

## WALL PAINTINGS, SUNDARI CHOWK

Report of the Institute of Conservation (IoC), University of Applied Arts Vienna

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Fig. 1: Detail of the northern wall painting, 2013

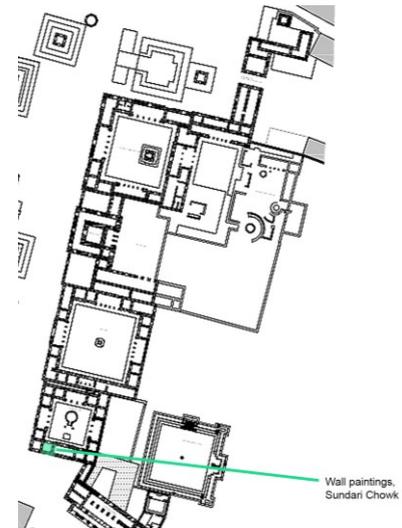


Fig. 2: Location within the Palace Complex

## Data Sheet

### Description

Sundari Chowk, one of the primary courtyards of the Royal Palace, houses elaborate wall paintings dating back to the 17th century. Located in a room on the second floor in the south-western corner of the building, they were only discovered in 1995, when loose lime wash, which was applied during the use of the building as police station (1959-1993), fell off the walls and revealed the underlying artwork. Both wall paintings are divided into four horizontal narrative bands, which are separated by ornamental friezes. Temples, processions, animal figures and gods are depicted. The preserved pictorial fragments witness the ability and skills of the artists working at the court of the Malla dynasty. Scientific and histochemical investigations of samples of the paintings and the underlying plaster layers identified materials and techniques used by the 17th-century Nepalese artists: the paintings were carried out in tempera technique a secco on a multi-layered mud plaster.

Prior to the conservation, the wall paintings showed extensive losses of both plaster and paint layers. The plaster was very fragile and flaking from the support in some areas. Secondary fillings applied in former restoration were too hard and the paintings were covered by overpainting and several layers of lime wash.

<b>Names</b>	-	
<b>Dated</b>	1647 (assumed)	
<b>Measurements (H x W x D)</b>	South wall (H x W)	197 x 240 cm
	North wall (H x W)	195 x 210 cm
<b>Materials/Technology</b>	Brick wall covered with (mud) plaster, secco painting	
<b>Interventions (IoC)</b>	Survey	2013
	Mapping	2022
	Sampling	2013
	Analyses	2013
	Conservation	2013
	Maintenance	2022
<b>Team (IoC)</b>	Gabriela Krist, Manfred Trummer, Marija Milchin, Veronika Loiskandl, Kathrin Schmidt, Katharina Fuchs, Barbara Rankl	
<b>Academic Research (IoC)</b>	-	

## Survey: Materials and Technology

- Supporting wall built of bricks
- Wall rendered with mud plaster composed of sheet silicates, quartz and plant fibres topped with a very smooth layer of fine mud mixed with plant fibres (traditional Nepalese plaster according to Cotte1999: first layer: cow dung, sandy mud, rice husks; second layer: sandy mud, cow dung, some clay added)
- White primer coat containing kaolin, lime and sheet silicates on mud plaster in base area
- Underpainting with red ochre in fresco technique
- Engraved lines in the upper part of the northern wall painting
- Original paint layers (one or two, in the base area partly seven) applied in secco technique: binding medium is animal glue with addition of drying oil (probably glue based tempera painting), identified pigments include carbon black, orpiment and red ochre
- Some layers containing synthetic cinnabar or synthetic ultramarine blue and can be thus dated after 1687 or after 1828 respectively



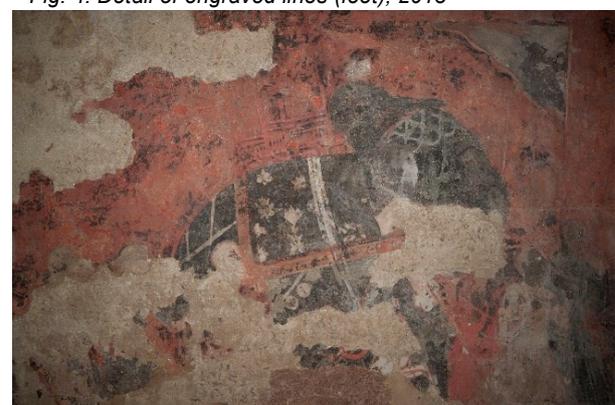
*Fig. 3: Underpainting with red ochre, 2013*



