



Gelati Monastery Complex

The Church of the Nativity of the Virgin Mary

Main Space

(IV, III, II tiers)

Wall Painting Technology and Condition Assessment & Documentation

Summary in English

Commissioned by:
Gelati Rehabilitation
Committee

December 2023

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1. Foreword



1. Foreword

The Gelati Monastery Complex, including the Church of the Nativity of the Virgin Mary, have historically had problems related to the architecture and wall paintings. Especially, worth noting are the problems associated with the roofing and its overlaps/openings, which had a great impact on the condition of the facade and interior masonry and interior wall painting.

The 2015-2019 rehabilitation process of the Church of the Nativity of the Virgin Mary, which was carried out with some defects, has left an important mark on the current condition of the wall painting.

During the 4-year rehabilitation process of the roof, a water leakage occurred, causing water to flow from the roof into the interior. Moreover, this process of water infiltration in the western arm of the main space, was ongoing until August of 2020. Resulting in severe damage of the interior wall painting, in particular the upper registers of the arms (vault and pendentives). The wall paintings of the upper register of the northern and western arms, reached a particularly critical state. In the autumn of 2019, emergency interventions were implemented to stabilize the murals of the northern arm.

Based on the mentioned situation, From March 2020- till 2021 September, The National Agency for Cultural Heritage Preservation of Georgia, carried out regular monitoring of the condition of the buildings and wall paintings in the Gelati monastery complex, monitored the progress of deterioration and produced appropriate photo and text documentation.

In August 2020, localised temporary stabilisation interventions were carried out on the facade of the northern wall and in the interior for wall paintings of the St. George church. Later, in the spring of 2021, temporary emergency stabilisation interventions were carried out on the west wall of the main space and in the chapel of Saint Marine (Church of the Virgin).

On June 22-28, 2021, under the organization of Ministry of Culture, Sports and Youth of Georgia, the first international mission took place in the Gelati Monastery (the Church of the Nativity of the Virgin Mary), which aimed, on one hand, to research architectural problems - to present preliminary assessment on the causes of water infiltration and prepare the necessary recommendations for protection against water infiltration; And on the other hand, to assess the condition and technology of the wall painting of the main space of the Church of the Nativity of the Virgin Mary, as well as to determine the causes of deterioration and make recommendations for the necessary emergency interventions.

Within the framework of the mentioned mission, in 2021 and 2022 (including December), Italian and Georgian restorers carried out restoration/conservation interventions of wall paintings in the main space of the Church of the Nativity of the Virgin Mary, in particular, on the upper registers of the western arm and partially on the northern arm.



1. Foreword

After December 2022, the wall painting restoration process was stopped. From October 2022, by the initiative of the Patriarchate of Georgia, regular monitoring of wall paintings was recontinued. At this stage, non-invasive investigations (observations) and documentation of the condition, technology and monitoring of extensive sections of wall paintings have been carried out (31.10.2022; 27.12.2022; 09.03.2023, 15.04.2023, 16.07.2023, 14.10.2023, 17.12.2023).

It should be noted that based on the agreement of February 24, 2023 between the Patriarchate of Georgia and the Ministry of Culture, Sports and Youth of Georgia, on April 6th, an agreement was signed between the Patriarchate of Georgia and the National Agency for the Protection of Cultural Heritage, according to which, the rehabilitation, conservation, restoration and other necessary works for Gelati, are carried out by the Patriarchate of Georgia.

Under the leadership of the Patriarchate of Georgia, local and international interdisciplinary councils were formed - Gelati Rehabilitation Committee. The duty of the committee includes the management of the conservation project of the monument.

Specialized groups are formed for the works carried out on the site, including the wall painting conservation group, which is staffed by local (Georgian) conservators with experience in international projects and highly qualified foreign specialists. The Wall painting conservation team is led by international supervisors Lisa Shekede and Stephen Rickerby, who are the wall painting conservation experts.

