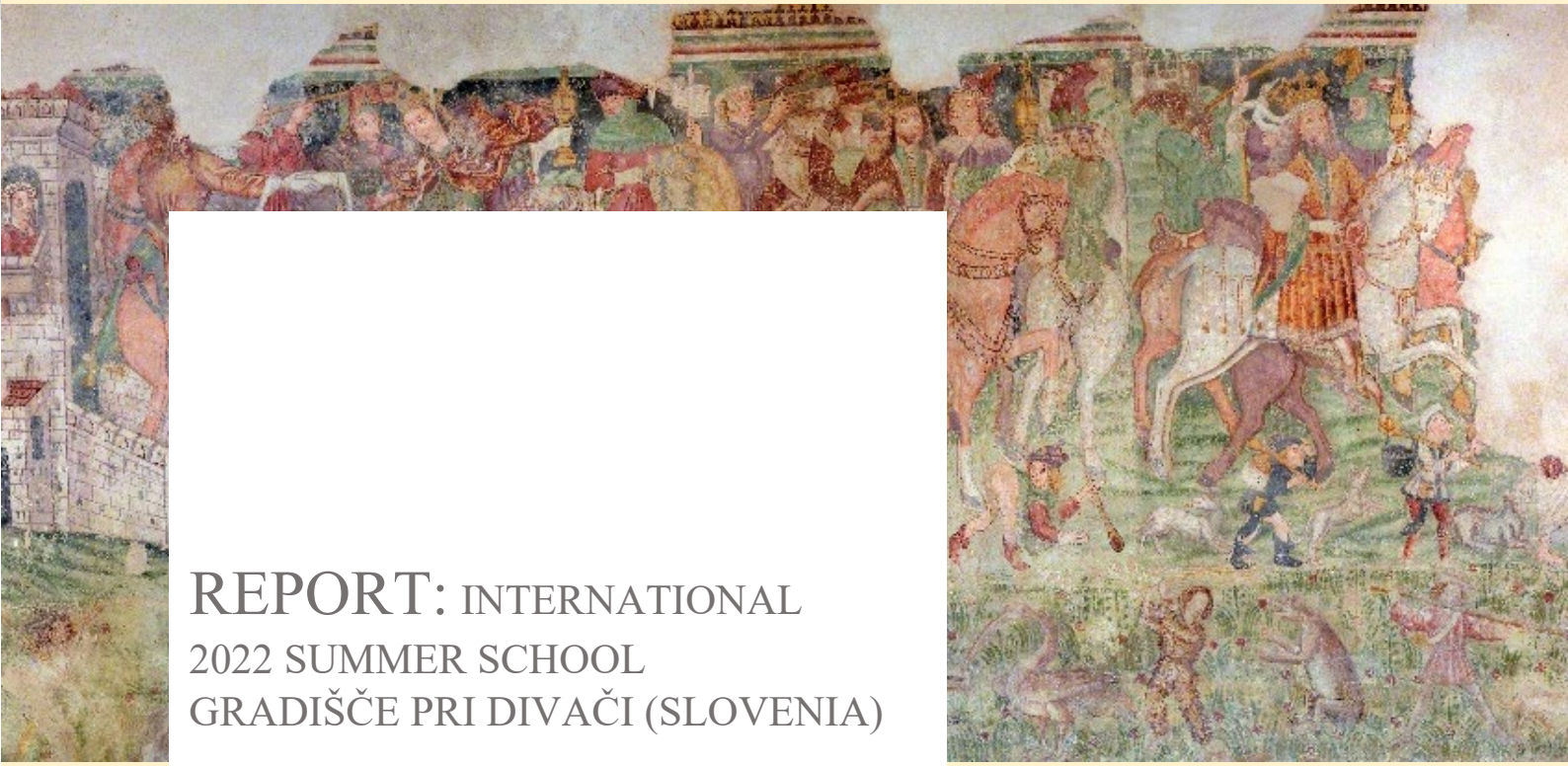
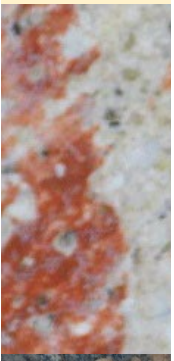


REPORT: INTERNATIONAL 2022 SUMMER SCHOOL GRADIŠČE PRI DIVAČI (SLOVENIA)

31st of August to 14th of September 2022

CHURCH OF ST. HELEN
CONSERVATION-RESTORATION OF WALL PAINTINGS



VOLUME 2
FINAL REPORT

Organizers of the Summer School: Alberto Felici, Ajda Mladenović, Anita Kavčič Klančar, Jelka Kuret, Marta Bensa, Minka Osojnik, Andrej Jazbec, Katja Kavkler, Anka Batič, Neva Pološki, Suzana Damiani.

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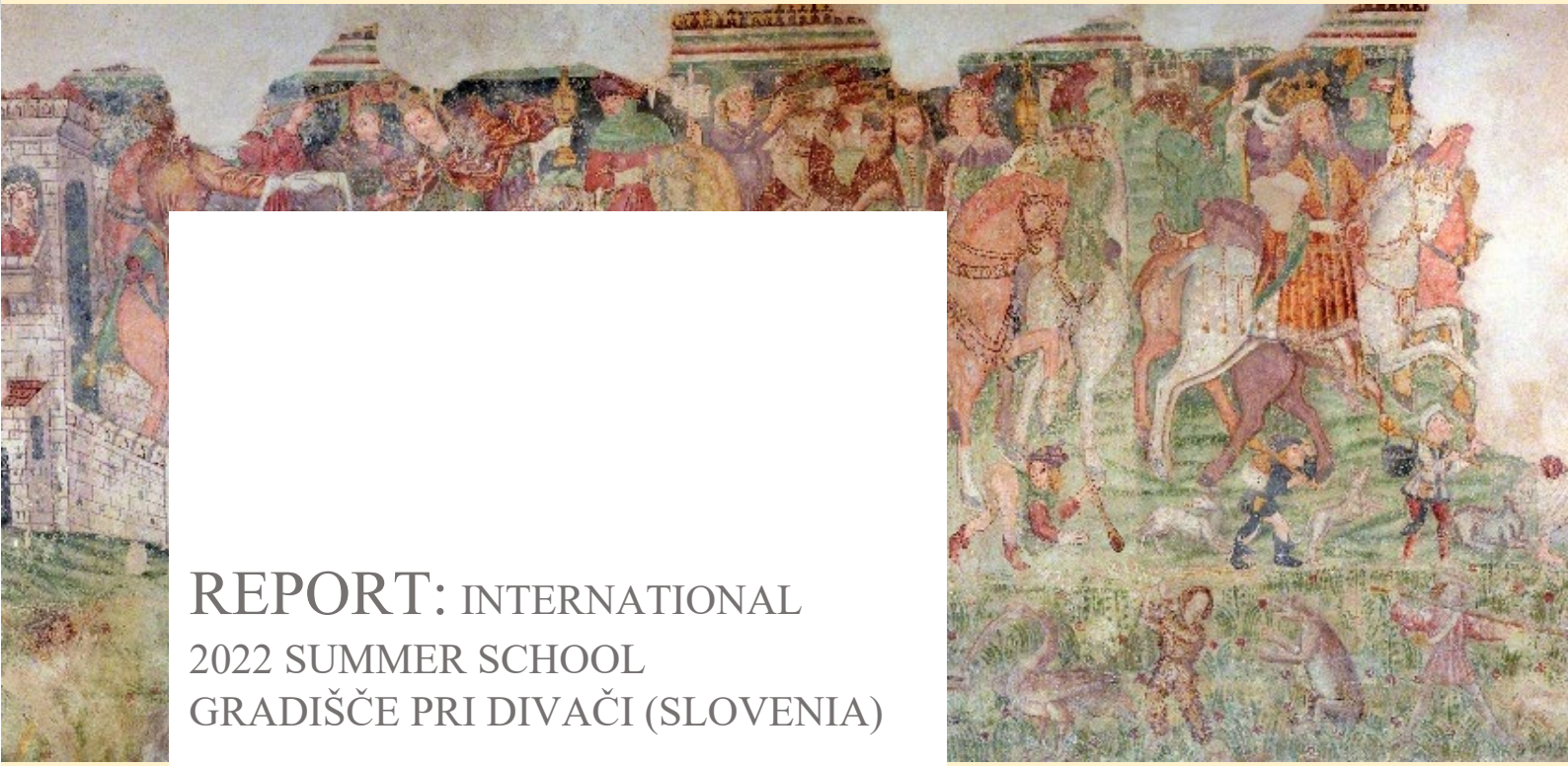

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Contents

1. Introduction

The International Summer School is a three-year project, running from 2021 to 2023. The aim is to develop and implement a conservation plan for the preservation of the medieval wall paintings in the Church of St. Helen in Gradišče pri Divači, Slovenia.

The 2022 workshops consisted of online theoretical lessons and practical work on site, regarding the methodology and approach to the conservation of wall paintings, with a special focus on the cleaning process. The church represents an ideal case study for the implementation of an interdisciplinary approach to the conservation process, useful for both students and professionals working in the field of decorated architectural surfaces.

The wall paintings in the Church of St. Helen were executed around 1490 (Osojnik, 2021, p. 13). The author is unknown. It is believed that they were painted by an assistant or associate of the painter Johannes from Kastav (Janez iz Kastva) (Osojnik, 2021, S. 14). The wall paintings were discovered under a whitewash in the 1950s and uncovered and restored in 1966-67 (Osojnik, 2021, S. 14). The iconographic composition in the nave includes the *Annunciation* on the triumphal arch (only two small fragments preserved), scenes from the *Passion of Christ* on the south wall (Osojnik, 2021, S. 14), fragments on the west wall (Jesus rides on a donkey into the city of Jerusalem and of the *Last supper*) (Osojnik, 2021, S. 15) and the *Journey and the Adoration of the Magi* on the north wall, supplemented by scenes of people's daily lives of the period as well as some animal anecdotal motives (Osojnik, 2021, p. 16).

1.1 Short summary of the 2021 Summer School

The 2021 Summer School lasted for four weeks. In the first preparatory week, which took place online, all project partners were introduced. This was followed by a presentation of the site and history of the church of St. Helen, wall painting monuments of the Karst region and Slovenia as a whole and techniques and materials of Slovenian wall paintings. The second part of the lectures addressed more technical and methodological aspects of wall paintings conservation:

- preparation and execution of a graphic documentation,
- lectures on the methodological and interdisciplinary approach for the wall paintings conservation,
- data collection and data management,
- making of a visual glossary,
- scientific research for the study of wall paintings,
- environmental monitoring and condition of the church.

The second and third week of the 2021 Summer School took place on site. The practical work on the wall paintings in the church in Gradišče included:

- observation and evaluation of the condition of the wall paintings,
- description and mapping of painting materials and techniques,
- assessment of the state of conservation,

- optical analysis of the paintings including scientific investigations with non-invasive and partially invasive analyses,
- cleaning and consolidation trials,
- documentation, compiling a visual glossary and graphic documentation.

The fourth week was again held online, with students working on completing the graphic documentation and their own summaries of the practical work. The on site work and the additional online lessons resulted in the report "Condition assessment of the wall paintings and proposal for a conservation treatment" which is the guideline of this year's Summer School.

1.2 The aim of the 2022 Summer School

The aim of the 2022 Summer School was to continue the activities of the 2021 Summer School by carrying out cleaning and consolidation trials in some areas of the wall paintings in Gradišče, to find the most suitable methods for cleaning and consolidation interventions. The latter will be carried out by the Institute for the Protection of the Cultural Heritage of Slovenia (IPCHS) in the next few months. However, as the cleaning trials already took some time due to the complex initial situation (cf. 2.3), no consolidation trials could be carried out during the 2022 Summer School.

1.3 Program and organization of on site work

This year's on site activities consisted of one week of practical work, lasting from 5th to 9th of September. The program included:

- presentations, held by the professors;
- discussion of the analytical investigations, carried out so far;
- observation of technical aspects and materials, former interventions, and decay phenomena of the wall paintings;
- practical work on site;
- preparation of a draft of a final evaluation report for the conservation-restoration of the wall paintings;
- presentation of the work carried out during the Summer School to the interested public, professionals, local community and media.

Before the beginning of the 2022 Summer School a team of IPCHS conservators led by Anka Batič carried out the cleaning of wall paintings with distilled water through Japanese paper and first trials for removal of residues on the surface (dirt, salts, etc.). Trials were carried out mainly on the north wall.

Students were divided into five groups, consisting of one professor/professional and two to three students. Each group was assigned a specific location on either the north or south wall of the church (see: Fig. 1, 2). The areas were strategically selected so each group had to address different areas of deterioration phenomena. These areas were left untouched during the conservation-restoration process carried out in 2021 and 2022.

Figure 1: North wall. Areas, selected by students for cleaning and several trials.

Figure 2: South wall. Areas, selected by students for cleaning and several trials.

First, the state of preservation of the church was assessed by the naked eye and digital microscopy. The results were compared with information from last year's Summer School, including observation of the church's exterior. We focused on information about the materials,[1] construction methods of the church, previous renovations and conservation and restoration treatments.

[1] The masonry consists of **limestone,** probably of local origin, worked as ashlars (Felici, 2021, p. 18). Inside the church, the masonry is plastered with several layers of plaster (rinzaffo, preparatory arriccio and an intonaco), which differ in appearance and thickness (Felici, 2021, p. 18). The plaster is made of **calcite binder with silicate aggregate** (Kavkler, 2021, p.35). The wall paintings on the intonaco are painted in a mixed technique that could be named **"mezzo fresco"** (buon fresco with extensive whitewash and secco finishings) (Felici, 2021, p. 18). As pigments could be identified with Raman spectrometers and XRF analyses: **haematite** (possibly in some areas caput mortuum), **goethite, green earths, magnetite, carbon black, quartz, calcite, kaolinite and vermilion.** Additionally, **copper** was identified in one area (possibly revealing the presence of malachite) (Kavkler, 2021, p. 35). **Proteins** were identified in two samples too, both extracted from green areas showing presence of proteins in plaster layers and in paint layers. It is not clear whether they are original or from a previous intervention (Kavkler, 2021, p.35). Furthermore, the following materials are present on the interior walls today,

One afternoon, Dr. Katja Kavkler from the Natural Science Research Department of the Institute for the Protection of Cultural Heritage of Slovenia joined us and conducted an investigation using portable Raman spectroscopy. We discussed and interpreted the results of the investigations already carried out in the previous years and monitoring done with data loggers over a longer period of time.

