

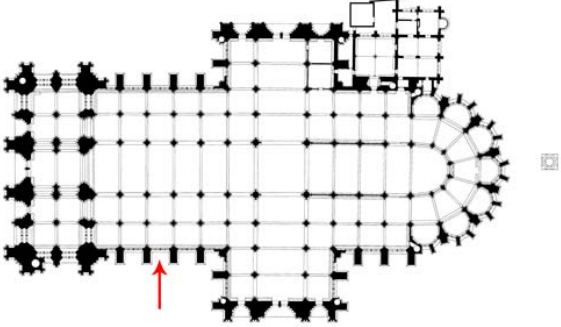
	CONSTGLASS	
	Data-sheet Cologne / BS 31	

Object: Cologne Cathedral	Date: 05. 12. 2008
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OBJECT IDENTIFICATION	
Site	Cologne (Germany)
Building	Cologne Cathedral
Location and orientation of the window Plan of the building	South side-aisle 



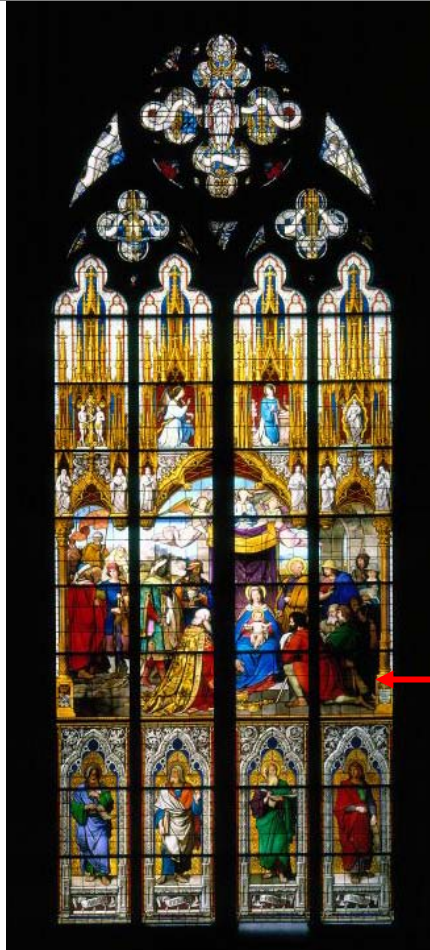
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Description of the window opening (dimensions, number of lights, test panel marked)



Window "Adoration of the Magi", 1846

4 lancet window with tracery
total height: circa 14 m
total width: circa 4,90 m
height per lancet: circa 10 m
width per lancet: circa 1,12 m

Test panel 4d

Date

1846

Short description of the window (identification of subject, artist, workshop)

The central scene combines the birth of Christ with the adoration of the Magi. The upper scene depicts the Annunciation to the Virgin. In the lower part stand the prophets Isaiah, Jeremiah, Ezekiel and Daniel as foretellers of the coming of the Saviour. The window was made in 1846 by the Royal Glass Painting Manufactory in Munich as a donation of King Ludwig I of Bavaria: His coat of arms and the donation inscription are shown in the framing architecture of the central scene.

Owner

Metropolitankapitel der Hohen Domkirche Köln

Person(s) in charge

Stained Glass Studio of Cologne Cathedral Works Department

Investigated panel (inventory number CVMA number, size)

s XXII, 4d.
Size: 111,5 x 99 cm






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Manufacturing technique	unpainted glazing		<input type="checkbox"/>
	painted glazing		<input checked="" type="checkbox"/>
		oxide paint / grisaille paint inside	<input checked="" type="checkbox"/>
		oxide paint / grisaille paint outside	<input checked="" type="checkbox"/>
		silver stain inside	<input type="checkbox"/>
		silver stain outside	<input type="checkbox"/>
		transparent enamel inside	<input type="checkbox"/>
		transparent enamel outside	<input type="checkbox"/>
		<input type="checkbox"/>
		<input type="checkbox"/>
<p>Further information: different paint layers in panel 4d: -multilayered shadings as well as cross hatches and thin layers of oxide paint -multicoloured paint layers (black, brown, green), eventually with partly transparent enamel inside? -oxide paint for the outlines</p> <p>Condition of the paint layers: Apparently on some glass pieces the different paint layers were not correctly fired (they look matt and open porous), but perhaps this is a result of a corrosion process? This is why some of these pieces were covered with BS 31.</p>			