*Fig. 4: Detail of engraved lines (feet), 2013*



*Fig. 5: Detail of figurative paintings, 2013*



*Fig. 6: Detail of elephant with voids, 2013*

## Previous (Conservation) Interventions

Unknown	Application of secondary paint layers on both wall paintings
Unknown	Greyish overpaint on both wall paintings (on north wall only partly, on south wall nearly everywhere)
Before 1995	Repeated application of whitewash/lime wash (at least seven layers), presumably during the use of Sundari Chowk as police headquarter
1999	Conservation treatment of wall paintings (focus on north wall) by French conservator Sabine Cotte: mechanical removal of lime wash layers and grey overpaint (partly), cleaning with dimethyl formamide / xylene (50/ 50), injections with "Kill Germ" (wood protector), consolidation of flaking plaster with acrylic resin Paraloid B 72, fillings (plaster of Paris = gypsum mixed with pigments) within lacunae, retouching with watercolours, protection coating made of acrylic resin Paraloid B72 7% in xylene
2002	Wall paintings were focus of a restoration workshop carried out following the proposal of German conservator Heike Pfund; it is not further documented which measures were implemented and by whom

## Survey: Condition and Causes of Decay (2013)

- Loss of mud plaster and paint layers
- Flaking of the mud plaster from support
- Flaking and powdering of the paint layers
- Loss of coherence and adherence (to brick wall underneath and to adjacent original plaster) of secondary applied plaster surrounding the wall paintings, cracks within secondary plaster
- Insufficient secondary fillings (hard and compact)
- Changes in colour and brightness within the retouching



Fig. 7: Scratches within the painting, 2013



Fig. 8: Different kind of relining, 2013



Fig. 9, 10 and 11: Details of plaster of Paris, cracks, hollow areas and insufficient completion, 2013

### Survey: Condition and Causes of Decay (2022)

- Thick dust layer due to leaning wall (south wall) and protective glass screen open on both sides
- Cracks in the original and the secondary plaster applied by the IoC in 2013 due to earthquake 2015
- Hairline cracks in plaster and paint layer
- Deformation of plaster (south wall only), elevated risk of loss of original material due to hollow area underneath; location of damage close to surrounding secondary plaster
- Lacunae and missing parts of original plaster (levelling coat and finishing plaster) caused by loss of adhesion and cohesion (partly) and mechanical stress
- Hollow space, possibly caused by seismic vibrations (2015) and due to different properties of original plaster layers and surrounding secondary plaster leading to tensions within the structure
- Darkening: intense change in colour of surface, yellowing and browning of plaster and paint layer (depth of approx. 2 mm, sometimes more), no further investigation of causes (probably mould infestation or colour change of protective coating layers)
- Partial scaling: detachment of finishing plaster parallel to surface
- Loose edges of plaster and paint layer;
- Colour saturation: intensification of colour of a surface caused by humidity or by use of conservation materials (in the present case probably caused by aging consolidation media)
- Flaking: detachment of small amount of paint layer due to loss of adhesion (caused by physical influences e.g., humidity, possibly salt crystallization)
- Chalking (limited occurrence in retouched areas)
- Bleaching: chromatic change manifested as whitening of surface layers, occurring mainly in lower areas