Lectures and practical demonstrations by Alberto Felici were given on site to deepen the knowledge of porosity and overall approach to the treatment, especially the cleaning of porous inorganic materials. After the lecture, the students were divided into groups previously described and assigned to a specific working area for the week. Before starting any practical work, students examined the state of conservation in detail and mapped additional signs of deterioration phenomena in their assigned area. The stability of different colours was assessed (cohesion assessment). A water cleaning of the entire area was then carried out.

Following the water cleaning procedure, the groups carried out a variety of different trials, using active components (ammonium carbonate and bicarbonate) with or without supporting agents (Arbocel, Sepiolite). Groups also used chelating agents (TAC, EDTA, DTPA), applying different methodologies and using various thickening agents (agar, silica gel) and did tests with anionic exchange resins. The cleaning trials were evaluated daily, especially after a drying phase period. Based on the results of the previous treatments, further cleaning methods were carried out, including laser treatment which was performed by professors.

In addition to the field-work and lectures, the students visited the town of Piran and a worksite in Dolenja vas.

On the last day of on site activities, more cleaning trials were conducted. In the afternoon, two students presented the results of the 2022 Summer School to the interested public, professionals, local community and media in the conference room in Famlje. After the presentation, the previously carried out cleaning trials were evaluated and the work on site was completed.

which have formed over the course of time or have been added: **Salts, dirt, limewash/whitewash residues, Yellowing and wax residues. A white veil (salts?) and brown spots** are present too but not (yet) identified (cf. report Sommer School Gradišče 2021, annex 3 "Visual glossary", and number 2 in this report).

2. Assessment of the state of Conservation of the wall paintings

The first step was to assess the state of conservation of the wall paintings and map the phenomena present. Then, the observations were compared using the report, mapping and visual glossary of the areas prepared by the students of the 2021 Summer School. To complete the visual assessment, photos of the wall were taken in frontal and raking light.

The following is a summary of observations made this year on the state of preservation of the wall paintings.

Compared to the observations from 2021 Summer School, the state of preservation of the Gradišče church and wall paintings has not changed significantly.

There are many signs of wall paintings deterioration due to environmental conditions. For example, the detachment of the plaster due to the high humidity and the transport of water-soluble salts, deterioration of the binder in the mortar and the paint layers. Prior to 2022 Summer School several treatments to prevent further deterioration were carried out, such as consolidation of the mortar and injection of grout where necessary. The ceiling of the church was also repaired in July 2022.

Monitoring of parameters such as humidity and temperature inside the church was measured with data loggers during 2021-2022. There were four data loggers, placed on the upper part in the middle of each wall (north, south, east, west side of the wall) (Image gra_csh_nw_a_vis_20220913). Comparing the data for the winter of 2021 with the data for the winter of 2022, Dr. Katja Kavkler noticed that the air inside the church was drier and warmer in the winter of 2022 than in 2021. It would be interesting to compare the climate data of the Karst region and the interior of the church over several years to determine whether the change is due to drier seasons or to interventions undertaken on the church (roof repairment, drainage).

Current deterioration phenomena have not increased in the past year. The major current phenomena include limewash/whitewash residues, white veil (on all walls), darkening, yellowing and very localized wax residues. Some areas show additional loss of adhesion, mostly on the north wall. In general, however, the plasters as well as the paint layer remain stable.

The phenomena of deterioration of the paint layer due to human activity is characterized by the presence of abrasion[2] (picture gra_csh_nw_dp_vis_20220906) probably caused by the mechanical action during the removal of the whitewash layer.

Other deterioration phenomena have been discovered and mapped this year. We observed traces of injection grout, used in conservation-restoration process in 2021 to improve the adhesion of plaster. Very localized flaking of the paint layer was observed in the lower zones of the north and south wall. This year, the traces of past restoration retouching (picture

[2] See page 21 of Visual glossary from 2021.

gra_csh_nw_dp_vis_20220907) on the surface of limewash residues[3] (located on the north wall near the entrance) was discovered (picture gra_csh_nw_dp_vis_20220908).

To summarize, there are five major deterioration phenomena:

- white veil[4] (picture gra_csh_sw_dp_vis_20210813_3),
- yellowing[5] (picture gra_csh_sw_dp_vis_20220912 right) on the surface of the painting,
- wax residues (picture gra_csh_sw_dp_vis_20220912 left),
- brown spots and
- limewash/whitewash residues.

The main objective of this year's Summer School and the conducted cleaning trails was to find a suitable method and sequence for cleaning and removal of the above-mentioned deterioration phenomena.

2.1 Raman spectroscopy analyses

In order to evaluate the presence of materials on the treated and untreated areas (work done during the 2021 Summer School) and cleaning trials done by Anka Batič before the start of 2022 Summer School, Dr. Katja Kavkler (IPCHS RC) carried out new investigations using Raman spectroscopy.[6] This analysis provided information about the effectiveness of the previous cleaning trials, i. e. whether the cleaning process removed or reduced the presence of salts on the surface. Unfortunately, the results were inconclusive – except that cleaning with anion exchange resins removed nitrates from the surface.

The evaluation was performed on cleaned and uncleaned surfaces, to allow comparison. (picture gra_csh_nw_a_vis_20220908).

The results are very heterogeneous:

	Treated Area	**Untreated area**
Trial 1.01	**ammonium bicarbonate paste** calcium sulphate + calcium carbonate	-
Trial 1.02	-	very little amount of calcium sulfate, calcium carbonate

[3] See page 35 of Visual glossary.

[4] See page 41 of Visual glossary.

[5] See page 40 of Visual glossary.

[6] The Raman-spectroscopy is a non-destructive analytical tool that analyses scattered light, resulting in a molecular specific spectrum by giving information about the constituent molecules present on the surface.

Trial 1.03	-	very high amount of calcium sulfate
Trial 1.04	-	very high amount of calcium carbonate + calcium sulfate
Trial 1.05	-	little amount of calcium sulfate
Trial 1.06	**ammonium bicarbonate** no calcium sulfate	-
Trial 1.07	**ammonium bicarbonate** little amount of calcium sulfate	-
Trial 1.08	-	Protein in the plaster, no calcium sulfate
Trial 1.09	-	no calcium sulfate, organic material
Trial 1.10	**ammonium bicarbonate** calcium sulfate	-
Trial 1.11	**ammonium bicarbonate** calcium oxalate very stable and calcium sulfate	-
Trials 1.12	**ammonium bicarbonate** calcium sulfate	-

One possible conclusion that can be drawn from these analyses with Dr. Katja Kavkler is that the previously conducted cleaning trials did not result in a homogeneous and consistent removal of calcium sulphate from the surface of the wall painting.

2.2 Paint layer cohesion evaluation

To determine the stability of the paint layer, cohesion test was performed. This test provides information on cohesion strength of each colour that make up the paint layer and gives crucial information for determining the methodology for cleaning/removal methods, i.e., which materials to use, how to apply them, and how the surface should be treated afterwards (rinsing procedure, additional chemical or mechanical cleaning or removal of deposits).

The test was performed with cotton swabs dipped in distilled water. Slightly moistened swabs were rolled over the surface of each specific colour approximately 3-5 times.

The cohesion of each colour was tested on a predetermined small area, sometimes on surfaces with no visible deterioration, and sometimes on abraded areas. Each colour was tested with three swabs rolled over the same area in order to determine its stability under mechanical action or repeated wetting. If the swabs were stained, it would indicate a lack of cohesion.

Pigments residues were visible on some cotton swabs, but most of them were yellowish in colour, which was interpreted as dirt. As a general conclusion, the colours that showed poor cohesion were red, yellow, brown and very locally, green.

2.3 Cleaning issues

In order to achieve a uniform aesthetic presentation of the wall paintings and improve their legibility, it was determined that the following deterioration phenomena should be addressed:

- residues of limewash/whitewash,
- white veil,
- wax residues,
- yellowing.

These four different deterioration phenomena, which had already been treated during cleaning trials in the previous year, reacted differently to the same cleaning methodology and sequence on different areas of the wall painting.[7] Therefore, it was difficult to determine a common cleaning method for each of the four issues. In addition, the instability of the yellow, red, brown and green pigments as well as *secco* decorations (stencil) must be taken into account during cleaning, as they are partially fragile (especially along the frames and contours).

[7] These different reactions to the same cleaning methodology and sequence on different areas of the wall paintings is probably due to the different state of conservation of the walls. The main problem on the north wall is a very heterogeneous white veil. On the south wall, on the other hand, the white veil is hardly present, but residues of a limewash/whitewash, that are thicker, but also weaker than on the north wall. In addition, the painting layer on the south wall is generally weaker than on the north wall (cohesion problems of the yellow, red, brown and green pigments).

3. General cleaning criteria

When evaluating cleaning methods for the wall paintings of St. Helen in Gradišče, many factors must be considered. These include the materials that need to be removed, as well as the current state of conservation of the paintings and the properties of the support. To determine an appropriate cleaning method, parameters such as porosity and water absorption capacity of the support must be considered, as well as the working properties, performance criteria and possible health hazards of the cleaning agents.

Trials, conducted during the 2021 Summer School and later by IPCHS team, and the cohesion assessment were very useful. Their results were used as guidelines for cleaning trials, carried out in September 2022.[8]

The methodological approach of the cleaning trials was to start with a less invasive method and gradually increase the level of chemical and physical action to achieve a satisfactory cleaning effect.

Figure 3: Application of a single layer of Japanese paper

Figure 4: Surface after removal of Japanese paper and rinsing with a moistened cotton swab

[8] For further information, see the report of 2021 Summer School.

4. Cleaning tests

As a preparatory step, the areas assigned to the students were first cleaned with distilled water, applied with a sponge through one layer of Japanese paper. This step was repeated until the residue water was clear enough to proceed with the cleaning tests. The surface was then cleaned with cotton swabs. The result were brighter, more vibrant colors, but the white veil and limewash/whitewash residues were not reduced.

Each day, the results of the cleaning trials were summarized and discussed to evaluate the effectiveness and reliability of each test and to determine how to proceed. Frontal and raking light were used for evaluation, as well as UV light, Dino-lite and head magnifiers to determine the effectiveness of the cleaning and whether residues of the cleaning agent were present.

4.1 Materials

4.1.1 Distilled water

Distilled water was applied in the form of poultices and as a rigid gel in the following compositions:

Poultice	**Gel**
Distilled water Technocel 200 and Sepiolite (ratio 2:1)	Agar 4%
Distilled water Technocel 1000	
Distilled water Technocel 200	

The poultices were applied to one sheet of Japanese paper, while the gel was applied directly to the surface. The poultices were left on the surface between 30 minutes and 24 hours, while the gels were left between 20 minutes and 1.5 hours.

After removal of the poultices, the Japanese paper was examined for any residues of the original material. The longer the poultices and gel remained in contact with the wall, the more the water-soluble salts were driven to the surface, especially in the infillings. The salts were easily removed with a brush or Wishab sponge. However, the water treatment did not prove effective in reducing the white veil or softening the limewash/whitewash residues (except in the case AB-8-CT, trial to remove limewash/whitewash residues with the rigid gel).

4.1.2 Ammonium bicarbonate

Ammonium bicarbonate solution was applied by poultice and as a paste in the following compositions:

Ammonium bicarbonate 20% Technocel 200 and Sepiolite (ratio 2:1)
Ammonium bicarbonate 20% Technocel 40
Ammonium bicarbonate 20% Technocel 200
Ammonium bicarbonate 20%

Technocel 1000
Ammonium bicarbonate paste

The poultices and paste were applied over one or two sheet/s of Japanese paper, fixed on the wall either with water or a solution of ammonium bicarbonate (20%). The paste was left on the wall between 10 minutes and 1.75 hours, while the contact time of the poultices ranged from 15 minutes to 24 hours.

After removing the poultices and paste, one sheet of Japanese paper was removed and the surface was rinsed with distilled water over the second sheet. When the last layer of Japanese paper was removed, it was examined for residues of the original material. Minimal traces of black, yellow, and red pigments (probably carbon black, goethite, haematite) were detected in some areas. The entire surface was then rinsed with distilled water. Treatment with ammonium bicarbonate caused swelling of the organic material under the limewash/whitewash residues, weakened its adherence to the surface and making it easier to remove mechanically later. The white veil was sometimes reduced, sometimes it reappeared later or remained translucent.

A test was also made on whitish residues, that are believed to have dripped down during the plastering work on the ceiling in 2022. Here, the paste proved to be particularly effective in softening the residues, which could then be removed mechanically.

4.1.3 Anion exchange resin

The anion exchange resin (CTS OH strong) was applied as a paste, with either distilled water or a 20% solution of ammonium bicarbonate over one or two sheet/s of Japanese paper and left on the surface for up to 45 minutes, with the intent to remove or reduce the white veil and the limewash/whitewash residues.

After removing the resin, the surface was rinsed and cleaned with distilled water. On the north wall, the paste with distilled water was effective in reducing the white veil (both alone and in combination with a prior ammonium bicarbonate poultice) and in removing the limewash/whitewash (in combination with a prior ammonium bicarbonate poultice). The softened limewash could then be removed mechanically. On the south wall, the white veil was removed with both distilled water and ammonium bicarbonate pastes.

The treatment with anion exchange resin should be done carefully, as it could slightly weaken the pigments cohesion (probably caput mortuum, goethite, haematite, green earth).

4.1.4 Chelating agents

4.1.4.1 Triammonium citrate (TAC)

The TAC was dissolved in distilled water (sometimes with an addition of ammonium carbonate), and applied in the form of a rigid gel and as a solution, with the intent to remove or reduce the white veil, limewash/whitewash residues and the brown spots. The following compositions have been tested:

Agar 4% TAC 3%
Agar 6%

TAC 1%
Agar 4% Ammonium carbonate 20% TAC 3% pH 8,4
TAC 3% Ammonium carbonate 20% pH 8,4

The gels were applied either to the surface previously cleaned with distilled water only or after prior treatment with ammonium bicarbonate poultice. The gels were left on the surface for 2-5 minutes, but did not remove or soften the white veil and limewash/whitewash residues consistently and they weakened the pigments too much. This effect was most apparent on the north wall. Otherwise, the gels were effective in removing and reducing the brown spots. The solution, in combination with anion exchange resin, showed good results in removing/reducing the white veil. Darker pigments (probably caput mortuum and carbon black) seem to be more sensitive to a treatment with TAC and the overall cohesion of the pigments seemed to be weakened.

4.1.4.2 Ethylenediaminetetraacetic acid (EDTA)

The EDTA tetrasodium salt was dissolved in distilled water and the pH was adjusted by adding ammonium carbonate (carbonate was also used to promote chelation because of its higher pH, i.e. alkalinity compared to bicarbonate). It was used in the form of a rigid gel with the following composition:

Agar 4% Ammonium carbonate 20% EDTA 3% pH 8,6

The EDTA in gel form was either applied on the surface previously cleaned with distilled water only or after prior treatment with ammonium bicarbonate poultice (removed after 45 min). The gel contact time was between 10 and 20 minutes. The treated areas were then rinsed with distilled water.