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ENVIRONMENT IN SITU / IN STORAGE			
Protective glazing	no protective glazing	<input type="checkbox"/>	
	protective glazing	<input checked="" type="checkbox"/>	
		installed in the original position of the ancient panels	<input checked="" type="checkbox"/>
		mounted to the outside (ancient panels stay in their original position)	<input type="checkbox"/>
		no ventilation	<input type="checkbox"/>
		internal ventilation	<input checked="" type="checkbox"/>
		external ventilation	<input type="checkbox"/>
		size of interspace between ancient panel and protective glazing	~ 4 cm
		ventilation slot at the top (size)	~3 cm
		ventilation slot at the bottom (size)	~3 cm
		date of installation	1981
	<i>Further information:</i>		
Material protective glazing	laminated double glazing		
Surround materials and construction related materials	<p>Before the protective glazing system was installed, the window was surrounded by sandstone. The panels were inserted in the grooves and fixed in mortar. At the crossbars they were fixed with putty. After the installation of the outer protective glazing in 1981 the panels were mounted on a stainless steel construction. Each panel is framed with U-profiles of brass, sealed by an industrial silicone for sealants.</p>		



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Museal exposition / Storage	Room	<input type="checkbox"/>
	Cabinet	<input type="checkbox"/>
	Store	<input type="checkbox"/>
	<i>Further information:</i>	

Objects exposed to	partial sunlight (south side)	<input checked="" type="checkbox"/>
	daylight, but no direct sunlight	<input type="checkbox"/>
	artificial warm light	<input type="checkbox"/>
	artificial cold light	<input type="checkbox"/>
	mixed warm-/cold light	<input type="checkbox"/>
	<i>Further information:</i>	

Climate of the building

The climatic data are: air temperature (T [C°]) and relative humidity (RH [%])

DBV Bayemfenster climate
RH - T
1.01.2009 - 31.12.2009

fig.1 DBV Cologne s XXII climate

The plot shows that RH tendencies depend on season of the year: in warmer, summer period of the year the RH averages drop down with rise of air temperature. This may suggest that there is no additional input of water vapors from more humid outer climate. The climate within Cologne Cathedral is rather humid, in average about 70%; there is no heating.

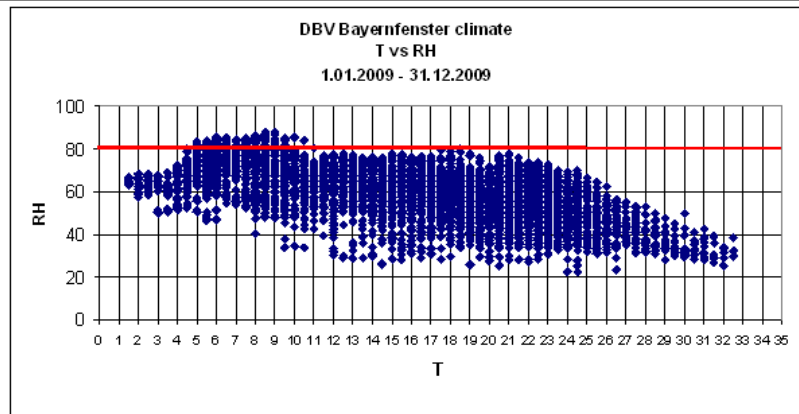


fig 2. DBV Cologne s XXII climate: T vs RH

The graph depicted on fig. 2 visualizes the possibility of wetness of the glass occurring when $T > 0\text{ }^{\circ}\text{C}$ and $\text{RH} > 80\%$. The graph shows, that wetness may occur only for short periods, when the temperature is low (5 to 11 $^{\circ}\text{C}$), although in much wider range (5 to 21 $^{\circ}\text{C}$) the danger of wetness may occur.

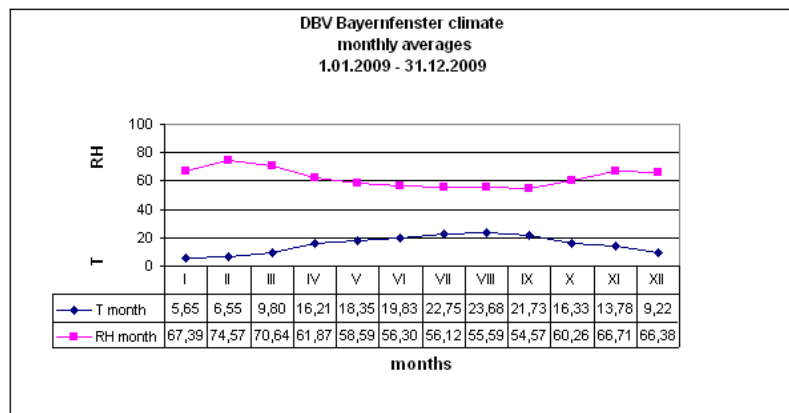


fig. 3. DBV Cologne s XXII climate: monthly averages

The mean monthly values of climate data follow the trend lines of plot 1 and also show, that probability of wetness occurrence is higher in the colder seasons of the year.