The Committee is guided by a document prepared as a result of a mission carried out by the UNESCO World Heritage Centre, ICOMOS and ICCROM from 28 November to 2 December. The report's recommendations concern expanding research on Gelati painting, filling in the deficient documentation, developing a safe methodology for emergency interventions, presenting them, and only then doing it.

According to the document, it is necessary to draw up a unified conservation plan and implement the project with an interdisciplinary approach.

Since the documentation submitted to the Patriarchate in 2021-22, including the graphic documentation showing the condition and interventions, contained significant gaps and did not reflect the actual state of the paintings, the Patriarchate of Georgia planned a detailed description-documentation of the current state of the wall paintings of the Gelati monastery complex as the first stage of work. This recommendation is given in the UNESCO report.

Because of the scale of wall paintings in the monastery complex, priority locations were determined, and the survey works were undertaken in following sequence:

1. The church of the Virgin, Main space, Tier IV (2023/04-08)
2. The church of the Virgin, Main space, Tier III (2023/10-11)
3. The church of the Virgin, Main space, Tier II (2023/11-12)
4. The church of the Virgin, Main space, Tier I (2024/01-02)



1. Foreword

The locations of the first and second missions were defined as:

- Upper tier (IV) of the north, south and west arms of the main space of the Church of the Nativity of the Virgin Mary (Vault level, Pendentives).

The third mission included:

- Research-documentation of all four arms of the main space (III, IV tiers) of the Church of the Nativity of the Virgin Mary

The fourth and fifth missions included:

- Research-documentation of all four arms of the main space (II tier) of the Church of the Nativity of the Virgin Mary

The sixth mission will include (February 2024):

- Research-documentation of all four arms of the main space (I tier) of the Church of the Nativity of the Virgin Mary

Within the framework of the missions following actions has been undertaken:

1. The wall painting survey: technology and condition assessment and documentation (visual glossary and graphic documentation) of main space of the Church of the Nativity of the Virgin Mary
2. The wall painting condition monitoring of the Church of the Virgin, Main space, North and South chapels and entrances and Narthex, the Church of St. George
3. Determination and documentation of critical areas and recommendations for the individual cases

the Georgian conservation/restoration team members:

Lela Ninoshvili	Mariam Sagaradze
Nana Khuskivadze	Sofio Mikaberidze
Erekle Naroushvili	Ella Saakiani
Eter Toloraia	Mariam Todua

Additional help from Kakhaber Chkhaidze, Giga Butsashvili, Aleksandre Koridze

The Georgian team is led by international wall painting experts: Stephen Rickerby and Lisa Shekede, who supervise and oversight the wall painting conservation programme, non-invasive and analytical researches and remedial interventions.

A general plan for the conservation of the wall paintings was created by Stephen Rickerby and Lisa Shekede.

The plan covers the following aspects:

- Salt investigation and monitoring
- Liquid moisture survey
- Investigation of original technology
- Environmental assessment and related investigations
- Condition assessment and improved monitoring systems
- Planning and implementation of remedial measures.



1. Foreword

At this stage, the following tasks are given to the local group by the international experts (supervisors):

- Finding and purchasing equipment and conservation materials needed for research and physical works. Purchases are necessary for the subsequent stages of work (the initial list was prepared by the supervisors themselves).
- Identifying and determining the locations of the previous conservation/restoration interventions. (The table of interventions including materials and methods was prepared by the supervisors themselves).
- Accumulation of English versions of physical history.
- Graphing of environmental monitoring data in order to assess the environmental conditions

List of current and to be implemented joint work of international experts (supervisors) and local group:

- Detailing of the developed general conservation plan.
- Processing of 3-year environmental data and salt activity updating monitoring strategies and preparation of sampling strategy.
- Development of sampling strategy for analytical research regarding technology and condition of wall paintings (determination of sampling locations and analytical tools: molecular and elemental analysis (XRD, XRF, SEM-EDX, IR spectroscopy, Raman, etc.), biological research, research into organic materials (GCMS, chemical analysis);
- Additional study of treated but still damaged wall painting areas (assessing the risks caused by the conservation material and determining the limitations of future intervention).
- Selection of untreated but critical areas to undertake minimal conservation intervention trials.



