



Giotto's fresco, 'The Last Judgement' from 1304-1305 fills the entire pictorial space of the counter-façade of the chapel.

THE 'NEW EYES' OF SCROVEGNI CHAPEL

BY MICHELE TREVISANELLO

The internal walls of the Scrovegni Chapel in Padua, Italy, are decorated with an astonishing cycle of frescoes by Giotto, a masterpiece of the Gothic period as well as a masterpiece for the Western art, second only to the Sistine Chapel by Michelangelo. The frescoes, which narrate events in the lives of the Virgin Mary and Christ, cover the entire walls and were frescoed by Giotto at the beginning of the 14th century. On the wall opposite the altar is the grandiose "The Last Judgement," which concludes the story of human salvation. A recent restoration of the chapel highlighted the importance of the preservation aspects of this work, and specifically the importance of the historical stained-glass windows that date from the 17th

century, which not only function as a filter between the inside and the outside, but are the eyes of the chapel onto the world.

The restoration team of the Council of Padua, the University of Padua, and Progetto Arte Poli carried out the preservation and restoration work of the stained-glass windows, blending together the knowledge of history and a restoration intervention which responded to the various aesthetic requirements of this sacred space, such as the existing relationship with the recently restored Giotto's frescoes.

The 13 stained-glass windows (six in the nave, three in the apse, three in the façade, and one in the sacristy) are made of light yellow, blue, and pink transparent roundels, which are

bound together using the ancient lead came technique. They are broken up by brighter green, red, and blue glass panes. The stained-glass windows of the nave stand out because of their alternating heraldic symbols belonging to the Scrovegni and Padua families.

The condition of the windows was severe: the lead came was weak and there were many panels warped towards the outside due to the excess pressure and detached from the support metal rods. Many roundels were broken or missing, the apse and the sacristy stained-glass windows had no external protection glass and were particularly deteriorated, while the stained-glass windows of the nave were particularly dusty. Frames were not perfectly sealed; in fact there were no gaskets, which allowed



Part of the cleaning processes.



Part of the new restoration involved the removal of inadequate restoration attempts from years earlier.

generous air infiltration, making it virtually impossible to control the microclimate.

The restoration work focussed on beauty and strength. Each panel was restored by strengthening the lead came and gluing or replacing all the *tesserae* (small square tiles of glass) that had deteriorated. Iron frames were restored, considerably improving the barrier between the inside and the outside. The restoration and preservation intervention enhanced the temporal qualities of the windows and their aesthetics: the stained-glass windows exude history; the breaks were fixed but still visible; the ancient binding lead components (which harmoniously match with Giotto's frescoes without interfering with them) enhance the entire architectural space; a renewed brightness enlivens the interior and the artwork.

DISMANTLING, SHIPPING, AND DOCUMENTATION

Before the windows were removed for restoration, in-situ graphic and metric survey of the sections of the stained-glass windows were carried out. A wood and polystyrene container for each glass section was fabricated to easily transport it. After removing the sections, they were packed into boxes wrapped in rice paper sheets and bubble wrap and transported to the workshop. After securing the boxes, each was opened and the windows carefully removed, handled in such a way as to not further stress the panels or damage them. Then a photo was taken of each section under transmitted and reflected light to highlight the deterioration status of the roundels and the lead came.

A graphic survey of each section was then digitized in AutoCAD, and the technical characteristics were listed, as well as the composition of the drawing. A complete mapping of the preservation status of each window was carried out, which contained the deterioration status of the lead came, the strength of the anchoring elements, the warped areas, the breaks, the missing Venetian roundels and crosses, the differences in the dimensions, and the colors of these elements.

Samples from the already deteriorated glass elements were taken, and analyses were carried out by the scientific group. As for the stained-glass windows in the apse, the nave, and the mullioned window with three lights, both the sampling operations and the analyses were carried out directly at the laboratories of the University of Padua. Progetto Arte Poli's analyses were carried out by R&C Lab.



Restored apse windows.

CLEANING

Analyses revealed that welded lead was particularly deteriorated; indeed its ends were covered by a reddish oxidation product. Although the cause of the rust could not be pinpointed, we believe it is probably due to the fact that lead was not cleaned after being welded and there was acid in the welding. The components were cleaned with White Spirit to remove the oxidation from the surface, which did not allow the natural oxidation of the lead underneath. The cleaning trial with isopropyl alcohol was particularly successful, since it was possible to remove both the upper dusty patina and the stains of biological origin. White Spirit was also used to remove the stains of black varnish (used to coat the external grids) and the brown stains (a product similar to Fidoil).

RESTORING THE TESSERAE AND LEAD-SEALING

Gluing trials were next carried out, which highlighted the validity of the intervention project. A UV-hardening acrylic resin was used to make the glass stiffer and stronger over time. The glass used for integrations was mouth-blown, made in the same way as the ancient techniques, fabricated by the German company Glashutte Lamberts. Each roundel was made up of a circular glass *tessera*, obtained by processing fused glass without cutting slabs. Skilled master glassmakers created them one at a time, precisely shaping each to a desired thickness. The gaps between the roundels in the lead came were filled by transparent flat glass stars, in this case with four points because of the position of the roundels. The copper wires were removed with the help of a welding machine

and a specific product for welding. The lead and the glass *tesserae* were then cleaned using solvents and some absorbent cotton.

Where possible, the glass *tesserae* were glued without removing them from their original position. This operation was particularly useful in those areas where re-handling the whole lead came ear was a too invasive intervention to be carried out. However, this operation was not particularly precise in terms of gluing. Instead, the glass *tesserae* were removed to obtain a better result. In the areas where lead components were not overly deteriorated, skilled operators lifted up the came ear and placed it back to its original position without further damaging the section. In the areas where lead components were particularly deteriorated, the ear was integrated with lead laminas (this operation was not carried out for



Two of the six restored windows in the nave.

the stained-glass window of the sacristy, since it was not needed). All the lifting and integration operations were carried out outside the chapel to reduce the impact on the aesthetic result as much as possible.

STRENGTHENING

Glass fiber was used to remove the upper oxidation layer from the welding points, which provided a better control during the removal phase compared to the use of a scalpel (proposed in the intervention specifications) to remove the upper oxidation layer and to weld thin support copper wires. New, thin support copper wires were installed with the help of

a welding machine, and soldering water was applied only in the tin alloy welding points. The new welds were burnished with a low concentration welding acid to foster the formation of the passivating upper patina. Finally, Silirain 50 protective treatment was applied with a sprayer.

POSITIVE PRESSURE FOR A UNIQUE CHAPEL

After the restoration work and re-installation of the stained-glass windows, an artificial pressure system that puts the chapel interior under positive air pressure was introduced to prevent outside dust from entering through the architectural lights. This groundbreaking solution

designed by the stained-glass restoration team uses sophisticated air-handling equipment to help preserve the interior, considering various factors such as the number of visitors and the corresponding levels of humidity.

The restoration thus represents a balance of glass restoration and preservation that takes into consideration the magnificent Giotto frescoes, with an in-depth study of the history of this landmark chapel—a UNESCO World Heritage site. 

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