The light data are: illuminance of visible light (VIS [lux]) and UV radiation [mW/m²]

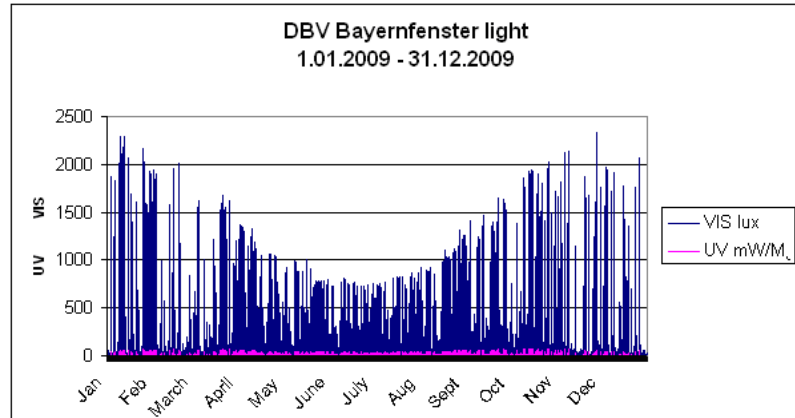


fig. 4. DBV Cologne s XXII visible and UV light levels

The lowest level of the light occurs in summer. The phenomenon, rather astonishing at the first glance may be caused by high sun path in summer, leading to shading the area where logger was situated. The UV level is very low through the all year.

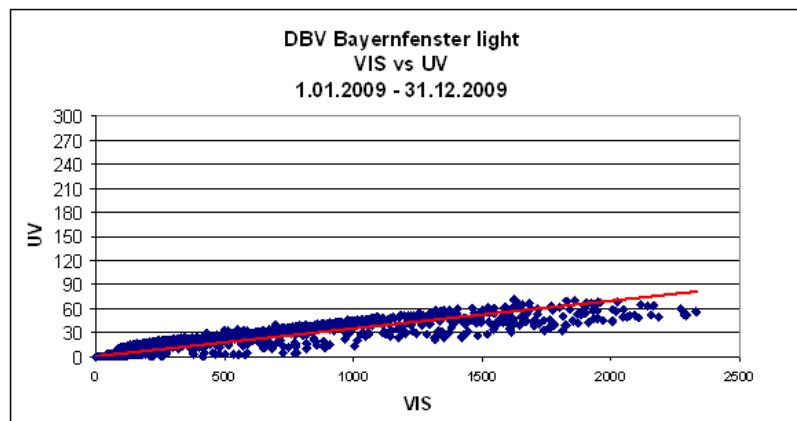


fig 5. DBV Cologne s XXII light:VIS vs. UV

The graph shows, that the UV level is low, as compared to visible light. The intensity of visible light has a very large span, although the low intensities are more common than the higher ones.



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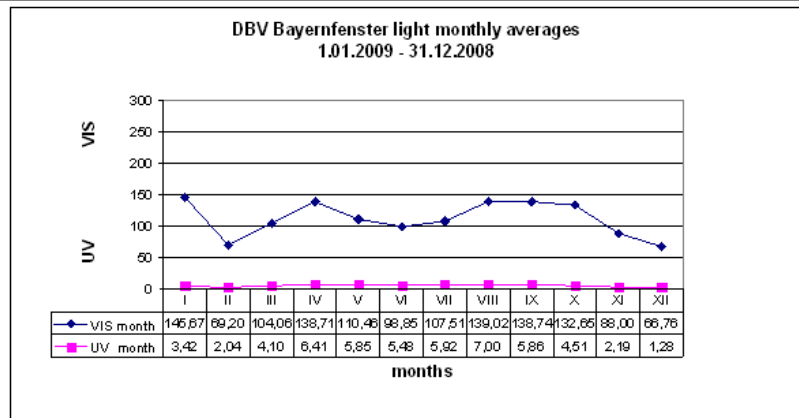








fig. 6. . DBV Cologne s XXII light: monthly averages

The UV radiation is low and rather stable throughout the year. The visible light shows highest values in January, April and Autumn months. The lowest levels occurred in February, November and December.

