



CONSTGLASS



Table of results

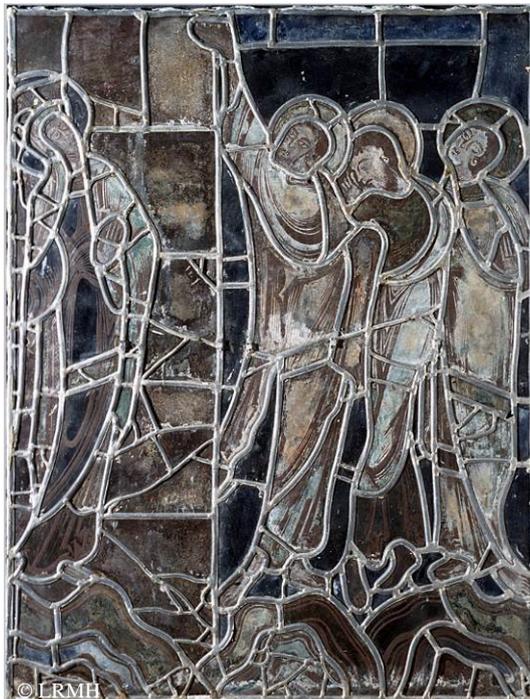
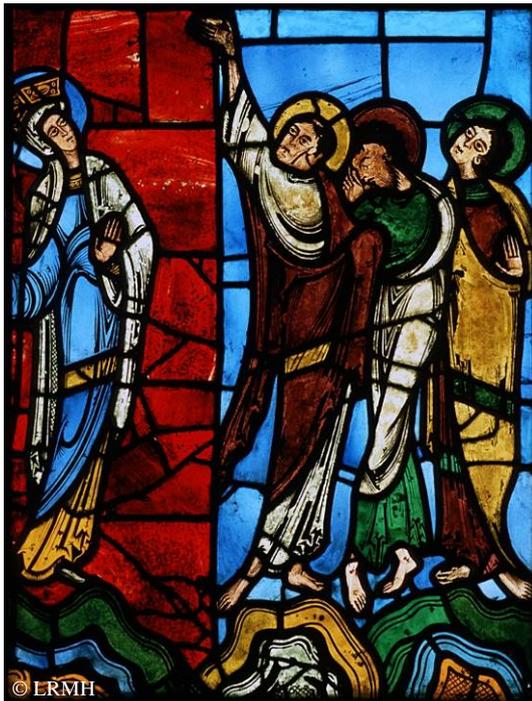


1- Pilot Object

Pilot object:

The *Crowning Virgin and the 12 apostles*, LE MANS
Bay XVI, panel 11

Picture



Identification of the panel:

Bay: XVI

Panel: 11

Internal face, transmitted light

Internal face, reflected light

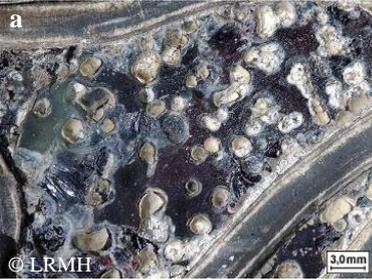
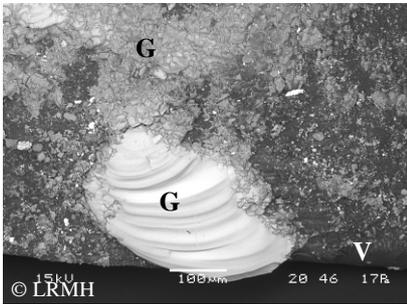
Treatment:

- 1974, by Gruber studio.
- Product: polyurethane resin (80% Viacryl® VC 363 + 20% Desmodur® N75).
- Application: with a soft brush after cleaning.

	<h1>CONSTGLASS</h1>	
	<h2>Table of results</h2>	

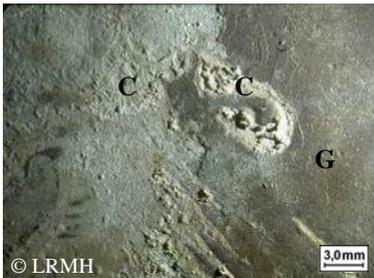
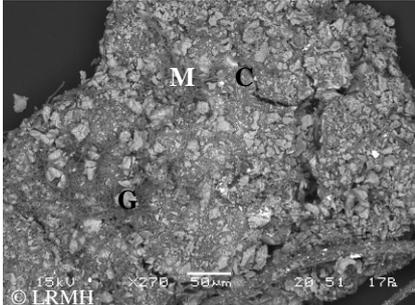
2-Results

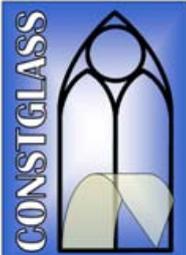
Sample reference: *CHA_bXVIp11_E_v5 : red glass, coated with Viacryl® on external surface*

