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The Illinois Senate chamber in the late 19th century with its elaborate carton-pierre ornament and decorative painting, designed by architect Alfred Henry Piquenard. (Illinois State Archives)

Carton-Pierre: a Case Study

When EverGreene began its conditions survey of the ceilings in the House and Senate chambers of the Illinois State Capitol, building staff were aware that carton-pierre ornament had been made for the rooms, but were not sure how much original material survived. **Carton-pierre** is one of the many moldable and castable materials similar to composition ornament that proliferated in the mid-to-late 19th century. *Preservation Briefs #34* (published by the National Park Service) describes it as "based on fully pulped paper fiber extended and hardened with substantial amounts of glue, whiting, and gypsum plaster, and sometimes alum and flour. It is mid-way between plaster and papier-mâché in weight and density."

The investigative team found fibrous ornament in the Senate that had clearly been cast in two-sided molds. A sample placed in hot water dissolved into a soft, sticky mass containing animal glue.

Research on the history of the chambers, combined with physical investigation, reveals a fascinating vignette of European architectural influences and American experimentation with materials in the 1870s.

A paper by Dr. Wayne Temple of the Illinois State Archives on Piquenard's life

and work tells us that in 1873 the French-born architect returned from a European tour, where he studied the interior decoration of public buildings and the latest techniques in the construction of domes. In France, he observed carton-pierre (meaning "stone made of paper"), a type of molded ornament that was tougher than plaster. Piquenard convinced the building commissioners to fund the ornamentation of the interior with this material. Over the next three years, Piquenard's designs were fabricated by a department of some 17 men supervised by an expert French ornamental plasterer, Paul Bedeau. "It was these gorgeous French art decorations which made the capitol look so grand and distinctive," Dr. Temple wrote.

Our archival research revealed that a French sculptor made clay patterns from Piquenard's drawings of ornament. Plaster molds were cast on the clay, then plaster models made from the molds. The dough-like fibrous mass of carton-pierre was hand-pressed between glue impressions of the plaster models and allowed to harden into hollow units. The House and Senate chambers were among the rooms richly decorated with carton-pierre. During our physical investigation we found that the cast ornament was attached with nails and wads of plaster, occasionally reinforced with fiber, onto a cementitious plaster on lath.

After fires in the 1930s, the House ceiling was entirely redone using gypsum and sand

Ornamental Ceiling Restoration at the Illinois State Capitol

by Jeff Greene and Terry VanderWell

The House and Senate chambers of the Illinois State Capitol in Springfield have been a beehive of activity this summer and fall, but not the usual political kind. Working from scaffolds on site and in the New York studio, EverGreene's architectural and paint conservators, designers, plaster artisans and decorative painters have joined forces to solve technical problems and return the ceilings to their appearance in the late 19th century based on painstaking study of physical and documentary evidence.

The Illinois State Capitol was principally designed by Alfred Henry Piquenard (1825-1876), who supervised its construction from 1870 onward in a classic French Renaissance style. The interior was richly ornamented with plasterwork (most notably carton-pierre), marbles, scagliola, frescos and other decorative painting, executed mainly by French and Italian artisans. Painting and decoration continued after his death into the 1880s.

Major changes to the House and Senate ceilings over the years included the replacement of glass skylights with plasterwork, remodeling of balconies and galleries, replacement of the flat plaster ceiling in the House after fires in the 1930s, repainting in non-historic colors, and installation of down-lighting and HVAC diffusers.

Last winter, visible fractures and bits of falling plaster and paint chips prompted the Secretary of State's Division of Planning & Development to install an enormous safety net below the ceiling. Repairs had to wait until after the spring legislative session.

The Division decided to retain EverGreene to undertake a conditions survey and make recommendations because of the depth of our experience in conserving and restoring historic plaster and decorative painting. The two of us and architectural conservator Tony Kartsonas inspected the ceiling and sounded surfaces from rolling towers. We brought in plaster expert Andrew Ladygo to survey conditions with us for two days and analyze samples in his lab.

"Coal-Popping" in Plaster

Our investigations identified several types of deterioration in both the flat plaster and

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Illinois State Capitol (continued from p. 1)

applied ornament: water damage, delamination from the substrate and between layers, detachment of ornament, and substantial cracking. The most interesting and unusual problem affecting the plaster is a phenomenon similar to that of spalling in brick faces. Expansion around shiny black particles in the brown coat forces finish plaster on the surface to dislodge, and can be surprisingly destructive in lifting or delaminating ornament attached to either the finish or brown coat. When the expelled plaster is removed, a black inclusion is visible at the center of the mass. This type of damage was widespread in the Senate chamber, which retains much original plaster, but not in the House, where the flat plaster was replaced in the 20th century.