2. Aim and Methodology



2. Aim and Methodology

Missions aim

The purpose of the missions of the survey work was to describe the technology and condition and to prepare the relevant documentation for the wall paintings of the Cathedral of the Nativity of the Virgin Mary- the west, north, south. The specific tasks of the project are based on visual observation of the target areas (using non-invasive investigation methods):

- ✓Determining various wall painting schemes according to their periods and their stratigraphic layers
- ✓Creating visual glossary for wall painting technology and condition accompanied with textual descriptions and photo documentation
- ✓Graphic documentation to illustrate technological characteristics (plaster joints) of wall paintings
- ✓Graphic documentation of wall painting condition phenomena
- ✓Determining critical areas and categorizing them according to the degree of deterioration and putting them on graphic documentation (in all spaces of the Nativity of the Virgin Mary and St. George's churches)

- ✓ Photo monitoring and reporting of wall painting deterioration activity in selected areas from the churches of the Nativity of the Virgin Mary and St. George.
- ✓ A summary of current state on wall painting technology and condition

Based on the existing documentation and newly collected data, the joint goal of the local group and international experts is to develop a conservation plan for the wall paintings of the Gelati Monastery Complex, which includes the creation of a more sophisticated monitoring model and system, research and determining the need for remedial interventions and prescribing work stages/plans.

At this stage, the given document presents the information about:

- *The results and relevant documentation of the visual assessment for wall painting technology and condition of the main space of the Church of the Nativity of the Virgin Mary (IV, III, II tiers)*
- *Graphical documentation of critical areas*
- *Documentation of wall painting condition monitoring*



2. Aim and Methodology

General conservation criteria followed by the working group:

- Preservation of the significance of the site
- Minimal intervention (during research, monitoring and remedial interventions)
- Knowledge of the original technology and added material
- Understanding of the condition and physical history
- Documentation
- Health and safety

The stages of the wall painting conservation research:

stage 1 and 2 - visual observations/assessments/survey and information gathering (study of physical history)

Non-invasive investigation and detailed documentation of the technology and condition of wall paintings.

Exploring the literature/reports and other supplementary material to determine the sources and/or activation mechanism for deterioration and damage.

Determination and documentation of previous interventions

(within the scope of the missions, stages 1, 2 are being done by the local group in the entire space of the monastery complex)

Stage 3 – Determining the problem, defining research questions and developing an analytical strategy

Stage 4 – analytical research

Stage 5 – Data collection and interpretation

Stage 6 – Determination of the conservation strategy, development of the methodology.



2. Aim and Methodology

Currently, the first two stages of the conservation research are being carried out by the conservation group: visual observations and information gathering (study of physical history).

It should be noted that the mentioned preparatory works (stage 1, 2) will be carried out in all the painted spaces of the Gelati monastery complex.

The principles of the documentation and the methodology of the research group for the assessment of the technology and condition of wall paintings in the Church of the Nativity of the Virgin Mary in Gelati:

Visual assessment of the original technology.

Wall painting is distinguished by the heterogeneity of materials; therefore, it is necessary to pay attention to the variety of painting technology (materials and techniques) spread in the building.

Wall painting consist of stratigraphic layers. Their visual assessment includes determining the chronology of the layers, their number, distribution and visual characterization of the composition: color; size, thickness, shape, texture, structural features, porosity, topography.

➤ **Observation of wall painting and the principle/methodology to reveal its technology**

stage 1 - preparatory works - observation of wall painting and general determination of painting schemes. Preliminary determination of painted schemes according to the style, subject matter and technology.