Fig. 12: Cracks due to earthquake, 2022



Fig. 13: Deformation, 2022

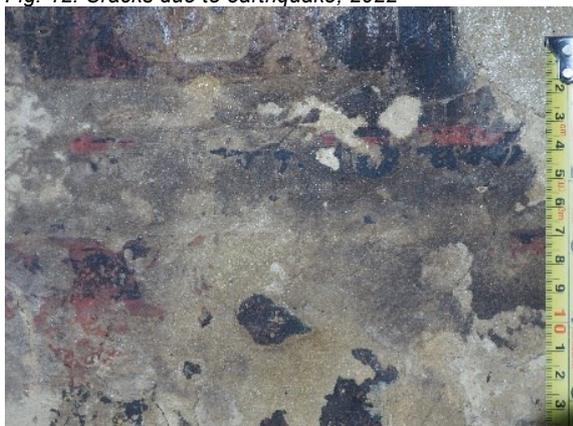


Fig. 14: Darkening, 2022



Fig. 15: Colour saturation of the fillings, 2022



Fig. 16: Thick dust layer, 2022

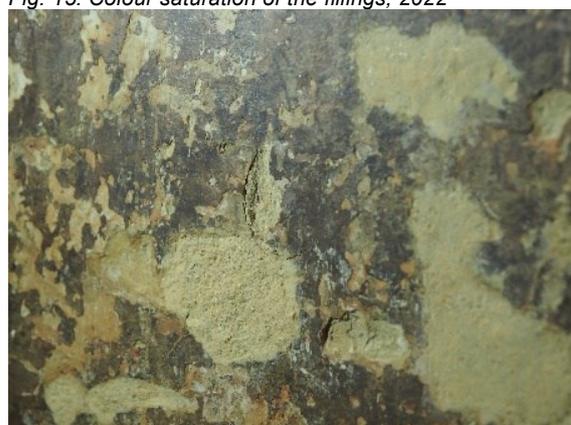


Fig. 17: Flaking of the edges (fillings and paint layers), 2022



Fig. 18: Glossy appearance of earlier applied coating, 2022

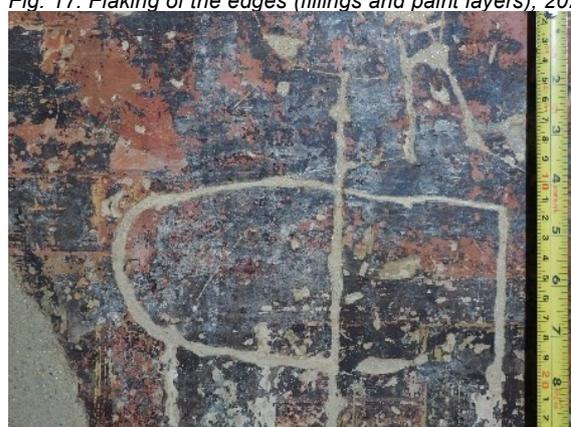


Fig. 19: Bleaching in some areas, 2022

## Conservation (IoC)

- 2013
- Removal of secondary paint layers, previous fillings, previous retouching, and of secondary plaster with spatulas, scalpels, brushes and glass fibre eraser; during the removal of the secondary plaster the adjacent wall painting was secured with Japanese tissue paper facings glued with hydroxypropyl cellulose Klucel EF in ethanol, the facings were then removed using ethanol
  - Pre-consolidation of flaking mud plaster and paint layers: plaster was consolidated with deionised water, Klucel EF and diluted sludge applied with brushes and syringes; paint layers were partly consolidated with Klucel EF in ethanol in different viscosities
  - Dry cleaning of wall painting with polyurethane sponges and brushes
  - Closing of holes within the brick wall around the wall paintings with bricks
  - Plastering of area surrounding the wall paintings with two different kind of plasters (first coarser and then finer plaster) without cow dung to avoid nitrate infiltration
  - Lacunae and cracks within the wall paintings were filled with a mortar (sieved for shallow lacunae and small cracks)
  - Consolidation of south wall painting: application of a thin layer of Klucel EF in ethanol with brushes
  - Retouching of fillings in the paintings with water colours
  - Retouching of newly added plaster with sludge and gouache colours (in order to match the earthen hue of the historical plaster)

### Conservation Materials\* and Recipes used:

- hydroxypropyl cellulose Klucel EF
- Ethanol
- Water colours
- Gouache colours

### Coarse plaster: 1 vol. part red mud : 1 vol. parts black mud : 1 vol. part sand : 2 vol. parts rice husks (adding water)

- Mud (local)
- Sand (local)
- Rice husk (local)