Results varied and were inconsistent from area to area, for both the white veil and the limewash/whitewash residues. The cohesion of a pigment (probably caput mortuum) was also weakened by the treatment.

4.1.4.3 Diethylenetriamine pentaacetate acid (DTPA)

The DTPA was dissolved in distilled water and the pH was adjusted by adding ammonium carbonate (carbonate was also used to promote the chelation because of its higher pH, i.e. alkalinity compared to bicarbonate). It was used in a form of a rigid gel with the following composition:

Agar 4% Ammonium carbonate 20% DTPA 3% pH 6

The DTPA was applied to Japanese paper only and left for 35 minutes, followed by cleaning with distilled water. The white veil reappeared, the limewash/whitewash residues were not softened and the purple pigments (probably caput mortuum) were weakened.

4.1.5 Benzyl alcohol and white spirit

The solvents benzyl alcohol and white spirit were mixed in a KSG 350 Z silicone gel. It was used on wax residues and brown spots. It was applied in the following composition:

Benzyl (35 g) alcohol and WS (25 g) in 100 g KSG 350Z

The gel was applied directly to a surface cleaned with distilled water. Some areas were previously isolated with D5 (cyclomethicone) that slows the action of solvents because it slowly sublimates on the surface. This gel, in combination with D5, has proven to be effective in thinning and eventually removing the wax residues but showed no results in reducing the brown spots.

4.1.6 SRF pulse regime laser

Laser treatment with the following parameters was attempted to remove the white veil:

Model: SRF pulse regime
Fluency: 1.20 - 1.27 J/cm^2
Frequency: 3-7 Hz
Mode: Dry

Treatment with laser was most effective on darker areas, but the results are not entirely satisfactory. The laser has difficulty distinguishing between white veil and original white paint layer, making the treatment extremely risky. Rigid agar gel with distilled water (4%) was used as a filter in some areas and was also useful for visual examination of removed particles that adhered to the agar gel. Generally, the results of the laser cleaning trial are not satisfactory.

4.2 Conclusion of the cleaning trials

Regarding the different situations of the north and south wall (cf. 2.3), the following trials proved to be the most effective:

DETERIORATION PHENOMENON	**NORTH WALL**		**SOUTH WALL**	
	Test trial number	**Application/sequence + (material code)**	**Test trial number**	**Application/ Sequence + (material code)**
White veil	AB-13-CT, MB-7-CT[9]	Ammonium bicarbonate poultice (AB4 or 2 x AB1)	MP-7-CT, MP-11-CT, MP-12-CT, MP-18-CT	Anion exchange resin (IER1 or IER2)
	MB-1-CT[10], MB-6-CT[10], IP-1-CT, IP-5-CT	Anion exchange resin (IER1) applied for 30 min.		
	MB-8-CT[9]	**1.** Ammonium bicarbonate poultice (AB1) **2.** Anion exchange resin (IER1)		
	MB-15-CT[9]	**1.** Ammonium bicarbonate poultice (AB3) **2.** Anion exchange resin (IER1) **3.** TAC + ammonium carbonate (TAC1)		
Limewash/ whitewash residues	AB-8-CT	Distilled water + agar (rigid gel) (AG1)	MP-4-CT NP-01-RT	Ammonium bicarbonate poultice (AB4 or AB1)
	MB-3-CT[10], IP-2-CT	Ammonium bicarbonate paste (AB5)		
	AB-7-CT, AB-13-CT, AB-14-CT, AB-16-CT, MB-10-CT[9]	Ammonium bicarbonate poultice (AB4 or AB3)		
	IP-6-CT, IP-7-CT, MB-12-CT[9], MB-13-CT[9]	**1.** Ammonium bicarbonate poultice (AB1 or AB4)		

[9] Group 5.
[10] Group 1.

		2. Anion exchange resin (IER1)		
	AB-10-CT	EDTA + ammonium carbonate + agar (rigid gel) (AG6)		
Wax residues	SD-x-CT	Benzyl alcohol and white spirit (KSG1)		/
Yellowing[11]		/		/
Brown spots	SD-2-CT	TAC + ammonium carbonate + agar (rigid gel) (AG5)[12]	NP-17-RT	TAC + agar (rigid gel) (AG3)[13]

For further information on application, contact times and code explanations, see appendix A1.

The evaluation of the results was not easy because different terminologies were used. The evaluation shows that on the **north wall** the cleaning trial AB-13-CT achieved a good result for both the white veil and the limewash/whitewash residues. It should be noted that the cleaning test MB-8-CT (group 5) also achieved good results. It is not listed under limewash/whitewash residues, because an even better result was achieved with the MB-10-CT (AB3) trial. Below are the two cleaning trials AB-13-CT and MB-8CT (group 5) in detail:

Deterioration phenomenon	**Test trial number**	**Material code + application/sequence**	**Results**	**Photo reference**
White veil and limewash/ whitewash residues	AB-13-CT	AB4 1. Japanese paper 1 x 2. Poultice/2h30 3. Cleaning with cotton swab (water)/10 min.	Very good result. Limewash softened, good surface cleaning, easily removes white veil.	gra_csh_nw_a_vis_20220912_ AB_01_CT_1 gra_csh_nw_a_vis_20220908_ AB_13_CT_2 gra_csh_nw_a_vis_20220908_ AB_13_CT_3
White veil and limewash/ whitewash residues	MB-8-CT	AB1 u. IER1 1. Japanese paper applied with ammonium bicarbonate 2. Poultice/45 min. 3. Removal of poultice and Japanese paper 4. Rinsing with H_2O and cotton swab 5. Japanese paper applied with H_2O	White veil was strongly reduced; limewash was easier to remove; The saturation of the colour is higher and the surface seems to be clean; very little residues of the red and yellow pigments visible on the cotton swab after treatment.	gra_csh_nw_in_MB-8-CT _20220908_la_002

[11] In all the cleaning trials carried out, the yellowing was never the declared target of the cleaning. However, the following finding should be noted:
South wall: deterioration phenomenon that should be cleaned: brown spots. In this test area it was difficult to distinguish whether the deterioration phenomenon was brown spots or yellowing. A success was achieved with AG3 (NP-17-RT).
[12] Result: Lightened brown spots AND original colour.
[13] Results: Immediately, a brownish layer removed (visible on cotton swabs). Darker colour (grey) is more unstable after application. The brown crust could not have been removed. Not completely dry when we left: The spot is whiter than the surroundings. The boundaries of the agar pieces are also visible.

		6. **Resin paste**; 3 x wetting; contact time 30 min 7. Removal of paste and rinsing with H_2O and cotton swab		

For the **south wall,** a combination of ammonium bicarbonate poultice and anion exchange resin seems to be a good way to remove or reduce both the limewash/whitewash residues and the white veil. Tests with this combination were also undertaken (MP-22-CT, MP-23-CT, NP-16-RT), but not until the end of the week, so the results could not be recorded before departure.

The results regarding wax residues, yellowing and brown spots stand for themselves.

It is suggested to check the results of the cleaning trials with UV light for any residues, before any method is used on a larger scale.

5. Conclusion

The 2022 Summer School was very intensive but also very instructive. The students learnt how a cleaning concept is developed step by step, which materials can be helpful to reach certain targets and how these materials can be applied. It is assumed that the results achieved with the trials carried out will be useful in defining a definitive cleaning concept.

Furthermore, it was a great opportunity to exchange with professionals, professors and students from other countries and to make new friends.

Last but not least, the excellent organisation of the Summer School and the wonderful hospitality in Slovenia should be pointed out. Despite a dense work programme, the students were brought closer to the country and its people (e. g. presentation on wall paintings in Slovenia, visit to another worksite in Dolenja vas and excursion to Piran).

From a technical point of view, the activities of this summer school focused on identifying a cleaning method that would allow the removal of materials that altered the colour of the paintings to be addressed and resolved. These were mainly fragments of whitewash and whitish patinas consisting of a mixture of calcium oxalate and residues of fixatives and protective agents applied during previous restoration work. The identified procedure was used by the conservators-restorers of the Ljubljana Restoration Centre on the entire surface of the paintings inside the church.

6. Bibliography

Felici, A. (2021). Technique of the wall paintings. In: without indication (Ed.): *Report: International Summer School Gradišče pri Divači. 2nd to 27th of August 2021. Church of St. Helen. Conservation-restoration of wall paintings* (vol. 1, working version, not published, p. 18–19).

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Osojnik, M. (2021). Historical information of the site and of the wall paintings. In: without indication (Ed.): *Report: International Summer School Gradišče pri Divači. 2nd to 27th of August 2021. Church of St. Helen. Conservation-restoration of wall paintings* (vol. 1, working version, not published, p. 11–17).

REPORT: SUMMER SCHOOL GRADIŠČE PRI DIVAČI (SLOVENIA)

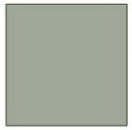
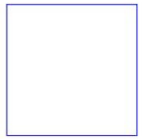
31st of August to 14th of September 2022

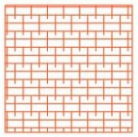
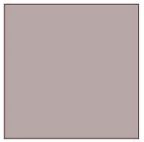
CHURCH OF ST. HELEN
CONSERVATION-RESTORATION OF WALL PAINTINGS

ANNEX n.1:
Tables of description of materials and of the carried-out trials

Mentors: Alberto Felici, Neva Pološki, Suzana Damiani, Blaž Šeme, Anka Batič.

Table 1 gives an overview and explains the different materials used with the assigned Material code and the CAD reference.

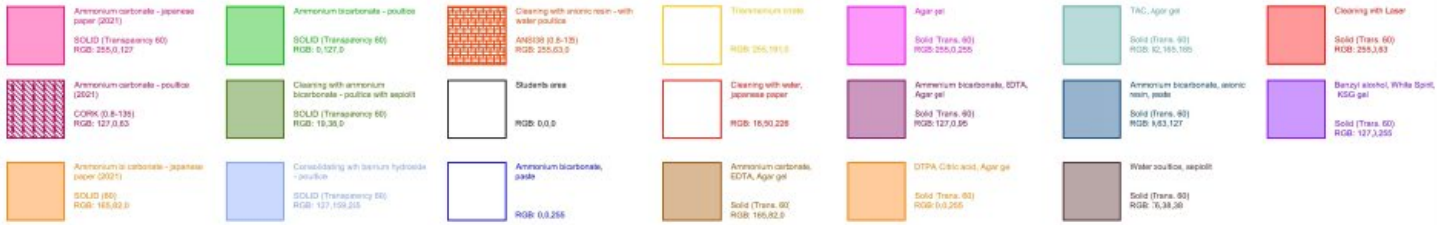
DESCRIPTION OF MATERIALS	MATERIAL CODE	CAD REFERENCE
Ammonium bicarbonate 20% Technocel 200 and Sepiolite (ratio 2:1)	AB1	 Cleaning with ammonium bicarbonate - poultice with sepiolit SOLID (Transparency 60) RGB: 19,38,0
Ammonium bicarbonate 20% Technocel 40	AB2	 Ammonium bicarbonate - poultice SOLID (Transparency 60) RGB: 0,127,0
Ammonium bicarbonate 20% Technocel 1000	AB3	 Ammonium bicarbonate - poultice SOLID (Transparency 60) RGB: 0,127,0
Ammonium bicarbonate 20% Technocel 200	AB4	 Ammonium bicarbonate - poultice SOLID (Transparency 60) RGB: 0,127,0
Ammonium bicarbonate paste	AB5	 Ammonium bicarbonate, paste RGB: 0,0,255

CTS Ionex OH strong anion exchange resin in ammonium bicarbonate 20%	IER2	 Ammonium bicarbonate, anionic resin, paste Solid (Trans. 60) RGB: 0,63,127
CTS Ionex OH strong anion exchange resin in H_2O	IER1	 Cleaning with anionic resin - with water poultice ANSI38 (0.8-135) RGB: 255,63,0
H_2O Technocel 200 and Sepiolite (ratio 2:1)	W1	 Water poultice, sepiolit Solid (Trans. 60) RGB: 76,38,38
H_2O Technocel 1000	W2	
H_2O Technocel 200	W3	
Agar 4% in water	AG1	 Agar gel Solid (Trans. 60) RGB: 255,0,255
Agar 4% TAC 3%	AG2	 TAC, Agar gel Solid (Trans. 60) RGB: 82,165,165

Agar 6% TAC 1%	AG3	 TAC, Agar gel Solid (Trans. 60) RGB: 82,165,165
Agar 4% Ammonium carbonate 20% TAC 3% pH 8,4	AG5	
Agar 4% Ammonium carbonate 20% EDTA 3% pH 8,6	AG6	 Ammonium carbonate, EDTA, Agar gel Solid (Trans. 60) RGB: 165,82,0
Agar 4% Ammonium carbonate 20% DTPA 3% pH 6	AG7	
KSG Benzyl alcohol and WS	KSG1	 Benzyl alcohol, White Spirit, KSG gel Solid (Trans. 60) RGB: 127,0,255
3% of TAC in Ammonium carbonate 20% solution pH 8,4	TAC1	

Summer School Gradišče pri Divači, 2022: **Mapping, Cleaning trials, North wall.**

LEGENDA:

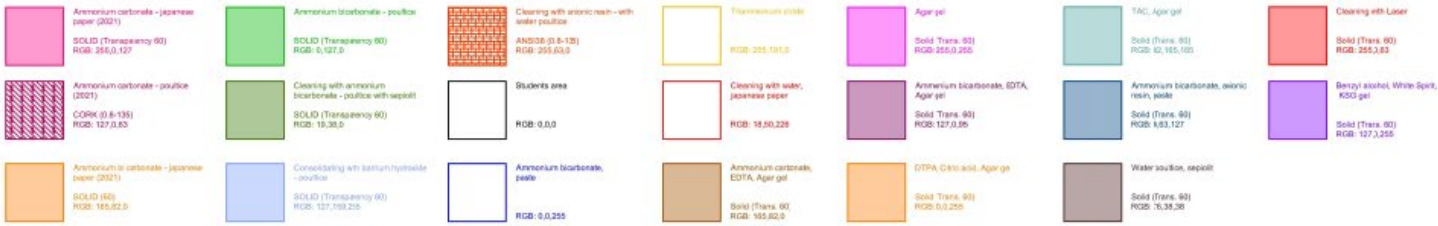


Location: Gradišče pri Divači
Object: Church of St. Helen
Subject: Wall paintings
Owner: Municipality of Divača

Trials made by: Katarina Bartolj, Maša Bardon, Irina Pozdorovkina, Urh Tačar, Antun Škrlec, Matea Primožić, Alésia Bartoulot, Gabriel Sebastian Klopferstein, Lorenz Amann, Lara Bassoli, Angela Waltner.
Mentors: Alberto Felici, Marta Bensa, Andrej Jazbec, Anka Batič, Neva Pološki, Suzana Damiani.