Determining wall painting stratigraphy for the various schemes identified in the initial survey:

Categorization of the structure according to the stratigraphic layers:

- primary support
- Plaster Layer(s)
- Paint layer(s)



2. Aim and Methodology

Stage 1 – Non-Invasive research/Visual Observation

First Stage is the **research of the Original Technology**: Determining the chronology of visually identifiable stratigraphic layers of wall paintings from different periods

1. Observation and characterization of the primary support:

Categorization: stone and mortar

Stone characteristics: color, build/structure, shape, size, topography, tool marks

mortar characteristics: color, joint thickness, binder, inorganic inclusions, organic inclusions, density/

2. Observation and characterization of the plaster layer of wall painting

Determining the number of plaster layers

characterizing each layer chronologically (from the base up) according to composition and execution techniques.

Composition: color, thickness, binder, inorganic inclusions, organic inclusions, density.

Execution techniques: tool marks, surface texture, topography, joints.

Categorization of plaster layers according to their composition and determination of its distribution extent and locations.

3. Observation and characterization of preparatory techniques of wall painting,

Categorization and determination of the extent and locations of their distribution:

- Underdrawings – paint outlines, incised lines
- Setting out geometry - straight incised lines, snapped lines (with paint or just string imprint)



2. Aim and Methodology

4. Observation and characterization of the paint layer

categorization according to colors:

Painting palette:

Colors (partially described at this stage: blue, green, yellow, red)

Gradations (e.g. greenish blue, reddish blue)

Saturation : intense, pastel, pale, crisp, dull, weak

Light: bright, dark

Transparency: clear, cloudy

Glossiness: glossy, matte/non-glossy

Additional information on visual descriptions:

- Colors (layered or mixed together)
- Maximum number of painting/color layers
- Description of pigment particles
- Observing the ratio of pigment and binder

Used Technology

The work of the above described two stages was carried out by non-invasive research methods:

- Visual observation with the unarmored eye was carried out with incident, racking (LED) and ultraviolet light flashlights.
- Microscopic observation was carried out using a portable microscope with 50X and 250X magnification with incident, racking and ultraviolet illumination.



2. Aim and Methodology

The wall painting condition assessment and documentation principles followed by the working group is described below:

5. Detection of wall painting deteriorations, categorization according to stratigraphic layers and deterioration types/subtypes.

The condition assessment includes mechanical damage (e.g. washed drips of paint layer) and deterioration that is undergoing degradation, in the process of change (e.g. flaking of paint layer, decohesion of plaster layer).

➤ *Example of deterioration description structure:*

Stratigraphic layer: Paint layer

Deterioration name: Loss of adhesive bond

Deterioration type: flaking

Definition: The process of separation of the paint layer from its support (lower layer), which is the result of the loss of bonding/adhesion between these layers.

Possible causes of deterioration: activity of salts/unstable climatic conditions

Distribution: South wall of the North Arm (S7, N8).

➤ **Deterioration observation and its detection principle/methodology**

- Determination of deterioration criteria
- Diagnosis by visual observation and manual technique, based on criteria:
 - Visual observation - using direct and raking artificial (LED) lighting (flashlight), ultraviolet light (flashlight).
 - Microscopic observation - determination of the condition of the stratigraphic layers of the wall painting at the microscopic level using a portable microscope with incident, raking and ultraviolet lights.
 - Manual technique - determination of the detached plaster layers by gentle mechanical touch of the hand on the wall surface (including the knocking method).



2. Aim and Methodology

Photo documentation of wall painting

Imaging of wall painting was carried out for the following purpose:

- For a visual illustration, which is needed for the exact identification of the wall painting technology and condition in the visual glossary

A protocol was made for taking photos in April 2023:

For imaging was undertaken with:

- camera- Nikon D5600 and Canon D850
- artificial light - Yongnuo YN-560 IV Flash Speedlite

White balance was adjusted using the Expo disc

And the standard data for the device were defined as:

Shooting mode: Manual

• Shutter speed - 1/60;

• F stop – 8;

• ISO - 100;

Photos were taken with incident and racking light, as well ruler for scale reference.

