the 1987-1988 conservation project. Analyses were carried out by Dr. Robert Koestler in August 1987.

12. The corrosive action of sulfuric acid on calcium carbonate (lime) materials, such as plaster, produces gypsum (calcium sulfate dihydrate). Gypsum is a soft and water-sensitive material; when found in this manner, it reduces the cohesive strength of the plaster.

13. Fragile areas were consolidated with a brushed application of a 5 percent solution of Acryloid B 72 in toluene. AB 57, which contains both sodium bicarbonate and ammonium bicarbonate, is a standard cleaning agent for frescoes. However, during tests on the canopy, it acted too energetically. The ammonium bicarbonate component provided effective cleaning with controllable action.

14. The unstable and overpainted figures presented several difficulties. The 1959 overpaint could not be left visible because the colors no longer matched the cleaned adjacent areas of the fresco. However, the overpaint had become tenaciously attached to and embedded in unstable paint and *intonaco*. Thus, separation of the overpaint from the original, without causing further damage to surviving original paint, remained a constant and difficult problem.

These areas of unstable and overpainted original paint were treated by brushing them with mineral spirits, followed by an application of water and/or a dilute solution of ammonium bicarbonate. The mineral spirits provided a semi-impervious layer over the original paint, protecting the original while the overpaint was removed. The mineral spirits evaporated out of the fabric of the fresco. However, in most areas some overpaint was left on the surface, to avoid further abrasion of the surviving original paint. The overpaint was visually reintegrated with reversible watercolors and artist's chalk.

In the most damaged and unstable areas, most of the overpaint was left intact, gently cleaned with a sable brush and Wishab sponge, and visually reintegrated.