Summer School Gradišče pri Divači, 2022: **Mapping, Cleaning trials, South wall.**

LEGENDA:



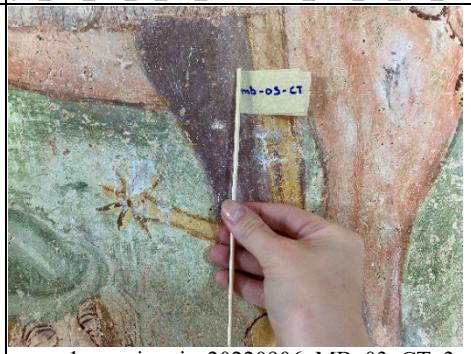
Location: Gradišče pri Divači
Object: Church of St. Helen
Subject: Wall paintings
Owner: Municipality of Divača

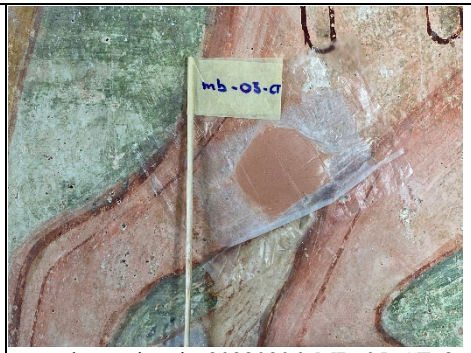
Trials made by: Katarina Bartolj, Maša Bardon, Irina Pozdorovkina, Urh Tačar, Antun Škrlec, Matea Primožić, Alésia Bartoulot, Gabriel Sebastian Klopferstein, Lorenz Amann, Lara Bassoli, Angela Waltner.
Mentors: Alberto Felici, Marta Bensa, Andrej Jazbec, Anka Batič, Neva Pološki, Suzana Damiani.

The following tables give detailed information of the used materials, assigned with the material code from Table 1, for every trial carried out by the five different groups (Column 1). Test trial number (Column 2) consists of the initials of the person who carried out the trial and in Column 3 the used materials are identified using the previously defined material code. The last column with the reference photos indicates the name of the photos than can be found in the Appendix.

Group 1 north wall

GROUP No.	TEST TRIAL No.	MATERIAL CODE	APPLICATION /CONTACT TIME	COMMENTS		REFERENCE PHOTOS[1]
				PROBLEM	RESULT	
1/nw	MB -1-CT	IER1	1. Japanese paper[2] 1x 2. Application of resin*/30min 3. Wetting 3-4x 4. Cleaning with cotton swab (water)	White veil	White veil less visible.	 gra_csh_nw_in_vis_20220906_MB_01_CT_2_IP_02_CT_2,  gra_csh_nw_in_vis_20220906_MB_01_CT_3

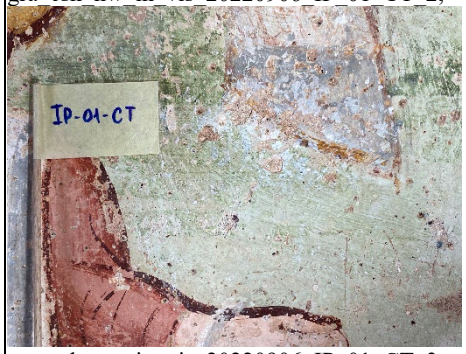
	MB-2-CT	IER1	1. Japanese paper 1x 2. Application of resin*/30min 3. Wetting 3-4x 4. Cleaning with cotton swab (water)	Limewash residue	White veil appeared, can be cleaned off with water, limewash stayed the same.	 gra_csh_nw_in_vis_20220906_MB_02_CT_3
	MB-3-CT	AB5	1. Japanese paper 1x 2. Application of paste with spatula/15min 3. Removing limewash with scalpel	Limewash residue	Limewash softened, easier to remove with mechanical force.	 gra_csh_nw_in_vis_20220906_MB_03_CT_3
	MB-4-CT	AB5	1. Japanese paper 1x 2. Application of paste with spatula/15min 3. Removing limewash with scalpel	Brown spots	No results.	 gra_csh_nw_in_vis_20220906_MB_04_CT_3

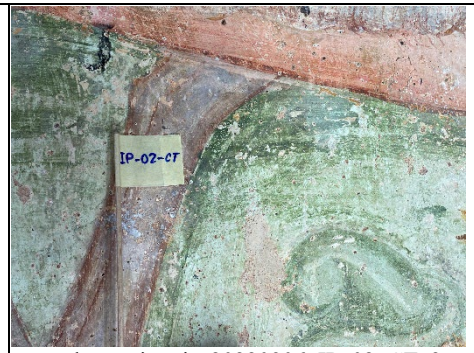
	MB-5-CT	IER1	1. Japanese paper 1x 2. Application of resin*/30min 3. Wetting 3-4x 4. Cleaning with cotton swab (water)	Brown spots	No results.	 gra_csh_nw_in_vis_20220906_MB_05_CT_2
	MB-6-CT	IER1	1. Japanese paper 1x 2. Application of resin*/30min 3. Wetting 3-4x 4. Cleaning with cotton swab (water)	White veil, bigger surface	White veil less visible.	gra_csh_nw_in_vis_20220912_MB_06_CT_1
	MB-7-CT	IER2	1. Japanese paper 1x 2. Application of resin with brush /30min 3. Wetting 3-4x 4. Cleaning with cotton swab (water)	White veil	More white veil appeared.	 gra_csh_nw_in_vis_20220908_MB_07_CT_2

	SD-1-CT	AG2	1. Applying rigid gel/5min 2. Removing gel 3. Rinsing with water	Brown spots	No results.	gra_csh_nw_in_vis_20220908_SD_01_CT_2, gra_csh_nw_in_vis_20220908_SD_01,02_CT
	SD-2-CT	AG5	1. Applying rigid gel/5min 2. Removing gel 3. Rinsing with water	Brown spots	Lightened brown spots and original colour.	 gra_csh_nw_in_vis_20220908_SD_02_CT_2,  gra_csh_nw_in_vis_20220908_SD_01,02_CT_3

	SD-x-CT	KSG1	1. Applying D5-cyclomethicone with a brush 2. Applying gel with brush 3. Massaging with brush for 1min 4. Rinsing with D5-cyclomethicone 5. Repeating application with gel 3-4x 6. Cleaning the area with cotton swab	Wax residue	Thining down the wax and eventually removing it.	 gra_csh_nw_in_vis_20220908_SD_x_CT_1,  gra_csh_nw_in_vis_20220908_SD_x_CT_2,  gra_csh_nw_in_vis_20220908_SD_x_CT_3

	SD-3-CT	IER2	1. Japanese paper 1x 2. Application of resin with brush/30min 3. Wetting 3-4x 4. Cleaning with cotton swab (water)	Trial on infilling	No visible results	 gra_csh_nw_in_vis_20220908_SD_03_CT_2
	SD-4-CT	KSG1	1. Applying gel with brush 2. Massaging with brush for 1min 3. Cleaning with cotton swab	Brown spots	No results.	 gra_csh_nw_in_vis_20220908_SD_04_CT_2,  gra_csh_nw_in_vis_20220908_SD_04_CT_3

	IP-1-CT	IER1*	1. Japanese paper 1x 2. Application of resin*/30min 3. Wetting 3-4x 4. Cleaning with cotton swab (water)	White veil	White veil less visible.	 gra_csh_nw_in_vis_20220906_IP_01_CT_2,  gra_csh_nw_in_vis_20220906_IP_01_CT_3
	IP-2-CT	AB5	1. Japanese paper 1x 2. Application of paste with spatula/15min 3. Removing limewash with scalpel	Limewash residue	Limewash softened, easier to remove with mechanical force.	 gra_csh_nw_in_vis_20220906_MB_01_CT_2_IP_02_CT_2,

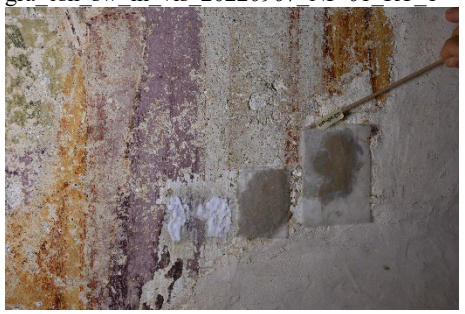
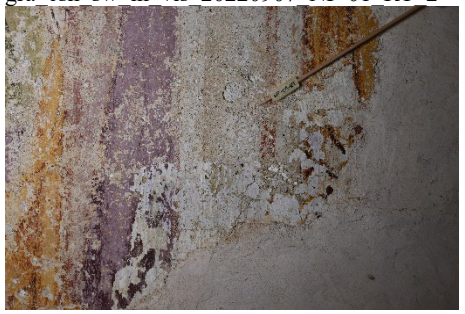
						 gra_csh_nw_in_vis_20220906_IP_02_CT_3
	IP-3-CT	W1	1. Japanese paper 1x 2. Application od poultice with spatula/over night-till falling 3. Rinsing with sponge and water	Trial on infilling	No visible results.	 gra_csh_nw_in_vis_20220908_IP_03_CT_2,  gra_csh_nw_in_vis_20220908_IP_03.04_CT_2

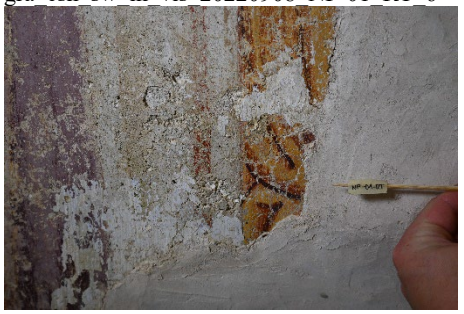
	IP-4-CT	AB1	1. Japanese paper 1x 2. Application od poultice with spatula/over night-till falling 3. Rinsing with sponge and water	Trial on infilling	No visible results.	 gra_csh_nw_in_vis_20220908_IP_04_CT_3
	IP-5-CT	IER1	1. Japanese paper 1x 2. Application of resin*/30min 3. Wetting 3-4x 4. Cleaning with cotton swab (water)	White veil, bigger surface	White veil less visible.	 gra_csh_nw_in_vis_20220908_IP_05_CT_2
	IP-6-CT	AB1 and IER1	FIRST APPLICATION 1. Japanese paper 1x 2. Application of poultice/45min 3. On one part rinsing with water 4. On one part no rinsing SECOND APPLICATION 1. Japanese paper 1x 2. Application of resin with brush/15min 3. Wetting 3-4x 4. Cleaning with cotton swab (water)	Big surface, white veil, limewash residue …	Limewash softened, easier to remove with mechanical force. ...	 gra_csh_nw_in_vis_20220908_IP_06,07_CT_3,

						 gra_csh_nw_in_vis_20220908_IP_06,07_CT_3_detail,  gra_csh_nw_in_vis_20220908_IP_06,07_CT_3_detail2
	IP-7-CT	AB4 and IER1	FIRST APPLICATION 1. Japanese paper 1x 2. Application of poultice/45min 3. On one part rinsing with water 4. On one part no rinsing SECOND APPLICATION 1. Japanese paper 1x 2. Application of resin with brush/15min 3. Wetting 3-4x 4. Cleaning with cotton swab (water)	Big surface, white veil, limewash residue …	Limewash softened, easier to remove with mechanical force. ...	gra_csh_nw_in_vis_20220908_IP_06,07_CT_3, gra_csh_nw_in_vis_20220908_IP_06,07_CT_3_detail, gra_csh_nw_in_vis_20220908_IP_06,07_CT_3_detail2

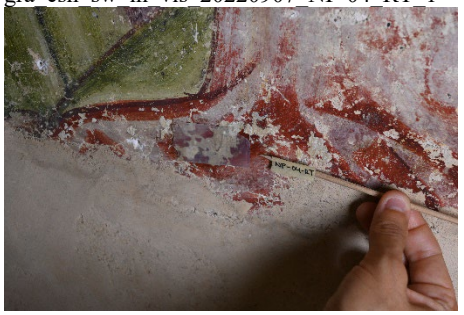
* Application of the Anion exchange resin with foil technique. It consist of firstly using a hard piece of foil, then a thinner one, on which you put the resin (thicker consistency then if using a brush). On top of the resin goes japanese paper that has to be wetted with water. We used pipette. Then you apply it on the wall and taking off only the hardest foil.

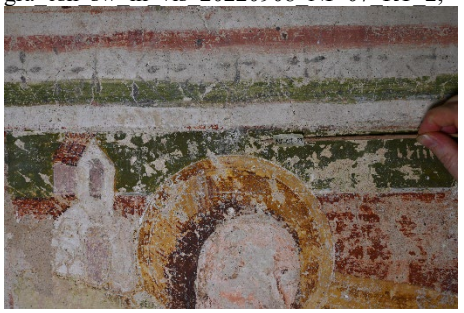
Group 2 south wall

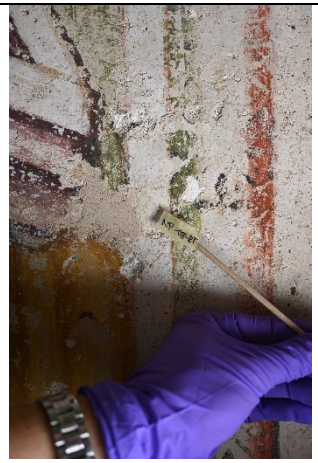
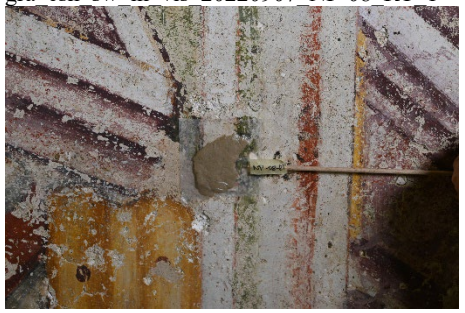
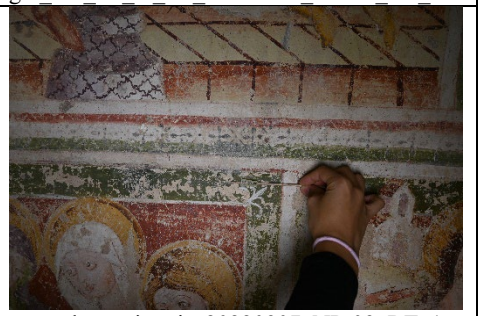
GROUP NUMBER	TEST TRIAL NUMBER	MATERIAL CODE	APPLICATION/ CONTACT TIME	COMMENTS		REFERENCE PHOTOS
				PROBLEM	RESULT	
2/sw	NP-01-RT	W1, AB1, AB5, AB1	FIRST: **application on the right side of the tested area.** 1. Japanese paper, 2. Poultice with water covered with one layer of Japanese paper left for 30 min, 3. Removal and cleaning with wet cotton swab, 4. Mechanical action with scalpel. SECOND: **application on the middle part of the tested area.** 1. Japanese paper, 2. Poultice with ammonium bicarbonate 20 % solution covered with one layer of Japanese paper left for 30 min., 3. Removal and cleaning with wet cotton swab, 4. Mechanical action with scalpel. THIRD: **application on the left part of the tested area.** 1. Ammonium bicarbonate paste left for 30 min, 2. Removal and cleaning with wet cotton swab, 3. Mechanical action with scalpel. FOURTH: **application on the right side of the tested area (same area as first + second).** Same as the second trial with longer contact time = 4 h 30 min, covered with plastic foil.	Residues of limewash	**FIRST:** Immediately: No color on the cotton. It is hardly distinguishable if the limewash is softer than before. The limewash is not easier to remove with the scalpel than before. **SECOND:** same as for the first application. **THIRD:** same as for the first and the second application. **FOURTH:** Immediately: a tiny bit of the limewash stuck on the Japanese paper. Limewash is softer than before and comes off easier than before (when working with a scalpel). The color of the paint layer underneath feels wetter. On the *intonaco* you can only thinner the limewash (and not completely remove).	 gra_csh_sw_in_vis_20220907_NP-01_RT_1  gra_csh_sw_in_vis_20220907_NP-01_RT_2  gra_csh_sw_in_vis_20220907_NP-01_RT_5