For photo documentation, a photo naming system was developed in July 2023, for which a guide was prepared.

The photo documentation given in report gives us the following information:

- Photo name (indicating location, number, photo type and magnification)
- Lighting perspective
- Photo location
- Annotation of the photo/ what the photo shows
- Photo scale

Note :

1.The scale attached to the photo is indicated for size orientation, however, an error of several millimeters should be taken into account, which results from the angle of the inclined surfaces;

2.The photo material used in the document represents the photos taken in July 2023, except for the complete diagrams of the scenes, which are used to indicate the locations of the photos. Part of the photos of the complete work was taken in April 2023, and part in 2017-2018.



2. Aim and Methodology

Graphic documentation of wall painting technology

The purpose of graphic documentation of technology is to present:

- Location and directions of the plaster joints

The purpose of graphic documentation of previous interventions is to demonstrate:

- Exact locations of previous conservation interventions
- Scale
- Correlation of deteriorations

Note: *The work on the graphic documentation of interventions has not been completed, therefore the mentioned material is not included in the report.*

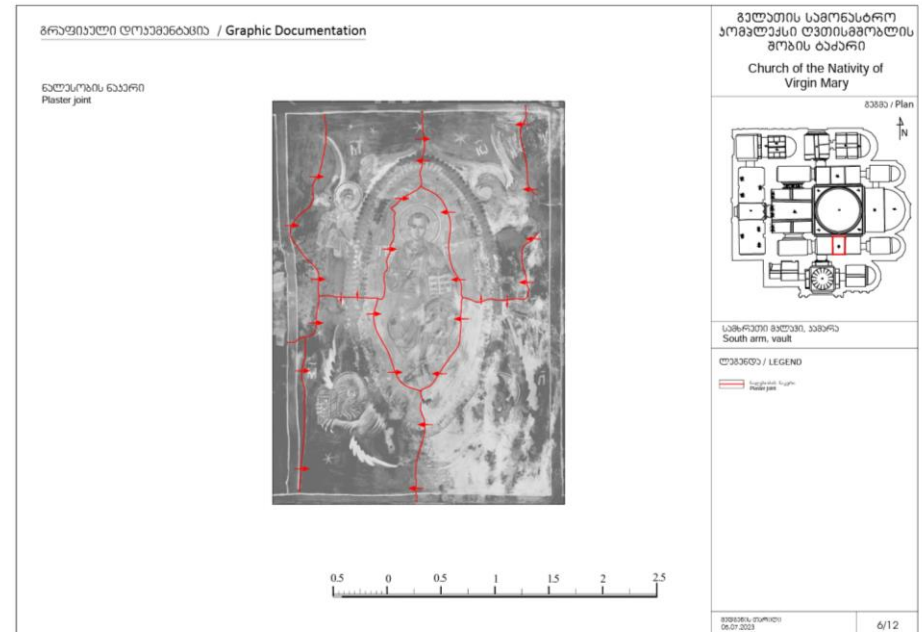
Graphic documentation was prepared using AutoCAD software.

One of the conservator/restorers - working in a pair - observed the technology and its distribution area on the wall, while the other schematically marked the provided information on the computer.

Note: The report uses the 2017-2018 photo material and drawings of the church provided to the Patriarchate by the National Agency for the Protection of Cultural Heritage of Georgia, as well as photogrammetric photos processed in April 2023.