### Fine plaster: 1 vol. part red earth : 1 vol. parts black mud : 1 vol. part sand (adding water)

- Red earth sieved (local)
- Mud (local)
- Sand (local)

### Filling mortar: 1 vol. part sand : 1 vol. part red mud (adding water, partly sieved)

- Sand sieved (local)
- Red mud (local)

\* Product / technical data sheets can be found in the supplement [A]

- 2022
- Dry cleaning of the surrounding plaster with Akapad-sponges
  - Dry cleaning of the original surface with soft brushes and Wallmaster-sponge and polyurethane (PU) sponges
  - Disinfection of the surface with ethanol/water-mixture (ratio 70:30) for containment of possible mould contamination of the plaster, not applied on areas with remaining paint layer due to solubility
  - Reduction of colour saturation by treatment with ethanol applied with cotton swabs
  - Filling of cracks with mortar
  - Removal and renewal of instable old infills
  - Repair of loose edges of plaster and paint layer with filling mass
  - Consolidation of hollow spaces with injection grout (where possible)

- Retouching of old infills with *acqua sporca* mixture

**Conservation Materials\* and Recipes used:**

- Ethanol
- Water colours

**Mortar: 1.5 vol. parts sand : 2 vol. parts binding media (3 vol. parts clay : 1.5 vol. parts lime powder (adding water)**

- Sand sieved (local)
- Yellow clay (local)
- Lime powder (adhesive for brighten up the colour produced from hydrated lime after carbonation)

**Injection grout (coarse): 1.5 vol. parts sand : 2 vol. parts clay : 0.5 vol. parts lime powder (adding water)**

- Sand sieved (local)
- Yellow clay (local)
- Lime powder (adhesive for brighten up the colour produced from hydrated lime after carbonation)

**Injection grout (fine): 1 vol. part sand : 1 vol. part red mud (adding water, partly sieved)**

- Sand sieved (local)
- Red mud (local)

\* Product / technical data sheets can be found in the supplement [A]



Fig. 20: Consolidation, 2013

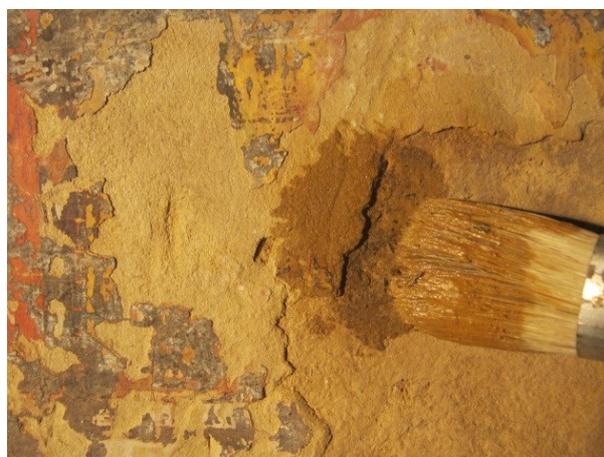


Fig. 21: Different kinds of relining, 2013



Fig. 22, 23 and 24: Mixing the fillings with mud, retouching and consolidation, 2013



*Fig. 25: Dry cleaning of surface, 2022*



*Fig. 26: Consolidation of flaking paint layer, 2022*



*Fig. 27: Edge repair, 2022*



*Fig. 28: Injection grout, 2022*



*Fig. 29: Retouching of old infills, 2022*

## Before and after Conservation



*Fig. 30: South wall before conservation, 2013*



*Fig. 31: South wall after conservation, 2013*



*Fig. 32: South wall before maintenance/conservation, 2022*



*Fig. 33: South wall after maintenance/conservation, 2022*



*Fig. 34: North wall before conservation, 2013*



*Fig. 35: North wall after conservation, 2013*



*Fig. 36: North wall before maintenance/conservation, 2022*



*Fig. 37: North wall after maintenance/conservation, 2022*

## List of Publications / Reports

Loiskandl, Veronika, Lattanzi, Stella, and Tanushree Gupta. 2017. "The Conservation of the Wall Paintings at Sundari Cok." In *Nepal Patan Palace. The Restoration of Sundari Cok. 2006-2016*, edited by Niels Gutschow and Raju Roka, 329-332. Vajra Books: Kathmandu

Lattanzi, Stella. 2013. *Gefasste Holzbalken und Wandmalerei im königlichen Palast von Patan, Nepal. Naturwissenschaftliche Untersuchungen*. Unpublished report, University of Applied Arts Vienna.