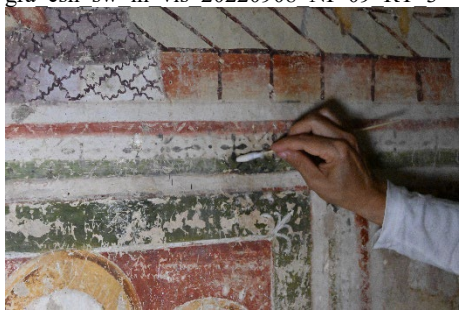
						 gra_csh_sw_in_vis_20220908_NP-01_RT_6  gra_csh_sw_in_vis_20220909_NP-01_RT_7
	NP-02-RT	AB5, AB1, AB3	FIRST: **application on the right side of the tested area.** 1. Ammonium bicarbonate paste left for 30 min, 2. Removal and cleaning with wet cotton swab, 3. Ammonium bicarbonate paste left for 45 min., 4. Removal and cleaning with wet cotton swab. SECOND: **application on the left part of the tested area.** 1. Japanese paper, 2. Poultice with ammonium bicarbonate 20% solution covered with one layer of		**FIRST**: Immediately: No color on the cotton. It is hardly distinguishable if the limewash is softer than before. The limewash is not easier to remove with the scalpel than before. **SECOND**: same as for the first trial. **THIRD:** Immediately: limewash comes off easier than before, but not as easy as at NP-01-RT after the 4 h 30 min-application.	 gra_csh_sw_in_vis_20220907_NP-02_RT_1

			Japanese paper left for 30 min., 3. Removal and cleaning with wet cotton swab, 4. Mechanical action with scalpel. THIRD: **application over the whole tested area.** same as the second but with poultice made of Arbocel 1000 without Sepiolite left for 1 h 30 min and covered with plastic foil.			 gra_csh_sw_in_vis_20220907_NP-02_RT_3  gra_csh_sw_in_vis_20220908_NP-02_RT_5  gra_csh_sw_in_vis_20220908_NP-02_RT_6

						 gra_csh_sw_in_vis_20220909_NP-02_RT_7
	NP-04-RT	AG1	1. Agar solid gel for 30 min, 2. Removal, no cleaning.	Residues of limewash	Immediately: No color on the cotton. It is hardly distinguishable if the limewash is softer than before. The limewash is not easier to remove with the scalpel than before.	 gra_csh_sw_in_vis_20220907_NP-04_RT_1  gra_csh_sw_in_vis_20220907_NP-04_RT_2

	NP-07-RT	IER2	1. Japanese paper, 2. anion exchange resin in ammonium bicarbonate 20% left for 1h 3min, 4 times reactivated with ammonium bicarbonate 20%, 3. Removal and cleaning with wet cotton swab.	Residues of limewash	No visible change.	 gra_csh_sw_in_vis_20220907_NP-07_RT_1,  gra_csh_sw_in_vis_20220908_NP-07_RT_2,  gra_csh_sw_in_vis_20220909_NP-07_RT_3

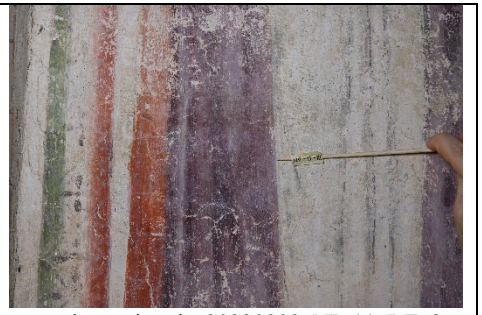
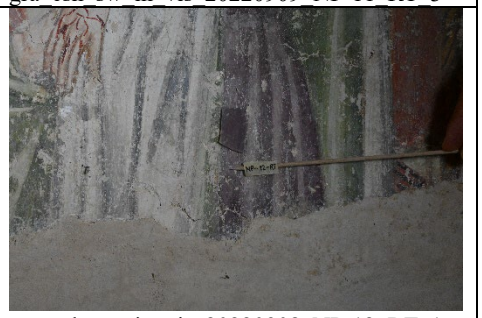
	NP-08-RT	W1	1. Japanese paper, 2. Poultice with water covered with plastic foil left overnight (approx..15 h), 3. Removal and cleaning with wet cotton swab.	Residues of limewash	Immediately: a bit of the limewash stuck on the Japanese paper. Spot was then left.	 gra_csh_sw_in_vis_20220907_NP-08_RT_1  gra_csh_sw_in_vis_20220907_NP-08_RT_3
	NP-09-RT	IER1 and IER2	FIRST: 1. Japanese paper, 2. anion exchange resin in H_2O left for 30 min, 3 times reactivated with H_2O, 3. Removal, cleaning with wet cotton swab. SECOND: 1. Japanese paper, 2. anion exchange resin in ammonium bicarbonate 20% left for 50min, 4 times	White veil	**FIRST:** Immediately: Deposit (probably dirt, yellowish) on the cotton. Dried: Reduced the white veil. Under UV-light minimal residues of the cleaning are visible.	 gra_csh_sw_in_vis_20220907_NP-09_RT_1

			reactivated with ammonium bicarbonate 20%, 3. Removal, cleaning with wet cotton swab.		**SECOND:** White veil has not been removed completely, slightly glossier surface than on the surroundings.[1]	 gra_csh_sw_in_vis_20220907_NP-09_RT_2  gra_csh_sw_in_vis_20220908_NP-09_RT_3  gra_csh_sw_in_vis_20220908_NP-09_RT_4

[1] Immediately no color traces on the cotton swab. Dried (same day after removal), the surface feels smoother, because the white veil had been taken off. The surface is glossy. Dried (one day after the removal), the white veil had not been removed completely. The surface is not as glossy as it was when the spot was still wet, but slightly glossier than the surroundings.

						 gra_csh_sw_in_vis_20220909_NP-09_RT_5
	NP-10-RT	IER1	1. Japanese paper, 2. anion exchange resin in H_2O left for 30min, 1 time reactivated with H_2O, 3. Removal, cleaning with wet cotton swab.	White veil	Immediately: The red color is unstable (traces on the cotton), but it is also unstable in not treated areas.	 gra_csh_sw_in_vis_20220908_NP-10_RT_1  gra_csh_sw_in_vis_20220908_NP-10_RT_2

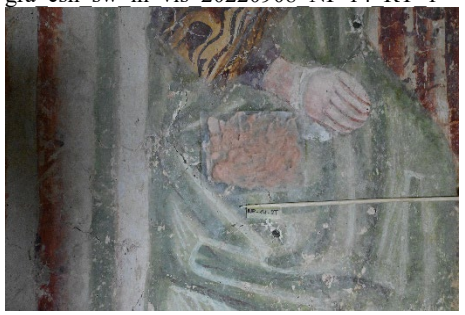
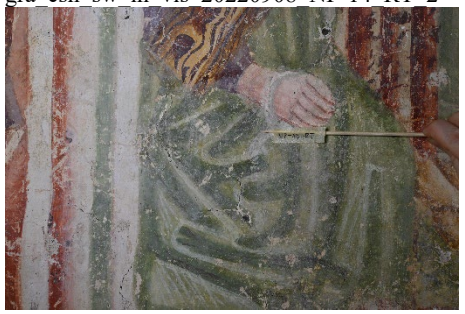
						 gra_csh_sw_in_vis_20220909_NP-10_RT_3
	NP-11-RT	IER1	On a spot, that had already been cleaned by Anka with a poultice in ammonium bicarbonate. 1. Two layers of Japanese paper, 2. anion exchange resin in H_2O left for 45 min, 3. Removal, cleaning with wet cotton swab.	White veil	Immediately: Color more unstable than before. Dried: Not homogeneously cleaned. The white veil is slightly removed.	 gra_csh_sw_in_vis_20220908_NP-11_RT_1  gra_csh_sw_in_vis_20220908_NP-11_RT_2

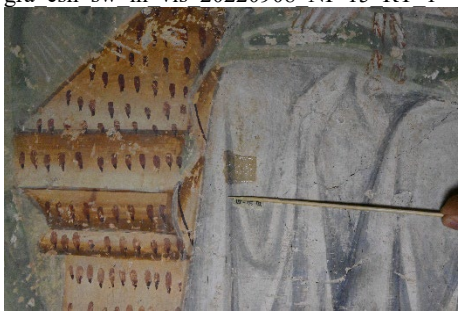
						 gra_csh_sw_in_vis_20220909_NP-11_RT_3
	NP-12-RT	AG7	1. Japanese paper[2], 2. Agar solid gel in Ammonium bicarbonate 20% and DTPA 3%, pH 6 left for 35min., 3. Removal, cleaning with wet cotton swab.	White veil	Immediately: purple color more unstable than before. Dried: White veil reappeared.[3]	 gra_csh_sw_in_vis_20220908_NP-12_RT_1  gra_csh_sw_in_vis_20220908_NP-12_RT_2

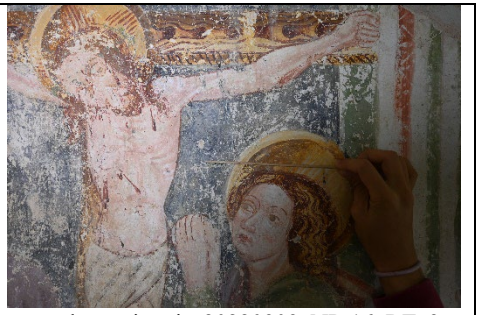
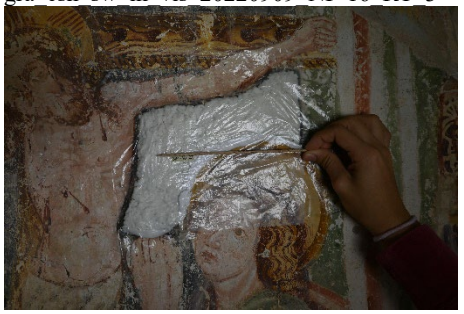
[2] On a spot, that had already been cleaned (not immediately before) by Anka with a poultice (only Arbocel + Sepiolite) + Ammonium bicarbonate
[3] Ammonium bicarbonate and chelating agent with pH 6 not OK.

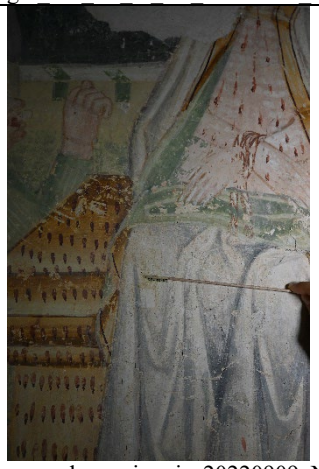
	NP-13-RT	AG6	1. Agar solid gel with EDTA pH 8.6 directly on the wall left for 20 min[4]., 2. Removal, cleaning with wet cotton swab.	White veil	Immediately: color more unstable than before. Dried: good result.[5]	 gra_csh_sw_in_vis_20220908_NP-13_RT_1  gra_csh_sw_in_vis_20220908_NP-13_RT_2  gra_csh_sw_in_vis_20220909_NP-13_RT_3

[4] On a spot, that had already been cleaned (not immediately before) by Anka with a poultice (only Arbocel + Sepiolite) + Ammonium bicarbonate
[5] Ammonium bicarbonate and chelating agent with pH 8,6 not OK. Is there a slight white veil on the after photo?