The climatic conditions of the window s XXII are under direct influence of outer climate, although, particularly in terms of temperature, it is in average, rather stable. The scatter plot (fig.2) however shows a certain danger of wetness of the glass surface. The visual radiation (fig. 4) shows an unusual phenomenon - contrary to typical rising of light level in summer and lowering in winter, in the case of window s XXII the radiation is the other way round: high in winter and lower in summer. It is interesting to note, that UV radiation is on fairly stable level throughout the year. An explanation of this phenomenon is, without knowing the situation of the window, impossible. If there is no mistake in measurements, it seems, that there is an additional source of light during darker periods of the year.

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INSPECTION OF THE SITE BEFORE REMOVAL (WITH PICTURES)	
Requirements for a safe removal in respect of minimal intervention	
Environmental causes for damage	
Short report of removal	As the panels are mounted on a special construction faced to the interior of the cathedral, the test panel was easy to remove. It only required a roll lifting cart (a "spider") and a screwdriver.
Short report of transport	The panel was transported in a wooden transport box with air filled tires. As the stained glass studio is very close to the cathedral, the transport was made by hand.

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CONSERVATION MATERIAL		
Conservation material (producer, product name, characterization, data, etc.)	<p>SH 1 (Glasbau Hahn, Frankfurt/Main, Germany, Tel: +49/69/490742) is a colourless epoxy resin, specially developed to assemble glass cases. For our special requirements the SH 1 was darkened by the producer with a black pigment (“ebony black”). Today the resin is not available any more, because the production has been stopped.</p> <p>BS 31 (Wacker Chemie, München, Germany, Tel: +49/89/627901) is an addition cross-linking two-part silicone resin (1,5 : 1) with good adhesion.</p> <p>The Silicone sealing the brass frame was surely a current industrial product, but we do not know which (the conservation campaign of 1981 was carried out by an outside company).</p>	
Purpose of use	consolidation of paint layer / paint pigments	<input checked="" type="checkbox"/>
	coating / lamination	<input checked="" type="checkbox"/>
	edge bonding	<input checked="" type="checkbox"/>
	stabilization of cracked glass	<input checked="" type="checkbox"/>
		<input type="checkbox"/>
		<input type="checkbox"/>
Application technique	application with brush (BS 31)	<input checked="" type="checkbox"/>
	application with spray	<input type="checkbox"/>
	single application (SH1 edge bonding)	<input checked="" type="checkbox"/>
	repeated application (BS 31)	several times
	concentration	
	mixing ration of the BS 31 (2part silicone rubber)	1,5:1
	mixing ratio Hahnzement SH 1 (2 component epoxy resin)	2 g : 3 drops

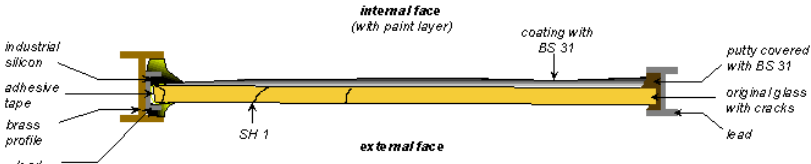


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	<p>Further information:</p> <p><u>Description of the treatment:</u></p> <p>BS 31 was used for the stabilisation of damaged paint layers and of new retouches. The application was carried out either partial or all over the surface. During the application Ester was used to stretch the setting time. In case the BS 31-treatment covers the complete surface, the putty between lead and glass was also covered with BS 31.</p>  <p>SH1 was used only to bond cracks.</p>																									
<p>Date of application</p>	<p>1981 (carried out by an outside company)</p>																									
<p>Documentation of this treatment</p>	<table border="1"> <tr> <td>photographs (colour transparent and black & white, prints, digital images)</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>written records</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>diagrams</td> <td><input type="checkbox"/></td> </tr> <tr> <td>data-files</td> <td><input type="checkbox"/></td> </tr> <tr> <td></td> <td><input type="checkbox"/></td> </tr> <tr> <td></td> <td><input type="checkbox"/></td> </tr> </table>	photographs (colour transparent and black & white, prints, digital images)	<input checked="" type="checkbox"/>	written records	<input checked="" type="checkbox"/>	diagrams	<input type="checkbox"/>	data-files	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	<table border="1"> <tr> <td></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td></td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td></td> <td><input type="checkbox"/></td> </tr> <tr> <td></td> <td><input type="checkbox"/></td> </tr> <tr> <td></td> <td><input type="checkbox"/></td> </tr> <tr> <td></td> <td><input type="checkbox"/></td> </tr> </table>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
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<p>Previous restorations (data, treatments, material)</p>	<p>Further information:</p> <p>The written record is available in Cologne Cathedral's stained glass studio</p> <table border="1"> <tr> <td rowspan="3">Do you think the information is</td> <td>Exact</td> <td><input type="checkbox"/></td> </tr> <tr> <td>more or less reliable</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>Hearsay</td> <td><input type="checkbox"/></td> </tr> </table>		Do you think the information is	Exact	<input type="checkbox"/>	more or less reliable	<input checked="" type="checkbox"/>	Hearsay	<input type="checkbox"/>																	
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CONDITION REPORT / DOCUMENTATION IN THE WORKSHOP