The graphic documentation contains:

- Name of the project, date of execution
- Photo and scale of the scene
- Marks applied on scene photo
- Legend: technology indicators
- Submitted scene/wall location text notation and schematic drawing on the plan



Above: *An example of graphic documentation. South arm of the Nativity of the Virgin Mary- Glory of God (Emmanuel's Ascension) - C12, on which the plaster joints are marked and the direction of the joints is indicated by an arrow.*



2. Aim and Methodology

Graphical documentation of critical areas of wall painting

The condition of the wall painting was divided into areas:

- ✓ Critical
- ✓ Non-critical

The deterioration process of the condition was defined in 3 categories:

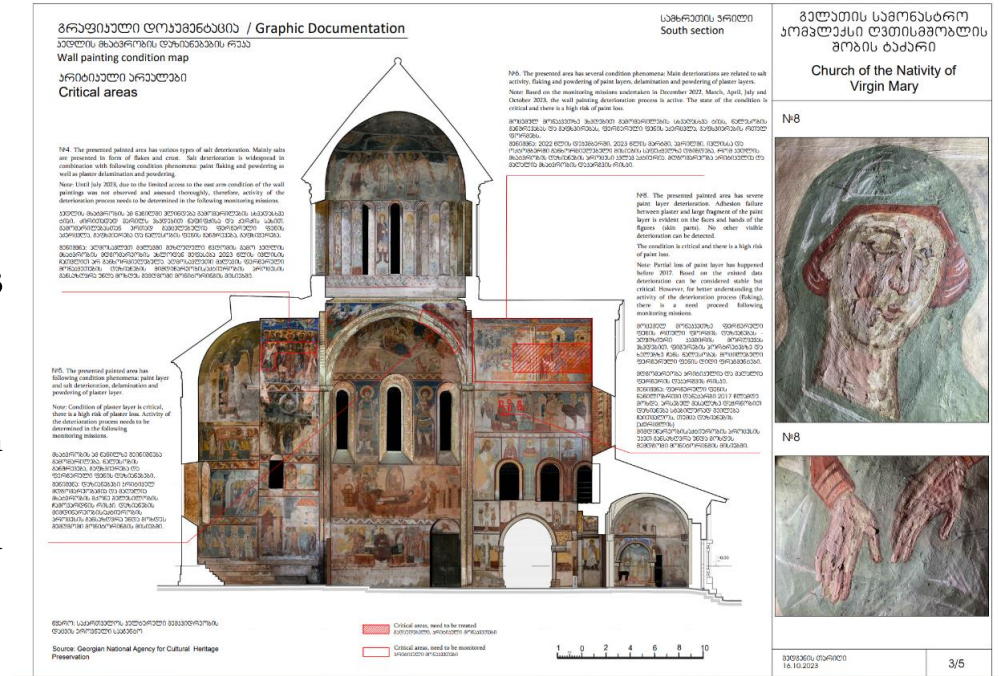
Active - Rapidly changing condition / rapid deterioration process

On-going - Relatively slow changing condition / slow deterioration process

Stable - visually indistinguishable change (after 2017/2020) (old photos were compared with current state)

The graphic documentation contains:

- Sectional views of the Main church
- Critical areas are marked in red
- The definition of the condition of the areas is marked on the section
- Exemplary photos showing the condition of the areas are displayed separately
- Photo and scale of the scene
- Deterioration marks on the photo of the scene
- Legend: deterioration indicators categorized



Above: An example of graphic documentation of critical areas. The southern Sectional view of the Church of the Nativity of the Virgin Mary.

Note: The report uses the 2017-2018 photo material and drawings of the church provided to the Patriarchate by the National Agency for the Protection of Cultural Heritage of Georgia.



3. Summary



3. Summary of the Condition of the wall painting

The survey work (stage 1,2), carried out in April, July and October, November, December of 2023 in the main space of the Church of the Virgin Mary has revealed the complexity of the technology and condition of wall paintings.

A brief overview of the Wall painting

In the Gelati monastery complex, the earliest known layer of the Church of the Nativity of the Virgin Mary is the 12th century mosaic located in the altar conch. The majority of the wall painting in the main space was done in XVI-XVII centuries. It should be noted, that in 1510 Gelati burned down, therefore the repainting of the church was done step by step, first in the 1520s-1550s with the support of King Bagrat III of Imereti and Bishop Melkhizedek Sakvarelidze, and in the 1560s-70s with the support of Giorgi II. The mural in the main space is generally from XVI century, but certain areas, for example the lower registers of the arms, were painted in the XVII century, during the reign of Alexander III of Imereti and Catholicos Zacharias Kvariani (approximately 1657-1660). In the main space, there are also some fragments from XVII-XIX centuries.