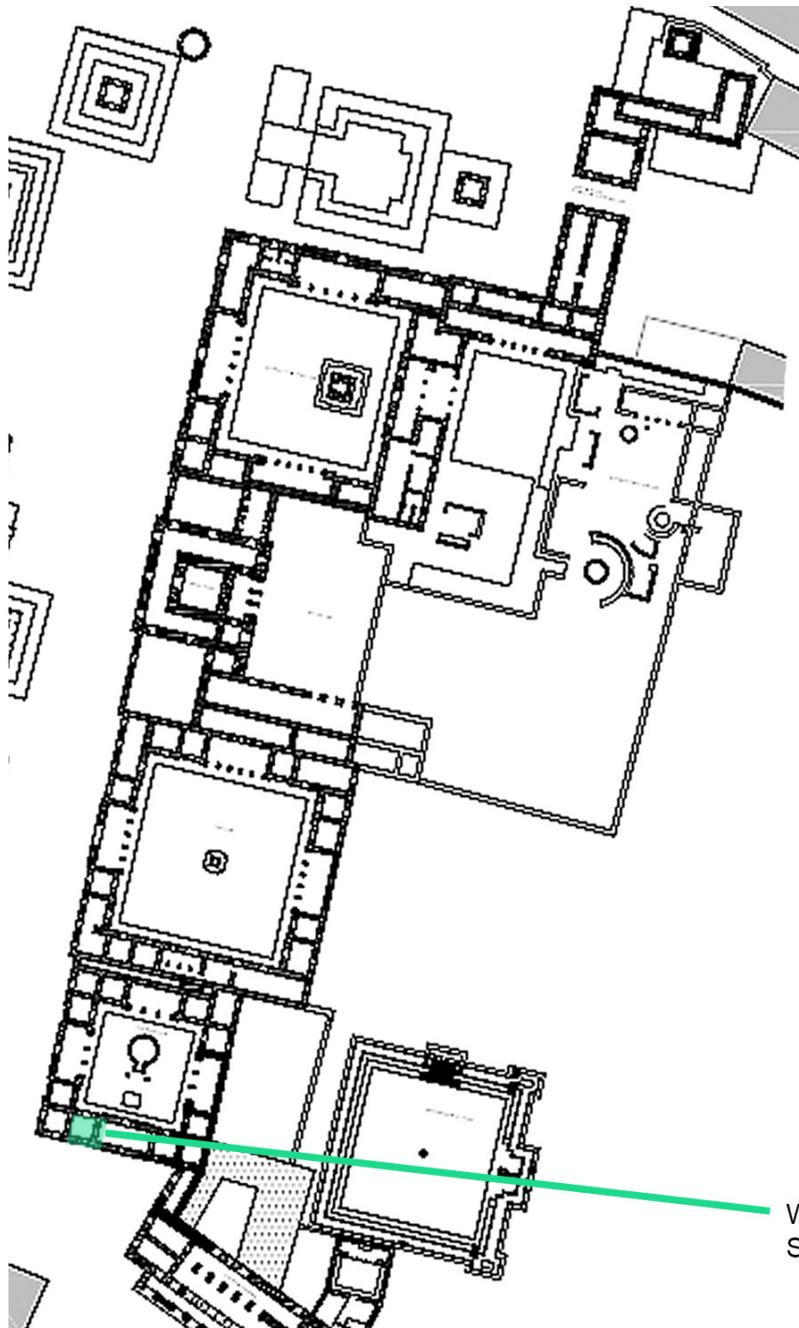
## Supplements

[A] All product / technical data sheets can be found in this additional document.