Pictures of panel / glass in transmitted light



Lighting: photoflash "Multiblitz"

[All digital photos in this data sheet were recorded with an Olympus E3 reflex camera; object lens: Vario 12-60 mm]

Pictures of panel / glass in reflecting and raking light, internal and external surface



internal face



external face

Lighting condition: artificial light

Examination of the object (if possible with microscope)

The internal surface coated with BS 31 seems to be in a good condition. But several parts of the coating (thick application) look somewhat milky as if air bubbles were enclosed. Under microscope you can see crizzled areas.



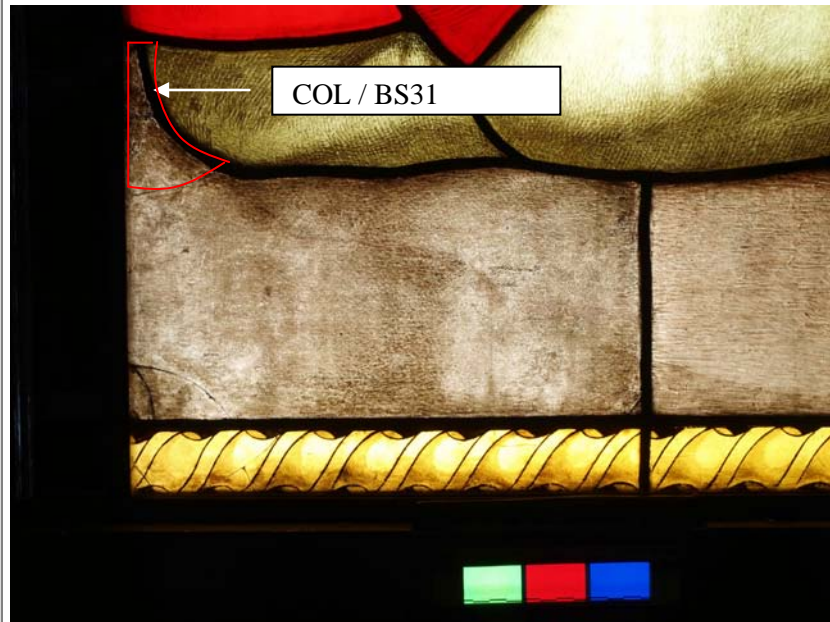
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Selected damages





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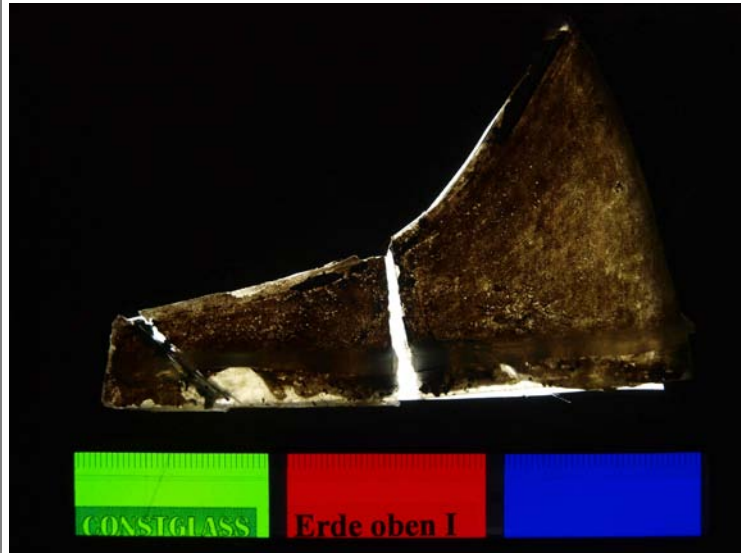