	NP-14-RT	IER2	On a spot, that had already been cleaned by Anka with a poultice in ammonium bicarbonate. 1. Japanese paper, 2. anion exchange resin in ammonium bicarbonate 20% left for 45min., 3. Removal, cleaning with wet cotton swab.	White veil	Immediately: yellowish residues on the cotton swab. Dried: not homogeneously cleaned. The white veil is slightly removed.	 gra_csh_sw_in_vis_20220908_NP-14_RT_1  gra_csh_sw_in_vis_20220908_NP-14_RT_2  gra_csh_sw_in_vis_20220909_NP-14_RT_3

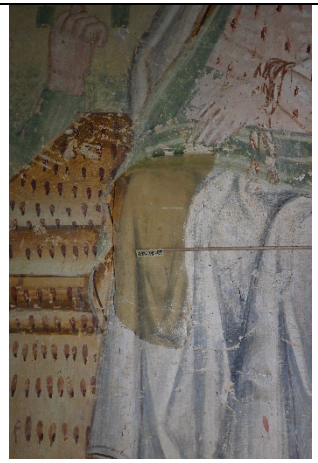
	NP-15-RT	AG2	(later the area was covered with NP-17-RT) 1. Four pieces of Agar solid gel with TAC left for 5 min., 2. Removal, cleaning with wet cotton swab.	Brown spots	Immediately: The outlines of the agar can be seen. The spot has been cleaned, but too much.	 gra_csh_sw_in_vis_20220908_NP-15_RT_1  gra_csh_sw_in_vis_20220908_NP-15_RT_2  gra_csh_sw_in_vis_20220909_NP-15_RT_4

	NP-16-RT	AB4 and IER1	FIRST: 1. Japanese paper, 2. Poultice covered with plastic foil for 45 min., 3. Removal of the poultice, cleaning with wet sponge SECOND: 1. (immediately) anion exchange resin in H_2O through the same Japanese paper left for 30 min (no reactivation), 2. Removal, cleaning with toothbrush and wet cotton swab.	White veil	Immediately: deposit (probably dirt) and a little bit of color on the cotton swab. Still wet when we left.	 gra_csh_sw_in_vis_20220909_NP-16_RT_3  gra_csh_sw_in_vis_20220909_NP-16_RT_4  gra_csh_sw_in_vis_20220909_NP-16_RT_6

						 gra_csh_sw_in_vis_20220909_NP-16_RT_9
	NP-17-RT	AG3	1. Agar solid gel with TAC left for 13 min.[6], 2. Removal, cleaning with wet cotton swab.	Brown spots	Immediately: a brownish layer removed (visible on cotton swabs). Darker color more unstable after application.[7]	 gra_csh_sw_in_vis_20220909_NP-17_RT_1

[6] On a spot, that had already been cleaned (not immediately before) by Anka with a poultice (only Arbocel or + Sepiolite)? + Ammonium bicarbonate

[7] Immediately, a brownish layer removed (visible on cotton swabs). Darker color is more unstable after application. The brown crust couldn't have been removed. Not completely dry when we left: The spot is whiter than the surroundings. The boundaries of the agar pieces are also visible.

						 gra_csh_sw_in_vis_20220909_NP-17_RT_2  gra_csh_sw_in_vis_20220909_NP-17_RT_5

	NP-18-RT	AG3	1. Agar solid gel with TAC left for 13 min.[8], 2. Removal, cleaning with wet cotton swab, 3. Cleaning with a toothbrush and ammonium bicarbonate solution.	White veil	Immediately: no color on the agar, but a lot of color traces on the cotton swab. The white veil reappeared[9]. Still wet when we left.	 gra_csh_sw_in_vis_20220909_NP-18_RT_1  gra_csh_sw_in_vis_20220909_NP-18_RT_2

[8] On a spot, that had already been cleaned (not immediately before) by Anka with a poultice (only Arbocel or + Sepiolite)? + Ammonium bicarbonate
[9] The white veil reappeared (discovered after approximately 45 minutes), and got worse than before. We then cleaned the surface with a toothbrush and Ammonium bicarbonate solution. Ammonium bicarbonate and TAC not OK.

Group 3 north wall

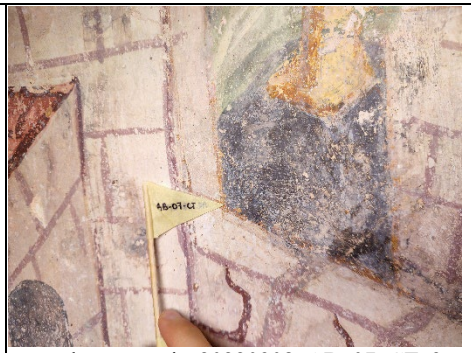
GROUP NUMBER	TEST TRIAL NUMBER	MATERIAL CODE	APPLICATION/ CONTACT TIME	COMMENTS		REFERENCE PHOTOS
				PROBLEM	RESULT	
3/Nw	AB – 01- CT		1. Japanese paper 1x 2. Poultice/40min 3. Water rinsing over JP, removal of JP, Cleaning with cotton swab (water)	White veil and whitewash	Minimal removal of limewash residues.	 gra_csh_nw_a_vis_20220912_AB_01_CT_1  gra_csh_nw_a_vis_20220908_AB_01_CT_2

						 gra_csh_nw_a_vis_20220908_AB_01_CT_3
	AB – 2- CT	AG1	1. Directly on the wall 2. Gel/20min 3. Cleaning with cotton swab (water)	White veil and whitewash	There is no cleaning results.	gra_csh_nw_a_vis_20220912_AB_01_CT_1  gra_csh_nw_a_vis_20220908_AB_02_CT_2  gra_csh_nw_a_vis_20220908_AB_02_CT_3
	AB – 3- CT	AB1	1. Japanese paper 1x 2. Poultice/20min	White veil and whitewash	Removal of pigment, a little dirt remains on the tampon, minimal removal of limewash residues.	gra_csh_nw_a_vis_20220912_AB_01_CT_1

			3. Water rinsing over JP, removal of JP 4. Cleaning with cotton swab (water)			 gra_csh_nw_a_vis_20220908_AB_03_CT_2  gra_csh_nw_a_vis_20220908_AB_03_CT_3
	AB – 4- CT	AG1	1. Directly on the wall 2. Gel/20min 3. Cleaning with cotton swab (water)	White veil and whitewash	There is no cleaning results.	gra_csh_nw_a_vis_20220912_AB_01_CT_1  gra_csh_nw_a_vis_20220908_AB_04_CT_2

						 gra_csh_nw_a_vis_20220908_AB_04_CT_3
	AB – 5- CT	AB1	1. Japanese paper 1x 2. Poultice/1h 3. Cleaning with cotton swab (water)	White veil and whitewash	The yellow pigments are very weak, the dirt comes off very well, removes limewash quite easily.	gra_csh_nw_a_vis_20220912_AB_01_CT_1  gra_csh_nw_a_vis_20220908_AB_05_CT_2  gra_csh_nw_a_vis_20220908_AB_05_CT_3

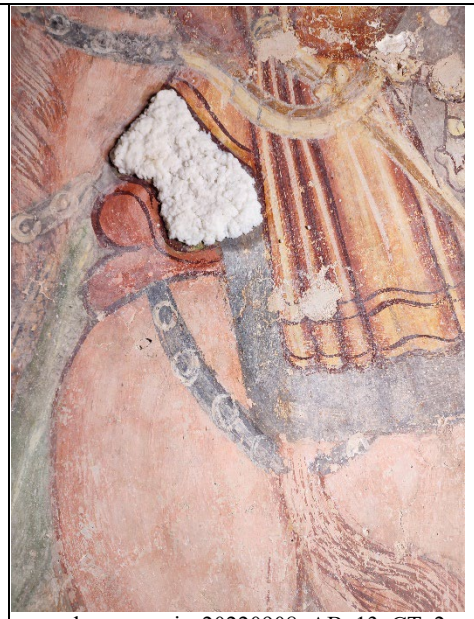
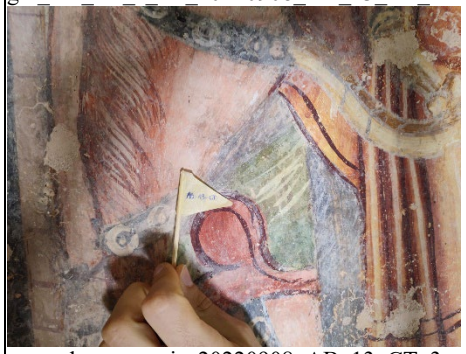
	AB – 6- CT	AG1	1. Directly on the wall 2. Gel/1h 3. Cleaning with cotton swab (water)	White veil and whitewash	There are no cleaning results.	gra_csh_nw_a_vis_20220912_AB_01_CT_1  gra_csh_nw_a_vis_20220908_AB_06_CT_2
	AB – 7- CT	AB4	1. Japanese paper 1x 2. Poultice/1h 3. Cleaning with Ammonium bicarbonate with 1%EDTA with Japan paper 4. Water rinsing	White veil and whitewash	Limewashe removed with ease, cotton is dirty.	gra_csh_nw_a_vis_20220912_AB_01_CT_1  gra_csh_nw_a_vis_20220908_AB_07_CT_2

						 gra_csh_nw_a_vis_20220908_AB_07_CT_3
	AB – 8- CT	AG1	1. Directly on the wall 2. Gel/1.5h 3. Cleaning with cotton swab (water)	White veil and whitewash	Good result for whitewash residues.	gra_csh_nw_a_vis_20220912_AB_01_CT_1  gra_csh_nw_a_vis_20220908_AB_08_CT_2
	AB – 9- CT	AB0	1. Japanese paper 1x/30min 2. Water rinsing with cotton swab (water)	White veil and whitewash	Good result for whitewash residues, cotton is dirty.	gra_csh_nw_a_vis_20220912_AB_01_CT_1

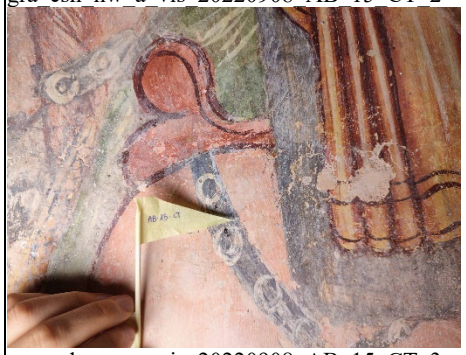
						 gra_csh_nw_a_vis_20220908_AB_09_CT_2
	AB – 10- CT	AG6	1. Directly on the wall 2. Gel/15min 3. Cleaning with cotton swab (water)	White veil and whitewash	Good result for whitewash residues, cotton is dirty, the white veil has been partially removed.	gra_csh_nw_a_vis_20220912_AB_01_CT_1  gra_csh_nw_a_vis_20220908_AB_10_CT_2
	AB-11-CT	IER1	1. Japanese paper 1 x 2. Poultice / 45 min ammonium bicarbonate rinsing over JP, removal of JP / 10 min 3. Water cleaning with a cotton swab on JP / 10 min	White veil and whitewash	Surface becomes white colours come off. Limewash reduced.	gra_csh_nw_a_vis_20220912_AB_01_CT_1

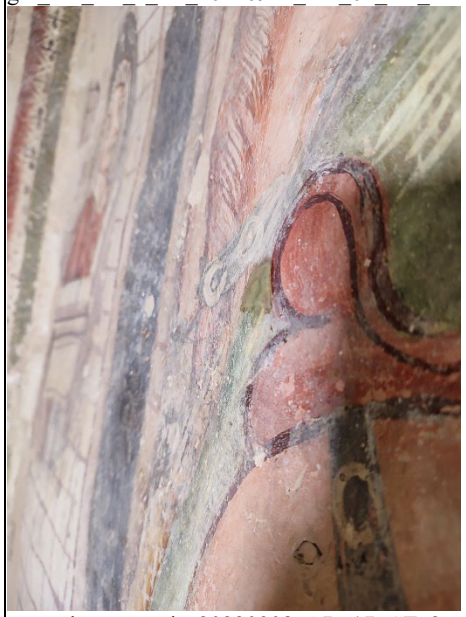
						 gra_csh_nw_a_vis_20220908_AB_11_CT_2  gra_csh_nw_a_vis_20220908_AB_11_CT_3
	AB-12-CT	AB5	1. Japanese paper 1 x 2. Poultice / 30 min 3. EDTA rinsing over JP, removal of JP / 10 min	White veil and whitewash	No result with EDTA A lot of mechanical strength, and weakens the surface and the pigments.	gra_csh_nw_a_vis_20220912_AB_01_CT_1

			4. Cleaning with an eraser and a fiberglass brush		With the eraser cleaning and the fiberglass brush, the whitewash is easily removed.	 gra_csh_nw_a_vis_20220908_AB_12_CT_2  gra_csh_nw_a_vis_20220908_AB_12_CT_3
	AB-13-CT	AB4	1. Japanese paper 1 x 2. Poultice /2h30 3. Cleaning with cotton swab (water)/ 10 min	White veil and whitewash	Very good result Limewash softened, good surface cleaning, easily removes white veil.	gra_csh_nw_a_vis_20220912_AB_01_CT_1

						 gra_csh_nw_a_vis_20220908_AB_13_CT_2  gra_csh_nw_a_vis_20220908_AB_13_CT_3
	AB-14-CT	AB4	Step 1: 1. Japanese paper 1x 2. Poultice /2h00 3. Cleaning with cotton swab (water)/ 10 min	White veil and whitewash	Step 1: Very good result: • it removes the dirty on the wall,	gra_csh_nw_a_vis_20220912_AB_01_CT_1

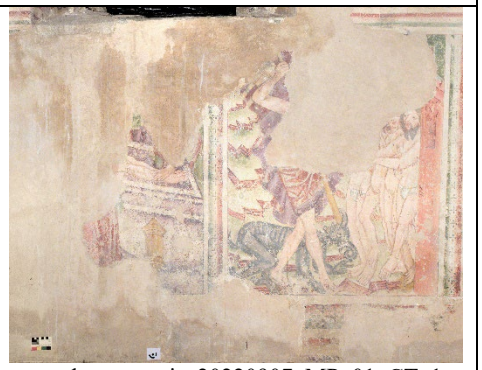
			Step 2: Transition area: 1. Japanese paper 1x 2. Poultice/ 2h00 3. Cleaning with ammonium bicarbonate on toothbrush / 10 min		• softened the limewash. Step 2: • it removes the dirty on the wall, • remove partially the white veil. Reduced the limewash.	 gra_csh_nw_a_vis_20220908_AB_14_CT_2  gra_csh_nw_a_vis_20220908_AB_14_CT_3
	AB-15-CT	AB5	1. Japanese paper 1x 2. Poultice /1h45 3. Cleaning with cotton swab (water)/ 10 min	White veil and whitewash	No result, whitewash even more apparent.	gra_csh_nw_a_vis_20220912_AB_01_CT_1

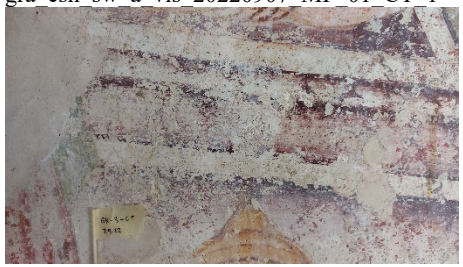
						 gra_csh_nw_a_vis_20220908_AB_15_CT_2  gra_csh_nw_a_vis_20220908_AB_15_CT_3
	AB-16-CT	AB4 + AG 2	Step 1: 1. Japanese paper 1x 2. Poultice /1h30 3. Cleaning with ammonium bicarbonate and toothbrush / 10 min Step 2: 1. Gel/ 10 min 2. Cleaning with cotton swab (water)/ 10 min	White veil and whitewash	Step 1 Very good result: • it removes the dirty on the wall, • reduced the limewash, • remove partially the white veil. Step 2: • no visible effect to the naked eye.	gra_csh_nw_a_vis_20220912_AB_01_CT_1  gra_csh_nw_a_vis_20220908_AB_16_CT_2

						 gra_csh_nw_a_vis_20220908_AB_16_CT_3
	AB-17-CT	AG2	1. Gel/ 2 min 2. Cleaning with cotton swab (water)/ 10 min	White veil and whitewash	No result for the white veil and whitewash, but it weakens the pigments (too aggressive).	gra_csh_nw_a_vis_20220912_AB_01_CT_1  gra_csh_nw_a_vis_20220908_AB_17_CT_2