Questions	Techniques	Answers	
<p>Morphology</p> <ul style="list-style-type: none"> - What is the morphology of the weathered coating? - How is the bonding between coating and glass? <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>© LRMH</p> </div> <div style="text-align: center;">  <p>© LRMH</p> </div> </div> <p><i>Transmitted light, internal surface</i></p> <p><i>Reflected light, external surface</i></p>	<p>Optical Microscope</p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>© LRMH</p> </div> <div style="text-align: center;">  <p>© LRMH</p> </div> </div> <p><i>a – Viacryl® flakes in glass craters. b - Detail of the glass surface.</i></p> <p>On most of the pieces, Viacryl® has been washed away by rain and wind. Here, a large part is still in the craters: we can see the film has been retracted when hardened, it is yellowing and has a milky aspect. A large part of healthy glass is bared (brilliant aspect).</p>	
	<p>SEM</p>	<div style="text-align: center;">  <p>© LRMH</p> </div>	<p>A flake of Viacryl® has been sampled on the external face.</p> <p><i>Internal face of the flake. The glass (G) – healthy (light grey) and gel layer (grey) – has been torn off with Viacryl® (V). There is not much corrosion products.</i></p>
	<p>Desktop tomography</p>	<p>SEM/EDX</p>	<p><i>Not foreseen in this case</i></p>
	<p>Phase-contrast tomography on Synchrotron</p>	<p>FTIR</p> <p>RAMAN</p>	<p><i>Not foreseen in this case, see panel 10</i></p>
<p>Chemical Composition</p> <ul style="list-style-type: none"> - What is the chemical composition of the alteration products? 	<p>SEM/EDX</p>	<p>The gel layer is a stratum of glass depleted in alkali and alkaline earth metal.</p>	
<p>Organic component composition</p>	<p>FTIR</p> <p>RAMAN</p>	<p><i>Not foreseen in this case, see panel 10</i></p>	
<p>Microbiology</p>	<p>Molecular biology, ATP measurements</p>	<p><i>Not foreseen in this case, see panel 6</i></p>	
<p>Reversibility</p>	<p>Test studies Elimination</p>	<p><i>Not foreseen in this case, see sample v3</i></p>	
<p>Re-treatability</p>	<p>Test studies Re-treatability</p>	<p>No re-treatability was recommended. An external protective glazing was installed in 2008, by Debitus studio (Tours, 37).</p>	

	<h1>CONSTGLASS</h1>	
	<h2>Table of results</h2>	

Sample reference:	<i>CHA_bXVIp11_I_v3 : beige glass, consolidated with Viacryl® on internal surface</i>
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Questions	Techniques	Answers
<p>Morphology</p> <ul style="list-style-type: none"> - What is the morphology of the weathered coating? - How is the bonding between coating and glass? 	<p>Optical Microscope</p>	 <p><i>Viacryl® on grisaille (G) and glass. It's flaking where corrosion (C) has restarted (particularly on glass).</i></p> <p>© LRMH</p>
 <p>© LRMH 10 mm</p> <p><i>Transmitted light, internal surface</i></p>  <p>© LRMH 10 mm</p> <p><i>Reflected light, internal surface</i></p>  <p>© LRMH 10 mm</p> <p><i>Before the restoration of 1974</i></p>	<p>SEM</p>	 <p>© LRMH 15 kV x278 50µm 28 51 17R</p> <p><i>Corrosion products (C) under Viacryl® have been sampled on the weathered glass (G).</i></p> <p><i>Internal surface of Viacryl®-film: between film and glass.</i></p> <p>In addition to gypsum, some micro-organisms (M) are visible on this SEM picture. They are not active anymore, but their presence is an indication of a favourable environment for their growth.</p>
	Desktop tomography	<i>Not foreseen in this case</i>
	Phase-contrast tomography on Synchrotron	<i>Not foreseen in this case</i>
<p>Chemical Composition</p> <ul style="list-style-type: none"> - What is the chemical composition of the alteration products? 	SEM/EDX	The main component of corrosion products is gypsum. It comes from alteration of the glass or alteration of rests of putty.
Organic component composition	FTIR	<i>Not foreseen in this case, see panel 10</i>
	RAMAN	
Microbiology	Molecular biology, ATP measurements	<i>See sample "microbiology tests" at the end of this data sheet.</i>

	<h1>CONSTGLASS</h1>	
<h2>Table of results</h2>		

Reversibility	Test studies Elimination	 <p>© LRMH</p>	<p>The restoration has been made in 2005 by Pivet studio (Morthemer, 86). N-methyl-2-pyrrolidone has been used to remove corrosion products and Viacryl® on glass in internal surface.</p> <p>Viacryl® and most of corrosion products have been cleaned, the grisaille is still in a good state of conservation.</p>
Re-treatability	Test studies Re-treatability	<p>No re-treatability was recommended. An external protective glazing was installed in 2008, by Debitus studio (Tours, 37).</p>	

Conclusion: On the external face, it remains not much Viacryl®. But microscope and SEM observations show the Viacryl® takes off the gel layer and the healthy glass when the film is cleaned by rainwater. In 2005, the rests of polymer has been removed to avoid these problems.

On the internal face, the consolidation is still good on most of the paints. Where corrosion products are on the glass paint, they don't seem to have an impact, because in this case they seem to come from alteration of the putty. If they were coming from the glass, it would damage the paint. The excess of Viacryl® on glass is no more effective because of alteration growing.