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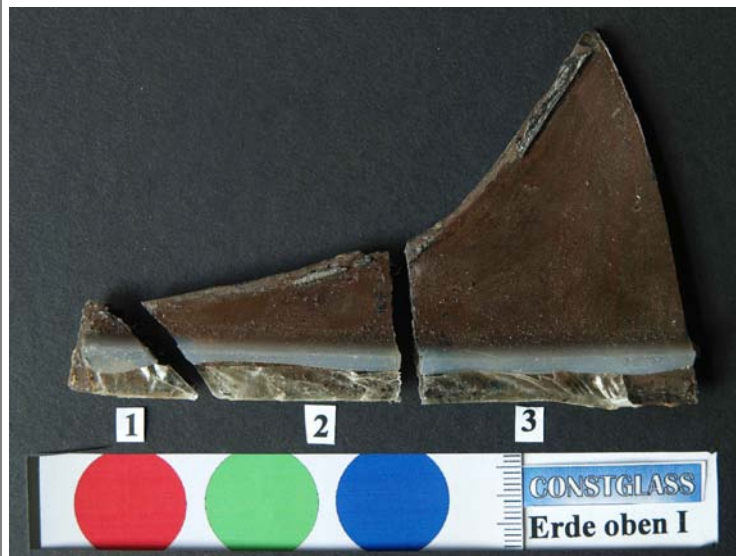


Selection and documentation of samples to be analysed

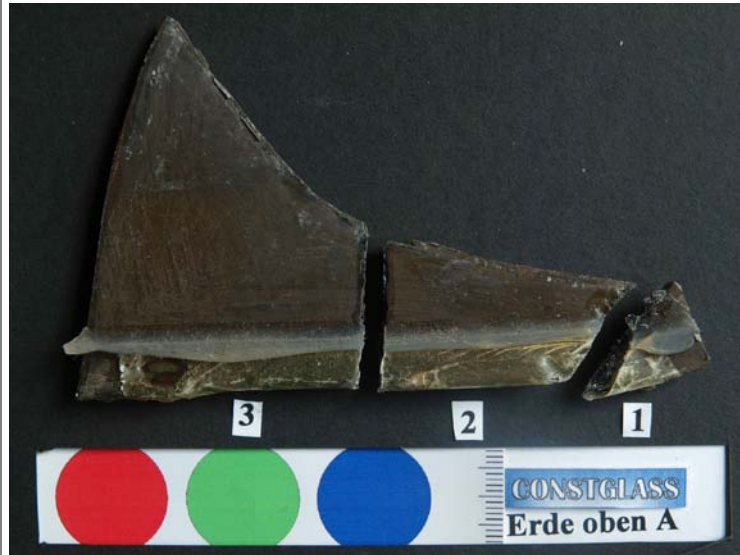
Conservators questions



internal face, transmitted light



internal face, reflected light



External face reflected light

sample no. 1: COL_BS31_1

sample no. 2: COL_BS31_2




sample no. 3: COL_BS31_3

Conservators Questions:

- What about the today's condition of the BS 31?
- How is the adhesion between glass and BS 31?
- Are the components of BS 31 mixed well?
- What about SH 1 in the cracks?
- Is there any reaction between SH 1 and BS 31?
- Can you detect and differentiate the various materials (glass / BS 31 / SH 1 / silicone)?
- What happened beneath the old adhesive tape?
- Are there any problems concerning the paint layer / the non-fired retouches?
- Is there any penetration of BS 31 into the paint layer?
- Is there any chance to remove the material without damaging the paint underneath?

Selection and documentation of areas for reversibility tests or reactivation tests

All 3 glass pieces can be used for the tests.

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RESPONSIBLE CONSERVATORS (name, phone, e-mail)	
Person 1	Dr. Ulrike Brinkmann phone: ++49/221/17940-365 e-mail: ulrike.brinkmann@dombau-koeln.de
Person 2	Hildegard Stocksiefen phone: ++49/221/17940-360 e-mail: hildegard.stocksiefen@dombau-koeln.de
Person 3	Carola Mueller-Weinitschke phone: ++49/221/17940-360 e-mail: carola.mueller-weinitschke@dombau-koeln.de
Person 4	Peter Berkenkopf phone: ++49/221/17940-360 e-mail: peter.berkenkopf@dombau-koeln.de