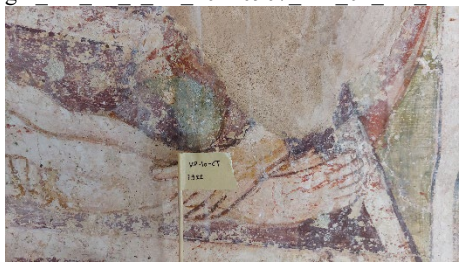
						 gra_csh_nw_a_vis_20220908_AB_17_CT_3
	AB-18- CT	AG2	1. Gel/ 4 min 2. Cleaning with cotton swab (water)/ 10 min	White veil and whitewash	No result for the white veil and whitewash, but it weakens the pigments (too aggressive).	gra_csh_nw_a_vis_20220912_AB_01_CT_1  gra_csh_nw_a_vis_20220908_AB_18_CT_2
	AB-19-CT	AG2	1. Gel/ 5 min 2. Cleaning with cotton swab (water)/ 10 min	White veil and whitewash	No result for the white veil and whitewash, but it weakens the pigments (too aggressive).	gra_csh_nw_a_vis_20220912_AB_01_CT_1  gra_csh_nw_a_vis_20220908_AB_19_CT_2

Group 4 south wall

GROUP NUMBER	TEST TRIAL NUMBER	MATERIAL CODE	APPLICATION/ CONTACT TIME	COMMENTS		REFERENCE PHOTOS
				PROBLEM	RESULT	
4/sw	MP - 1 - CT	AB4 AB5	1. Japanese paper 1x 2. Poultice/30min Paste/10min 3. Water rinsing over JP, removal of JP 4. Cleaning with sponge (water) 5. Removal of Limewash with scalpel	Dirt White veil Limewash	White veil appearance softened, limewash softened and removable with scalpel.	 gra_csh_sw_a_vis_20220907_MP_01_CT_1  gra_csh_sw_a_vis_20220907_MP_01_CT_3
	MP - 2 – CT	WB3	1. Japanese paper 1x 2. Poultice/30min 3. Water rinsing over JP, removal of JP 4. Cleaning with sponge (water)	Dirt White veil Limewash	White veil appearance softened, limewash softened and removable with scalpel.	gra_csh_sw_a_vis_20220907_MP_01_CT_1

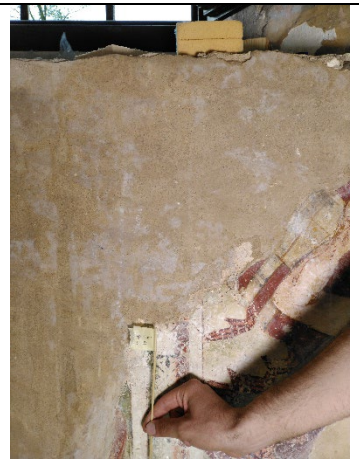
			5. Removal of Limewash with scalpel			 gra_csh_sw_a_vis_20220907_MP_02_CT_3
	MP - 3 - CT	W1	1. Japanese paper 1x 2. Poultice/30min 3. Water rinsing over JP, removal of JP 4. Cleaning with sponge (water) 5. Removal of Limewash with scalpel	Dirt White veil Limewash	White veil appearance softened, limewash softened and removable with scalpel, but hardened again quickly.	gra_csh_sw_a_vis_20220907_MP_01_CT_1  gra_csh_sw_a_vis_20220907_MP_03_CT_3
	MP - 4 - CT	AB4	1. Japanese paper 1x 2. Poultice/15-30min 3. Water rinsing over JP, removal of JP 4. Cleaning with sponge (water) 5. Removal of Limewash with scalpel	Dirt White veil Limewash	White veil appearance softened, limewash harshly softened and is easily removable with scalpel. There was no significant difference in longer times of contact.	gra_csh_sw_a_vis_20220907_MP_01_CT_1  gra_csh_sw_a_vis_20220907_MP_04_CT_3
	MP - 5 – CT	W3	1. Japanese paper 1x 2. Poultice/30min 3. Water rinsing over JP, removal of JP 4. Cleaning with sponge (water) 5. Removal of Limewash with scalpel	Dirt White veil Limewash	White veil appearance softened, limewash softened and is removable with scalpel, but hardened again quickly.	gra_csh_sw_a_vis_20220907_MP_01_CT_1

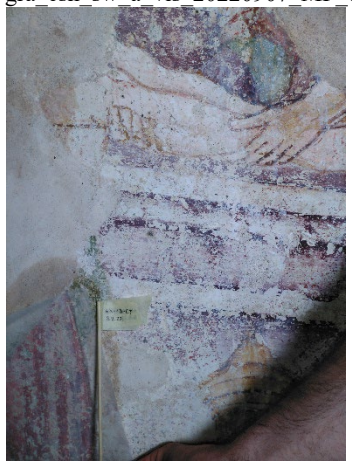
						 gra_csh_sw_a_vis_20220907_MP_05_CT_3
	MP - 6 – CT	AB5	1. Japanese paper 1x 2. Paste/10min 3. Water rinsing over JP, removal of JP 4. Cleaning with sponge (water) 5. Removal of Limewash with scalpel	Dirt White veil Limewash	White veil appearance softened, limewash softened and is removable with scalpel.	gra_csh_sw_a_vis_20220907_MP_01_CT_1  gra_csh_sw_a_vis_20220907_MP_06_CT_3
	MP - 7 – CT	IER1	1. Japanese paper 1x 2. Paste/1st Half 15min, 2nd Half 30min 3. Water rinsing over JP, removal of JP 4. Cleaning with sponge (water) 5. Removal of Limewash with scalpel	Dirt White veil Limewash	White veil disappeared, limewash softened and isremovable with scalpel. No difference between contact times.	gra_csh_sw_a_vis_20220907_MP_01_CT_1  gra_csh_sw_a_vis_20220907_MP_07_CT_3
	MP - 8 – CT	AB4	1. Japanese paper 1x 2. Poultice/24h 3. Cleaning with brush	Salts within wall Water stains on plaster	Appearence of salts on the surface, easily removable with a brush.	gra_csh_sw_a_vis_20220907_MP_01_CT_1

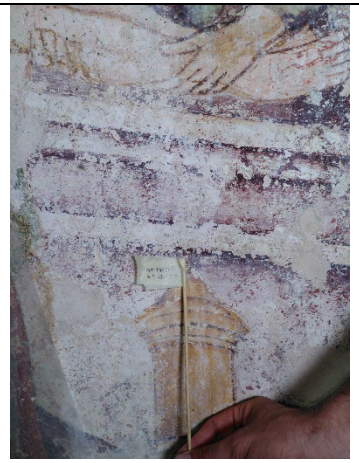
						 gra_csh_sw_a_vis_20220907_MP_08_CT_3
	MP - 9 – CT	AB1	1. Japanese paper 1x 2. Poultice/30min 3. Water rinsing over JP, removal of JP 4. Cleaning with sponge (water)	Dirt White veil Limewash Salts within wall Water stains on plaster	Appearence of salts on the surface.	gra_csh_sw_a_vis_20220907_MP_01_CT_1  gra_csh_sw_a_vis_20220907_MP_09_CT_3
	MP - 10 – CT	AG1	1. Hard Gel/30min 2. Cleaning with sponge (water)	Water stain	Appearence of white veil.	gra_csh_sw_a_vis_20220907_MP_01_CT_1  gra_csh_sw_a_vis_20220907_MP_10_CT_3
	MP - 11 – CT	IER2	1. Japanese paper 2x 2. Paste/1st Half 15min, 2nd Half 30min 3. Water rinsing over JP, removal of JP 4. Cleaning with sponge (water) 5. Removal of Limewash with scalpel	Dirt White veil Limewash	White veil disappeared, limewash softened and is removable with scalpel. No difference between contact times. Worked better than IER1.	gra_csh_sw_a_vis_20220907_MP_01_CT_1

						 gra_csh_sw_a_vis_20220908_MP_11_CT_3
	MP - 12 – CT	IER1	1. Japanese paper 2x 2. Paste/1st Half 15min, 2nd Half 30min 3. Water rinsing over JP, removal of JP 4. Cleaning with sponge (water) 5. Removal of Limewash with scalpel	Dirt White veil Limewash	White veil disappeared, limewash softened and is removable with scalpel. No difference between contact times.	gra_csh_sw_a_vis_20220907_MP_01_CT_1  gra_csh_sw_a_vis_20220908_MP_12_CT_3
	MP - 13 – CT	AG2	3. Hard Gel/4min 4. Cleaning with sponge (water)	White veil caused by Ammonium bicarbonate	White veil removed.	gra_csh_sw_a_vis_20220907_MP_01_CT_1

						 gra_csh_sw_a_vis_20220908_MP_13_CT_3
	MP - 14 – CT	W3	1. Japanese paper 1x 2. Poultice/24h 3. Water rinsing over JP, removal of JP	Salts within wall Water stains	No results.	gra_csh_sw_a_vis_20220907_MP_01_CT_1  gra_csh_sw_a_vis_20220908_MP_14_CT_3
	MP - 15 – CT	W1	1. Japanese paper 1x 2. Poultice/24h 3. Water rinsing over JP, removal of JP	Salts within wall Water stains	No results.	gra_csh_sw_a_vis_20220907_MP_01_CT_1

						 gra_csh_sw_a_vis_20220908_MP_15_CT_3
	MP - 16 – CT	W1	1. Japanese paper 1x 2. Poultice/24h (foil over poultice) 3. Water rinsing over JP, removal of JP	Salts within wall Water stains	Appearance of salts on the surface. Easily removable by brush.	gra_csh_sw_a_vis_20220907_MP_01_CT_1  gra_csh_sw_a_vis_20220908_GK_16_CT_3
	MP - 17 – CT	W3	1. Japanese paper 1x 2. Poultice/24h (Sepiolite in water over poultice, separated by Japanese paper)	Salts within wall Water stains	Appearance of salts on the surface. Easily removable by brush.	gra_csh_sw_a_vis_20220907_MP_01_CT_1

						 gra_csh_sw_a_vis_20220908_GK_17_CT_3
	MP - 18 – CT	IER2	1. Japanese paper 2x 2. Paste/1st Half 15min, 2nd Half 30min 3. Water rinsing over JP, removal of JP 4. Cleaning with sponge (water) 5. Removal of Limewash with scalpel	Dirt White veil Limewash	White veil disappeared, limewash softened and is removable with scalpel. No difference between Contact times.	gra_csh_sw_a_vis_20220907_MP_01_CT_1  gra_csh_sw_a_vis_20220908_GK_18_CT_3
	MP - 19 – CT	IER1	1. Japanese paper 1x 2. Paste/1st Half 10min 3. Water rinsing over JP, removal of JP 4. Cleaning with sponge (water)	Dirt White veil Limewash	White veil appearance softened, limewash softened and is removable with scalpel.	gra_csh_sw_a_vis_20220907_MP_01_CT_1

			5. Removal of Limewash with scalpel			 gra_csh_sw_a_vis_20220908_GK_19_CT_3
	MP - 20 – CT	W3	1. Japanese paper 1x 2. Poultice/24h (Sepiolite in water over poultice, separated by Japanese paper)	Salts within wall Water stains	Appearance of salts on the surface. Easily removable by brush.	gra_csh_sw_a_vis_20220907_MP_01_CT_1 gra_csh_sw_a_vis_20220909_MP_20_CT_3
	MP - 21 - CT	W1	1. Japanese paper 1x 2. Poultice/24h (Sepiolite in water over poultice, separated by Japanese paper)	Salts within wall Water stains	Appearance of salts on the surface. Easily removable by brush.	gra_csh_sw_a_vis_20220907_MP_01_CT_1 gra_csh_sw_a_vis_20220909_MP_21_CT_3
	MP - 22 – CT	AB4 IER1	1. Japanese paper 2x 2. Poultice/15min Paste/15min 3. Water rinsing over JP, removal of JP 4. Cleaning with sponge (water) 5. Removal of Limewash with scalpel 6. Japanese paper 1x (water)	Dirt White veil Limewash		gra_csh_sw_a_vis_20220907_MP_01_CT_1 gra_csh_sw_a_vis_20220909_MP_22_CT_3
	MP - 23 - CT	AB4 IER1	1. Japanese paper 2x 2. Poultice/15min Paste/15min 3. Water rinsing over JP, removal of JP	Dirt White veil Limewash		gra_csh_sw_a_vis_20220907_MP_01_CT_1

			4. Cleaning with sponge (water) 5. Removal of Limewash with scalpel 6. Japanese paper 1x (water)			 gra_csh_sw_a_vis_20220909_MP_23_CT_2

Group 5 on the north wall

GROUP NUMBER	TEST TRIAL NUMBER	MATERIAL CODE	APPLICATION/ CONTACT TIME	COMMENTS		REFERENCE PHOTOS[10][11]
				PROBLEM	RESULT	
5/nw	MB-1-CT	AB1	6. Japanese paper applied with Ammonium bicarbonate 7. Poultice/30 min 8. Removal of JP 9. Cleaning with cotton swab (water)	White veil, limewash	White veil was reduced; limewash was softened and is easier to remove.	 gra_csh_nw_in_MB-1 - CT_20220907_la_002
	MB-2-CT	W1	1. Japanese paper applied with H_2O 2. Poultice/30 min 3. Removal of JP 4. Cleaning with cotton swab (water)	White veil, limewash	White veil reappeared; limewash was softened but removal was harder than in MB-1-CT.	 gra_csh_nw_in_MB-2-CT_20220907_la_002

[10] The before picture for the trials MB-1-CT to MB-11-CT can be found under the appendix named gra_csh_nw_in_before_20220906_ab_001 and the before picture for the trials MB-12-CT to MB-15-CT can be found under the name gra_csh_nw_in_before_20220909_la_001

[11] The after picture of the trials MB-1-CT to MB-11-CT can be found under the appendix named gra_csh_nw_in_after_20220913_ab_003 and the after picture for the trials MB-12-CT to MB-15-CT can be found under the name… Still missing

	MB-3-CT	IER1	1. Japanese paper applied with H_2O 2. Paste; 3x wetting; contact time 30 min 3. Removal of JP 4. Cleaning with cotton swab (water)	White veil	White veil was slightly reduced but less than MB-1-CT.	 gra_csh_nw_in_MB-3-CT_20220907_la_002
	MB-4-CT	AB5	1. Direct application of paste; contact time 10 min 2. Removal of paste and rinsing with H_2O and cotton swab	White veil	White veil was not reduced.	 gra_csh_nw_in_MB-4-CT_20220907_la_002