## Photo Credits

Unless otherwise stated, all photographs © Institute of Conservation, University of Applied Arts Vienna

GENERAL INFORMATION		
<b>Monument</b> Wall paintings Sundari Chowk (South Wall)	<b>Orientation</b> North Wall South Wall	<b>Size (H x L x W)</b> South wall 197 x 240 cm North wall 195 x 210 cm
<b>Date of Production</b> -	<b>Location</b> Sundari Chowk, Royal Palace	
<b>Date of the last Treatment</b> Conservation 2013; Maintenance 2022	<b>Institutions of the last Treatment</b> IoC	



Wall paintings,  
Sundari Chowk

Condition Assessment			
<b>Date of Evaluation</b> May 2024		<b>Evaluation done by</b> Fabian Sever Sarah Moyschewitz	
<b>Recent Damages:</b>			
<input type="checkbox"/> Lacunae and missing parts of original plaster  <input checked="" type="checkbox"/> Not detected	<input type="checkbox"/> Major <input type="checkbox"/> Medium <input type="checkbox"/> Minor		
Comment:			
<input type="checkbox"/> Changes in colour and brightness of retouching  <input checked="" type="checkbox"/> Not detected	<input type="checkbox"/> Major <input type="checkbox"/> Medium <input type="checkbox"/> Minor		
Comment:			
<input checked="" type="checkbox"/> Cracks in original plaster / in  <input type="checkbox"/> Not detected	<input type="checkbox"/> Many <input checked="" type="checkbox"/> Some <input type="checkbox"/> Few		
		Some of the cracks may be recent as they run through fillings that were - presumably - done in 2022	
Comment:			
<input checked="" type="checkbox"/> Lose parts / Loss of plaster / loss of paint layers  <input type="checkbox"/> Not detected	<input type="checkbox"/> Many <input type="checkbox"/> Some <input checked="" type="checkbox"/> Few		
Comment:			
<input checked="" type="checkbox"/> Loss of coherence and adherence  <input type="checkbox"/> Not detected	<input checked="" type="checkbox"/> detachment of paint layer	<input type="checkbox"/> Many <input checked="" type="checkbox"/> Some <input type="checkbox"/> Few	It cannot be said with certainty, if detachment of paint layers present are recent

Comment:

<input type="checkbox"/> Flaking, Powdering of paint layers  <input checked="" type="checkbox"/> Not detected	<input type="checkbox"/> Major <input type="checkbox"/> Medium <input type="checkbox"/> Minor	

Comment: Cannot be determined through visual inspection through the glass

<input type="checkbox"/> Biological Colonization  <input checked="" type="checkbox"/> Not detected	<input type="checkbox"/> Microbiological Growth	<input type="checkbox"/> Major	
		<input type="checkbox"/> Medium	
		<input type="checkbox"/> Minor	
	<input type="checkbox"/> Mosses	<input type="checkbox"/> Major	
		<input type="checkbox"/> Medium	
		<input type="checkbox"/> Minor	
	<input type="checkbox"/> Higher Plants	<input type="checkbox"/> Major	
		<input type="checkbox"/> Medium	
		<input type="checkbox"/> Minor	

Comment:

<input type="checkbox"/> Mechanical Damage  <input checked="" type="checkbox"/> Not detected	<input type="checkbox"/> Abrasion	<input type="checkbox"/> Major	
		<input type="checkbox"/> Medium	
		<input type="checkbox"/> Minor	
	<input type="checkbox"/> Other	<input type="checkbox"/> Major	
		<input type="checkbox"/> Medium	
		<input type="checkbox"/> Minor	

Comment:

<input type="checkbox"/> Salt Deterioration  <input checked="" type="checkbox"/> Not detected	<input type="checkbox"/> Efflorescence	<input type="checkbox"/> Major	
		<input type="checkbox"/> Medium	
		<input type="checkbox"/> Minor	
	<input type="checkbox"/> Subflorescence	<input type="checkbox"/> Major	
		<input type="checkbox"/> Medium	

Minor

Comment:

Soiling

Heavy

Not detected

Medium

Dusty

Light

Comment:

Deformation of plaster

Heavy

Not detected

Medium

Light

Comment:

Other

Comment:

**Evaluation of the Condition**

- good (no need for treatment)
- satisfactory (some minor treatments necessary)
- unsatisfactory (major conservation measures necessary)

**Conclusion**

Due to the glass panel in front of the paintings it was neither possible to take good quality photographs nor conduct a proper evaluation of the wall paintings.