We encountered the same condition when we were working in the rotunda of the Iowa State Capitol, also designed by Piquenard. Plaster artisans on the building staff said they had been repairing pop-outs around the building over the years, and had coined the term "coal-popping" because the particles are shiny and black like coal. A cloud painting on a curved plaster panel was ruined by hundreds of pop-outs. We dug them all out, filled the holes and skimcoated the surface to prepare it for a duplicate painting.



Plaster doctor Ed Magee consolidates hairline cracks in flat plaster and delaminating carton-pierre ornament at the Illinois State Capitol.

In Illinois we have been able to study the problem further. Our hypothesis is that Piquenard intentionally specified this ash in the mortar mix for both state capitols. Volcanic ash is known to have been used since Roman times as a pozzolanic additive which will react with lime in the presence of water, enabling the lime mortar to set hydraulically. Much experimentation with cements was going on in the 19th century, and in fact, pulverized coal ash (PFA) of low sulphate content is among the modern pozzolanic additives. According to archival documents, Piquenard experimented with plaster and artificial cements and specified a brown mortar which was half cement so that it would bear the weight of the carton-pierre. Unfortunately his formulation backfired. Petrographic analysis by Wiss, Janney, Elstner Associates in Chicago classified the particles in the brown coat as coal cinder with minute inclusions of pyrite. The pyrite oxidizes to produce sulfuric acid, which attacks the surrounding plaster.

Treatment Strategy

As we realized the full extent of the plaster problems in May, the rigid October deadline loomed in our minds. It was imperative to perform a full-scale conditions survey of every element from scaffolding, including each of the thousands of pieces of applied ornament to determine which were loose or secure. At the same time, we were determining which ceiling elements were original or replacements, based on physical investigation and historic photos, and using that information to help interpret the paint history. We pointed out specific areas where leaks and condensation from the climate control

system had to be eliminated. Our strategy for conserving historic plaster and carton-pierre ornament and repairing damage involves many techniques which we have employed over the years:

- Consolidate by drilling and injecting acrylic dispersions to secure delaminating flat plaster and ornament.
- Mechanically secure plaster ornament using stainless steel fasteners, some set in epoxy.
- Replicate missing or damaged ornament in our plaster shop to match the appearance of the originals.
- Repair cracks using standard methods of channelling and filling.
- Repair spalls in flat plaster caused by oxide jacking.
- Coat flat plaster with liquid polymer coating with a fiberglass mesh interleaf, and skim coat. This creates a tough, impervious skin which will serve as a smooth receptive surface for the new decorative painting. It is a longer-lasting system than the canvas previously used on the ceiling.

Rediscovering the Decorative Painting Scheme

The close-up investigation of the plasterwork from scaffolding provided a golden opportunity for paint analysis by Tony Kartsonas and consultant Darla Olson to ascertain the color schemes that the two rooms had in the late 19th century. The number of paint layers varied from six to twelve in a jig-saw puzzle of original plaster, alterations and previous repairs. Black-and-white historic photographs of the rooms indicated tonalities and patterns.

Scanty evidence remained of the original water-soluble distemper paint, most of which had been washed off before subsequent repainting. Frescoes on flat panels show up in old photographs, but are completely gone. We concluded that the color palettes and patterns were repainted with little change until about the time of the Second World War. Colors since then have been quite different.

Although not every detail is clear in the historic photos of the House and Senate chambers, our study of historic decorative painting elsewhere in the Capitol, combined with our knowledge of similar ornamental motifs of the period in other buildings, provides precedents for interpreting the evidence. Altered areas had to be integrated into the scheme.

Our conservators and designers (chiefly Jeff Greene and Evgeny Nikitin) synthesized physical and documentary evidence in a research report, maquettes showing the ceiling designs, and color samples of the earth-toned palettes employed in the late 19th century.

"Most people were comfortable with the contemporary colors and we weren't sure we wanted to make any dramatic changes. But when Jeff Greene unveiled his design, everybody was pleasantly surprised and reacted favorably. We expect the end result to be magnificent. We probably wouldn't have walked down this road if we hadn't had Jeff and his team on board."—Jim Harry, Secretary of the Senate

The House and Senate leadership and the Secretary of State's Division of Planning and Development decided to adopt the historic decorative painting scheme on the ceilings. We also consulted with the State Historic Preservation Officer, Michael Jackson, who supports our interpretation.

While plaster repairs were underway, Evgeny and the design team prepared detailed drawings and renderings of the decorative painting patterns. Artists painted some elements on canvas in the New York studio to prepare for rapid installation, and decorative painters are glazing, gilding and stenciling on site this fall.

Enthusiasm at the Capitol about restoring the ceilings has extended to other features. We're designing draperies and carpeting based on documentary evidence and will oversee their production by specialist manufacturers. We're also advising on desks and lighting. For all of us at EverGreene, a commitment to reaching the best solutions for each historic building, and delivering a high quality project that thoroughly satisfies the client, is the driving force behind every team effort.