	MB-5-CT	AG6	1. Direct application of hardened gel; contact time 10 min 2. Removal of gel and rinsing with H_2O and cotton swab	White veil	White veil was not reduced.	 gra_csh_nw_in_MB-5-CT_20220907_la_002
	MB-6-CT on MB-2-CT area	AG6	1. Direct application of hardened gel; contact time 10 min 2. Removal of gel and rinsing with H_2O and cotton swab	White veil, limewash	White veil was not reduced and limewash was not weakened.	 gra_csh_nw_in_MB-6-CT_20220908_la_002

	MB-7-CT on MB-1-CT area	AB1	1. Japanese paper applied with ammonium bicarbonate 2. Poultice/30 min 3. Removal of JP 4. Cleaning with cotton swab (water)	White veil, limewash	White veil was further reduced; limewash was softened and is easier to remove.	 gra_csh_nw_in_MB-7-CT_20220908_la_002
	MB-8-CT	AB1 **IER1**	1. Japanese paper applied with ammonium bicarbonate 2. Poultice/45 min 3. Removal of poultice and JP 4. Rinsing with H_2O and cotton swab 5. Japanese paper applied with H_2O 6. **Resin paste**; 3x wetting; contact time 30 min 7. Removal of paste and rinsing with H_2O and cotton swab	White veil, limewash	White veil was strongly reduced; limewash was easier to remove. The saturation of the colour is higher and the surface seems to be clean. Very little residues of the red and yellow pigments visible on the cotton swab after treatment.	 gra_csh_nw_in_MB-8-CT_20220908_la_002

5/nw	MB-9-CT	AB1 **AG6**	1. Japanese paper applied with ammonium bicarbonate 2. Poultice/45 min 3. Removal of poultice and JP 4. Rinsing with H_2O and cotton swab 5. Direct application of **hardened gel**; contact time 10 min 6. Rinsing with H_2O and cotton swab	White veil, limewash residues	White veil was slightly reduced, limewash was easier to remove.	 gra_csh_nw_in_MB-9-CT_20220908_la_002  gra_csh_nw_in_MB-9-CT_20220908_la_02.1

5/nw	MB-10-CT	AB3	1. Japanese paper applied with ammonium bicarbonate 2. Poultice/ 45 min 3. Removal of poultice and JP 4. Rinsing with H_2O and cotton swab	Limewash	Limewash was very easy to remove due to swelling.	 gra_csh_nw_in_MB-10-CT_20220908_la_002
5/nw	MB-11-CT	W2	1. Japanese paper applied with H_2O 2. Poultice/ 45 min 3. Removal of poultice and JP 4. Rinsing with H_2O and cotton swab	Limewash	Limewash was possible to remove, but not as easy as in MB-10-CT.	gra_csh_nw_in_MB-11-CT_20220908_la_002
5/nw	MB-12-CT	AB1 **IER1**	1. 2x Japanese paper applied with ammonium bicarbonate 2. Poultice/ 45 min 3. Removal of poultice and JP 4. Rinsing with H2O and cotton swab 5. Japanese paper applied with H2O 6. **Resin applied by brush**; 3x wetting; contact time 30 min 7. Removal of paste and rinsing with H2O and cotton swab	Limewash, white veil	Limewash was swollen and it was able to remove it mechanically. The white veil was reduced but reappeared in some areas. The trial area was too large to fully remove the limewash residues.	 gra_csh_nw_in_MB-12-CT_20220908_la_002
5/nw	MB-13-CT	AB1 **IER1**	1. Japanese paper applied with ammonium bicarbonate 2. Poultice/ 45 min 3. Removal of poultice and JP	Limewash, white veil	Limewash was swollen and it was able to remove it mechanically. The white veil was reduced but reappeared in some areas.	gra_csh_nw_in_MB-13-CT_20220908_la_002

			4. Rinsing with H2O and cotton swab 5. Japanese paper applied with H2O 6. **Resin applied by brush**; 3x wetting; contact time 30 min 7. Removal of paste and rinsing with H2O and cotton swab		The trial area was too large to fully remove the limewash residues.	
5/nw	MB-14-CT	AB3 **IER1**	1. 2x Japanese paper applied with ammonium bicarbonate 2. Poultice/ 45 min 3. Removal of poultice and JP 4. Rinsing with H2O and cotton swab 5. Japanese paper applied with H2O 6. **Resin applied by brush**; 3x wetting; contact time 30 min 7. Removal of paste and rinsing with H2O and cotton swab	Limewash, white veil	Limewash was swollen and it was able to remove it but it was easier in MB-13-CT. The white veil was reduced but reappeared in some areas. The trial area was too large to fully remove the limewash residues.	gra_csh_nw_in_MB-14-CT_20220908_la_002
5/nw	MB-15-CT	AB3 **IER1** **TAC1**	1. Japanese paper applied with ammonium bicarbonate 2. Poultice/ 45 min 3. Removal of poultice and JP 4. Rinsing with H2O and cotton swab 5. Japanese paper applied with H2O 6. **Resin applied by brush**; 3x wetting; contact time 30 min 7. Removal of paste and rinsing with H2O and cotton swab 8. Cleaning the surface with **TAC** and tooth brush and rinsing with water	Limewash, white veil	Limewash was swollen and it was able to remove it but it was easier in MB-13-CT. The white veil was reduced but reappeared in some areas where it was then treated with TAC1 that further reduced/ removed the white veil. No pigments were removed paintlayer remained stable. The trial area was too large to fully remove the limewash residues.	gra_csh_nw_in_MB-15-CT_20220908_la_002

Zavod za varstvo kulturne dediščine Slovenije
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Dipartimento ambiente costruzioni e design
SUPSI

University of Ljubljana
Academy of Fine Arts and Design

Sveučilište u Zagrebu
Akademija likovnih umjetnosti

REPORT: SUMMER SCHOOL GRADIŠČE PRI DIVAČI (SLOVENIA)

31st of August to 14th of September 2022

CHURCH OF ST. HELEN
CONSERVATION-RESTORATION OF WALL PAINTINGS

ANNEX n. 2
Program of the 2022 Summer School

Mentors: Alberto Felici, Neva Pološki, Suzana Damiani, Blaž Šeme.

Program of the 2022 Summer School

Activities and general program

The Summer School will offer on site activities and online lessons:

- lectures on the methodological and interdisciplinary approach for the conservation of wall paintings and on intervention techniques;
- direct experience and work on site;
- visits on site to see other wall paintings of the area comparable in age and character to the wall paintings of church of St. Helen and, if possible, other conservation-restoration projects;
- presentation of the work carried out to the local population in order to share the significance of the site and the steps to be taken to guarantee its preservation.

2022 Summer School will be presented over three weeks:

First week: 3 days, 31. 8. 2022 – 2. 9. 2022 online lectures.

Second week: 5 days, 5. 9. 2022 – 9. 9. 2022, on site work, cleaning and consolidation.

Third week: online work, 3 days, 12. 9. 2022 – 14. 9. 2022 online, working on summaries and final report.

Aim of the 2022 Summer School

The main objective of 2022 Summer School is to assess and document the conservation condition of the wall paintings, understand what has been done so far, carry out cleaning and consolidation work, and write a report on the activities carried out.

1. Preparatory week online 31st of August – 2nd of September 2022

- General presentation of the partners, participants and organization:
  - presentation of IPCHS (Martina Kikelj, Anita Kavčič Klančar);
  - presentation of SUPSI (Giacinta Jean);
  - presentation of ALUO (Blaž Šeme);
  - presentation of ALU Zagreb (Suzana Damiani);
- Presentation and introduction about the site and history of the church / Slovenian wall paintings/ Wall painting monuments of the Karst region (Marta Bensa, Minka Osojnik, Andrej Jazbec IPCHS NG);

- Techniques and materials of Slovenian wall paintings (Martina Kikelj, Anita Kavčič Klančar);
- Lectures on the methodological and interdisciplinary approach for the conservation of wall paintings (Alberto Felici, SUPSI);
- Data collection and data management (Stefania Luppichini, SUPSI);
- Visual glossary (Giulia Russo, SUPSI)
- Scientific investigation for the study of wall paintings (Francesca Piqué, Patrizia Moretti, SUPSI)
- Scientific investigation carried out in Gradišče (Katja Kavkler KK, IPCHS);
- Illustration of the work already carried out on the church's wall paintings (Anka Batič);
- Results of Summer School 2021: Students' work Katarina Bartolj (MA student, UL ALUO)

Participants of the workshop 'The Consolidation of Wall Paintings' organised by IPCHS, which will take place in the church from the 3rd to the 7th October 2022, will also be present for the online activities.

2. Work on site: 5th of September 2022 – 9th of September 2022

Activities:

- Presentations held by the professors (evening hours) Neva Pološki – Case Study: Medieval Wall Paintings in the Church of St. Mary of Pond in Gologorica; Researches and treatments;
- Discussion about previous analytical investigations;
- Observation of the technical aspects and materials, former interventions, and decay phenomena of the wall paintings;
- Practical work on site;
- Writing the draft of a final assessment report for the conservation-restoration of the wall paintings. The final report will be concluded the week after the end of the work on site;
- Presentation of the work carried out during the Summer School to the officers of the Ministry of Culture of Slovenia.

3. Follow-up week 12th of September 2022 – 14th of September 2022 (online)

- Discussion of analytical results and further steps to be taken;
- Writing up the final report and complete documentation of the activities carried out.

DAILY PLAN

31. 8. – 1. 9. 2022 **WEEK 1 online: ZOOM** **The Zoom link:** https://uni-lj-si.zoom.us/j/91950345034	
DAY 1 **31.8 Wednesday** **9.00 – 16:30** **For Summer School and Workshop**	9.00–10.30 - Presentation of the Summer School Introduction of the partners and participants - (short PPT of each institution): Anita Klančar Kavčič, Martina Lesar Kikelj (IPCHS); Giacinta Jean (SUPSI); Blaž Šeme (ALUO); Jonas Roters (HKB); Suzana Damiani (ALU) 10.45–12.30 - **Lecture**: *Presentation and introduction about the site and history of the church* (Minka Osojnik, IPCHS NG). - **Lecture**: *Available documentation about the church* and State of conservation and previous interventions (Marta Bensa, IPCHS NG) -*Results of the 2021 Summer School*, Summary of the Report (Alberto Felici (SUPSI), Anka Batič (IPCHS), Katarina Bartolj (ALUO student)). 12.30–13. 30 Lunch break 13.30–14:30 - **Lecture**: *Environmental monitoring and conditions of the Gradisce church, invasive and non-invasive resarch, all results so far* (Katja Kavkler, IPCHS). 14.30 – 15.30 - **Lecture**: *Techniques and materials of Slovene wall paintings* (Anita Klančar Kavčič, Martina Lesar Kikelj, IPCHS). 15.30-16.30 - Discussion, questions **- Students' work**
DAY 2 **01.9 Thursday** **9.00 – 17:00**	9.00–10.00 - **Lecture**: *The methodological and interdisciplinary approach for the conservation of wall paintings* (Alberto Felici, SUPSI). 10.00–11.00 - **Lecture***: Wall painting monuments of the Karst region* (Minka Osojnik, Andrej Jazbec, IPCHS). 11.15–12.00

	- Lecture: An overview of the state of preservation of exterior medieval wall paintings in Slovenia (Blaž Šeme) 12.00–12. 30 - Discussion, questions 12.30–13. 30 Lunch break 13.30–14.30 - **Lecture***: Data collection and data management* (Francesca Reichlin, SUPSI). 14.30–15.30 - **Lecture***: Visual glossary* (Giulia Russo, SUPSI). 15.30-16.30 **- Lecture:** Riva San Vitale, The conservation work on the Carolingian cycle of wall painting in the Baptistery, (Daniela Murphy, SUPSI). - Discussion, questions
DAY 3 **02.9 Friday** **9.00 – 16.00**	9.00–10.00 - **Lecture**: *Scientific investigation for the study of wall paintings* (Francesca Piquè, Patrizia Moretti, SUPSI) 10.00–11.00 - **Lecture:** Medieval Wall Paintings in the Church of St. Mary of Pond in Gologorica; Researches and treatments (Neva Pološki) 11.15–12.00 **- Lecture**: Slovenian Case studies (Anita Klančar Kavčič) 12.00–12. 30 - Discussion, questions 12.15–13. 30 Lunch break 13.30–14.30 - **Lecture** *The consolidation of wall paintings with inorganic treatments* (AF) 14.30-16.00 - Discussion, questions **- Students' work**

SUNDAY 4. 9. 2022	Travel and arrival
5.9. – 9. 9. 2022 **WEEK 2 on site**	
DAY 4 **Monday** **8.00-17.00** 12.30 -13.30 Lunch Break	**On site:** *Short presentation of all partners – introduction of participants;* **Practical work on site:** - Individual observation of the church exterior and of the wall paintings inside. - Presentations on site *(Anka Batič, Marta Bensa, Andrej Jazbec present their preliminary work on site);* - Feedback on individual observations, Group forming; - Looking over documentation; - Observation, description and mapping of working areas; - Feedback – groups exchange information; - Investigation *(Katja Kavkler).*
DAY 5 **Tuesday** **8.00-17.00** 12.30 -13.30 Lunch Break	**Practical work on site:** cleaning trials **Afternoon trip to the nearby churches.**
DAY 6 **Wednesday** **8.00-17.00** 12.30 -13.30 Lunch Break	**Practical work on site:** Cleaning trials assesment cleaning trials consolidation trials **Afternoon trip to the coast (Piran)**
DAY 7 **Thursday** **8.00-17.00** 12.30 -13.30 Lunch Break	**Practical work on site:** Cleaning trials assesment Consolidation trials assement cleaning trials consolidation trials
DAY 8 **Friday** **8.00-17.00** 12.30 -13.30 Lunch Break	**Practical work on site** Cleaning trials assesment Consolidation trials assement 13h (in the church) –

	Presentation of the results by the students to the local community, representatives of the Ministry of Culture of Slovenia and interested professionals and public (In case of bad weather in Matavun). Welcome speeches (representative of the Ministry of Culture of Slovenia, representative of IPCHS, Mayor of Municipality of Divača) Presentation of the Summer school and its results.
Saturday 10. 9. 2022	**Travel**

12.9. – 14.9 **WEEK 3 online**	
DAY 9 **Monday** **8.00-17.00** 12.30 -13.30 Lunch Break	Discussion of analytical results and further steps to be taken. Writing up the final report "Cleaning and consolidating and complete documentation of the activities carried out. AF, NP, SD, BŠ
DAY 10 **Tuesday** **8.00-17.00** 12.30 -13.30 Lunch Break	Writing up the final report "Cleaning and consolidating and complete documentation of the activities carried out.
DAY 11 **Wednesday** **8.00-17.00** 12.30 -13.30 Lunch Break	Writing up the final report "Cleaning and consolidating and complete documentation of the activities carried out Discussion about the 2022 Summer School. Short Presentation of students' work, common conclusion for all partners and participants.