By visual inspection, some cracks and detachment of paint layers could be seen. It cannot be determined, if the cracks were filled during last conservation, or if they are recent. Some of the retouchings are dark on the edges, it is assumed that they were made prior to the 2022 conservation of the IoC.

**PHOTO DOCUMENTATION**

**Condition at Evaluation Date**



Fig. 3: North wall, overview.



Fig. 2: South wall, overview.

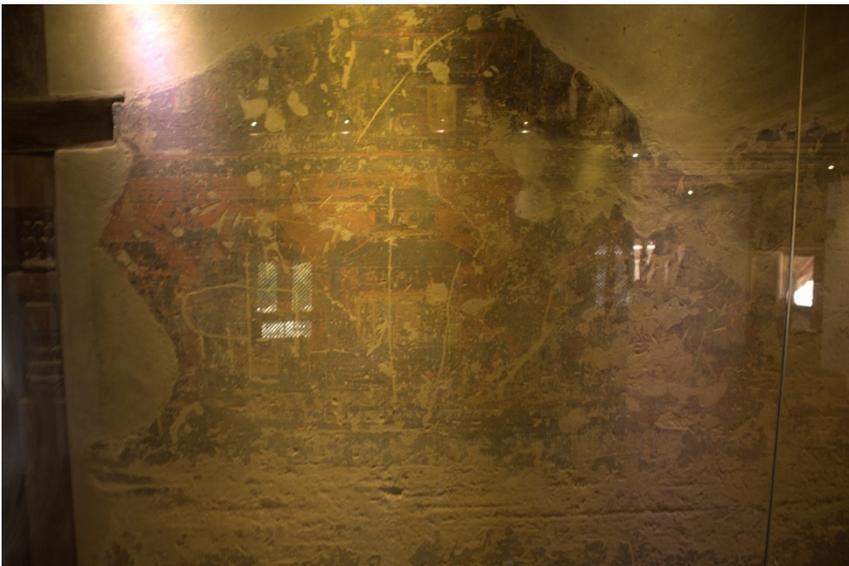


Fig. 1: South wall, close up.



Fig. 5: South Wall, Detail with cracks and fillings (cracks-yellow arrow, fillings-blue arrow).



Fig. 4: South Wall, fragment surrounded by different fillings. Some cracks visible between wall and painting (arrows).

## [A] Product Data Sheets – Links<sup>1</sup> to Suppliers/Manufacturers

AEROSIL® 200

[https://products.evonik.com/assets/or/ld/AEROSIL\\_200\\_TDS\\_DE\\_DE\\_TDS\\_PV\\_52043839\\_de\\_DE\\_WORLD.pdf](https://products.evonik.com/assets/or/ld/AEROSIL_200_TDS_DE_DE_TDS_PV_52043839_de_DE_WORLD.pdf)

Aviva Silikat Grundierung

[https://www.adler-lacke.com/Canto/tmb/aviva-silikat-grundierung\\_tmb\\_4079\\_de.pdf](https://www.adler-lacke.com/Canto/tmb/aviva-silikat-grundierung_tmb_4079_de.pdf)

Alkylbenzyltrimethylammonium chloride

<https://www.sigmaldrich.com/AT/en/sds/mm/8.14858?userType=anonymous>

KluceI™ EF

<https://www.kremer-pigmente.com/elements/resources/products/files/63701-63713.pdf>

Aviva Tirokat-Color, Adler

[https://www.adler-lacke.com/Canto/tmb/aviva-tirokat-color\\_tmb\\_4087\\_de.pdf](https://www.adler-lacke.com/Canto/tmb/aviva-tirokat-color_tmb_4087_de.pdf)

Mixtion Le Franc, Kremer

<https://shop.kremerpigments.com/elements/resources/products/files/98000e.pdf>

Waxes, Deffner und Johann

[https://deffner-johann.de/media/datasheets/4186000/EN/Zusatzinformation\\_Wachse\\_DE\\_DJ.PDF](https://deffner-johann.de/media/datasheets/4186000/EN/Zusatzinformation_Wachse_DE_DJ.PDF)

Injection mortar HFX

[https://productdata.hilti.com/APQ\\_HC\\_RAW/ASSET\\_DOC\\_7567931.pdf](https://productdata.hilti.com/APQ_HC_RAW/ASSET_DOC_7567931.pdf)

Kölner Classic Ölmixtion 3h; 12h; 24h

<https://www.kolner-vergolderprodukte.de/produkte/koelner-oelmixtion/>

KSE 500 E

[https://media.remmers.com/celum/export/documents/Remmers\\_0715\\_KSE-500-E-\\_Technisches-Merkblatt\\_de\\_DE\\_26355.pdf](https://media.remmers.com/celum/export/documents/Remmers_0715_KSE-500-E-_Technisches-Merkblatt_de_DE_26355.pdf)

Lascaux 498 20 X acrylic adhesive

[https://deffner-](https://deffner-johann.de/media/datasheets/2051100/DE/2051100_Technisches%20Datenblatt_Lascaux%20Acrylkleber%20498%2020%20X_DE_DJ.pdf)

[johann.de/media/datasheets/2051100/DE/2051100\\_Technisches%20Datenblatt\\_Lascaux%20Acrylkleber%20498%2020%20X\\_DE\\_DJ.pdf](https://deffner-johann.de/media/datasheets/2051100/DE/2051100_Technisches%20Datenblatt_Lascaux%20Acrylkleber%20498%2020%20X_DE_DJ.pdf)

Marble dust

[https://www.kremer-pigmente.com/elements/resources/products/files/58500-58580\\_59001-59690.pdf](https://www.kremer-pigmente.com/elements/resources/products/files/58500-58580_59001-59690.pdf)

Natural hydraulic lime

<https://www.preservationworks.us/wp-content/uploads/2019/10/NHL-Datasheet-Lafarge-23.5.pdf>

Plextol B-500 (acrylic dispersion)

[https://deffner-](https://deffner-johann.de/media/datasheets/2556500/DE/2556500_Technical%20Data%20Sheet_Acrylic%20Dispersion%20B%20500_EN_DJ.pdf)

[johann.de/media/datasheets/2556500/DE/2556500\\_Technical%20Data%20Sheet\\_Acrylic%20Dispersion%20B%20500\\_EN\\_DJ.pdf](https://deffner-johann.de/media/datasheets/2556500/DE/2556500_Technical%20Data%20Sheet_Acrylic%20Dispersion%20B%20500_EN_DJ.pdf)

Primal® SF 016

[https://deffner-](https://deffner-johann.de/media/datasheets/2543001/DE/2543001_Technical_Data_Sheet_Primal_SF_016_DJ_EN.pdf)

[johann.de/media/datasheets/2543001/DE/2543001\\_Technical\\_Data\\_Sheet\\_Primal\\_SF\\_016\\_DJ\\_EN.pdf](https://deffner-johann.de/media/datasheets/2543001/DE/2543001_Technical_Data_Sheet_Primal_SF_016_DJ_EN.pdf)

AKEPOX® 2010

[https://data.akemi.de/fileadmin/user\\_upload/products/productdocuments/TMB/Akepox\\_2010\\_TMB\\_D.pdf](https://data.akemi.de/fileadmin/user_upload/products/productdocuments/TMB/Akepox_2010_TMB_D.pdf)

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<sup>1</sup> All links were last accessed on 13 May 2025.

EPO-TEK® 301-1

<https://www.epotek.com/docs/en/Datasheet/301-1.pdf>

Titebond Wood Glue

<http://sds.franklini.com/msds/1411.042k0nmo0020.pdf>

Paraloid™ B-72, Kremer

<https://www.kremer-pigmente.com/elements/resources/products/files/67400-67409.pdf>

Keim Granital®

[https://www.keim.com/documents/de-AT/723/TM\\_Granital\\_DE-AT.pdf](https://www.keim.com/documents/de-AT/723/TM_Granital_DE-AT.pdf)