Source: Cultural heritage portal of Georgia:
<https://memkvidreoba.gov.ge/objects/wallart/wallartPaintingObject?id=22>

Comment: with the conservation research, it is necessary to study the monument from the perspective of art history

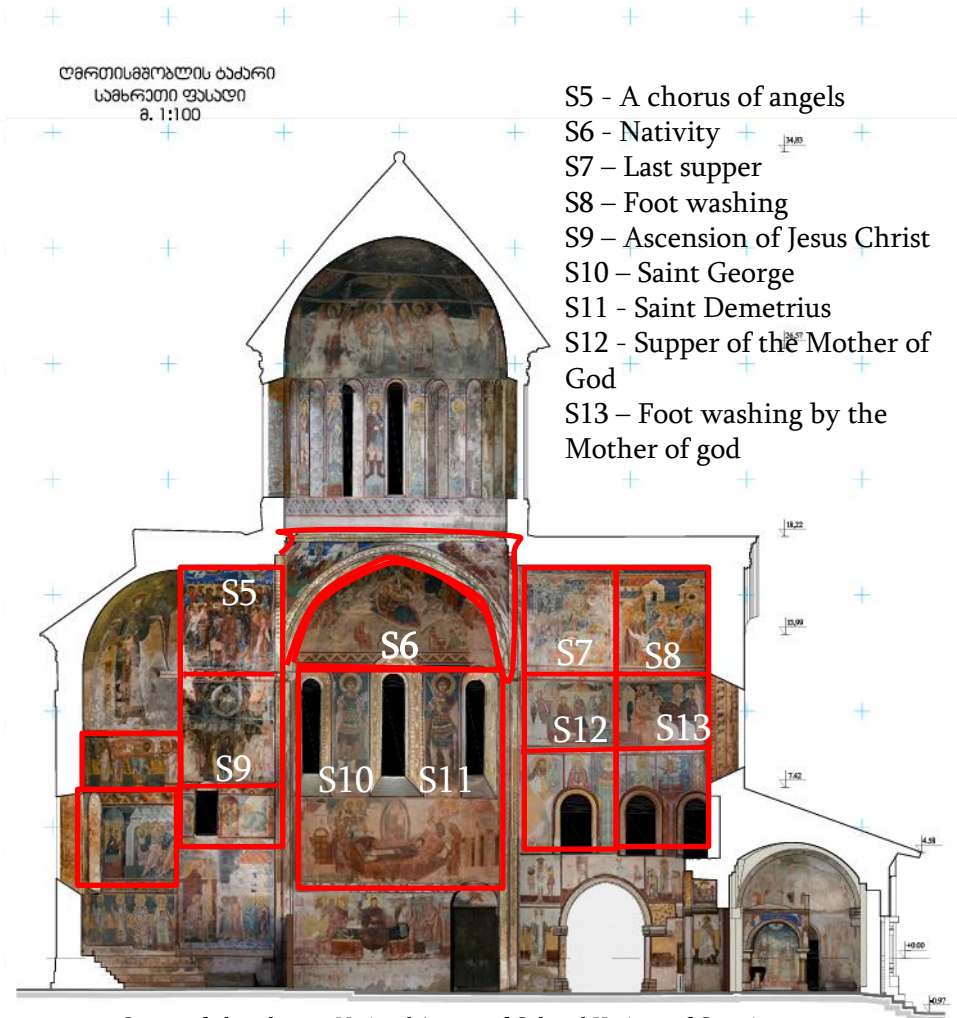
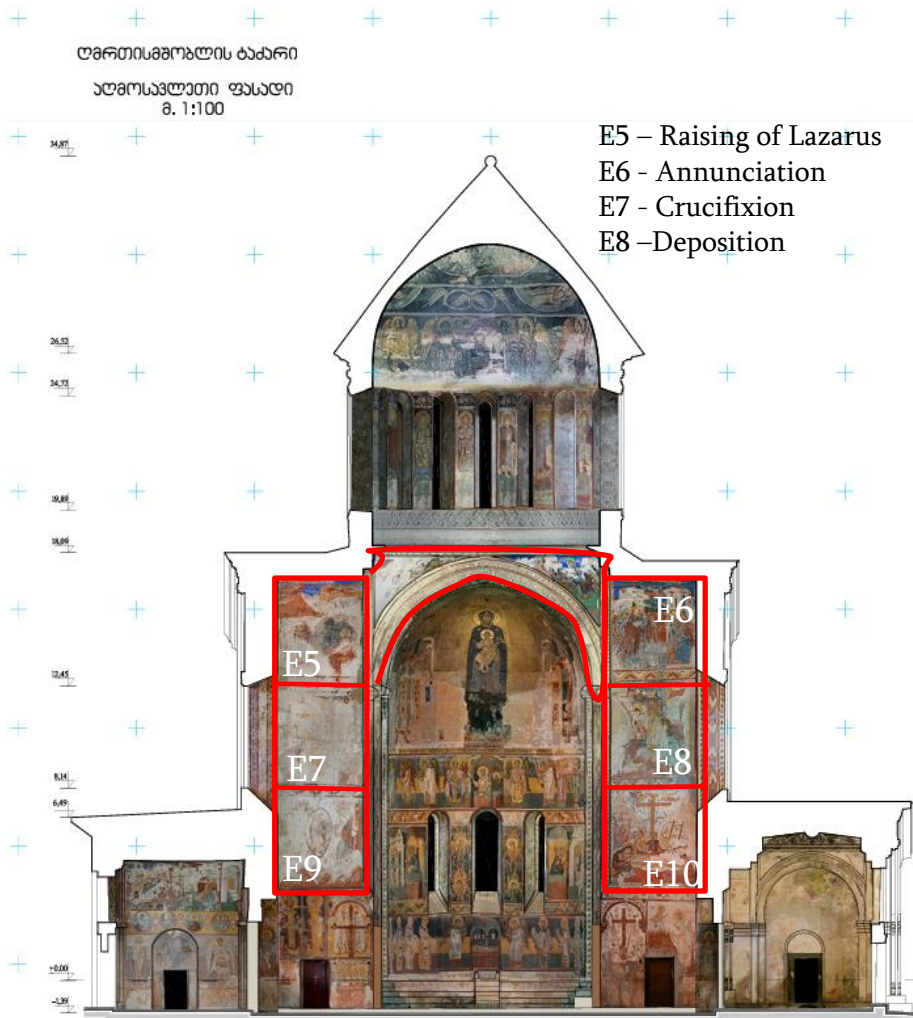
The programme (subject matter) of the main space of the main church in the Gelati monastery complex is characterized by its complexity. In the Apse, we encounter scenes such as: Eucharist, sacrificial worship, heavenly liturgy. The arms depict the cycle of twelve feasts, the cycle of the Virgin Mary, the cycle of passion, scenes from the Old Testament are presented. The figures of saints and secular people are often seen: Queen Helen, the clergy, Queen Rusudan (her first spouse), George II, King of Imereti, Bagrat III, King of Imereti, Davit Agmashenebeli.

The research locations for the undertaken missions of the conservation group were the II, III and IV registers of the eastern, western, southern and northern arms of the main space of Gelati Cathedral of the Nativity of the Virgin Mary. The mural mainly dates from the 16th century – the period of Bagrat III, although the scenes in the third and second registers of the northern wall of the west wing are known to be from the 1950s. On the bema of the eastern arm, we find the 19th century repainting on top of the 16th century wall painting, which in terms of technology and style are markedly different from the 16th century mural of the church.

See the researched wall painting compositions on the next page.



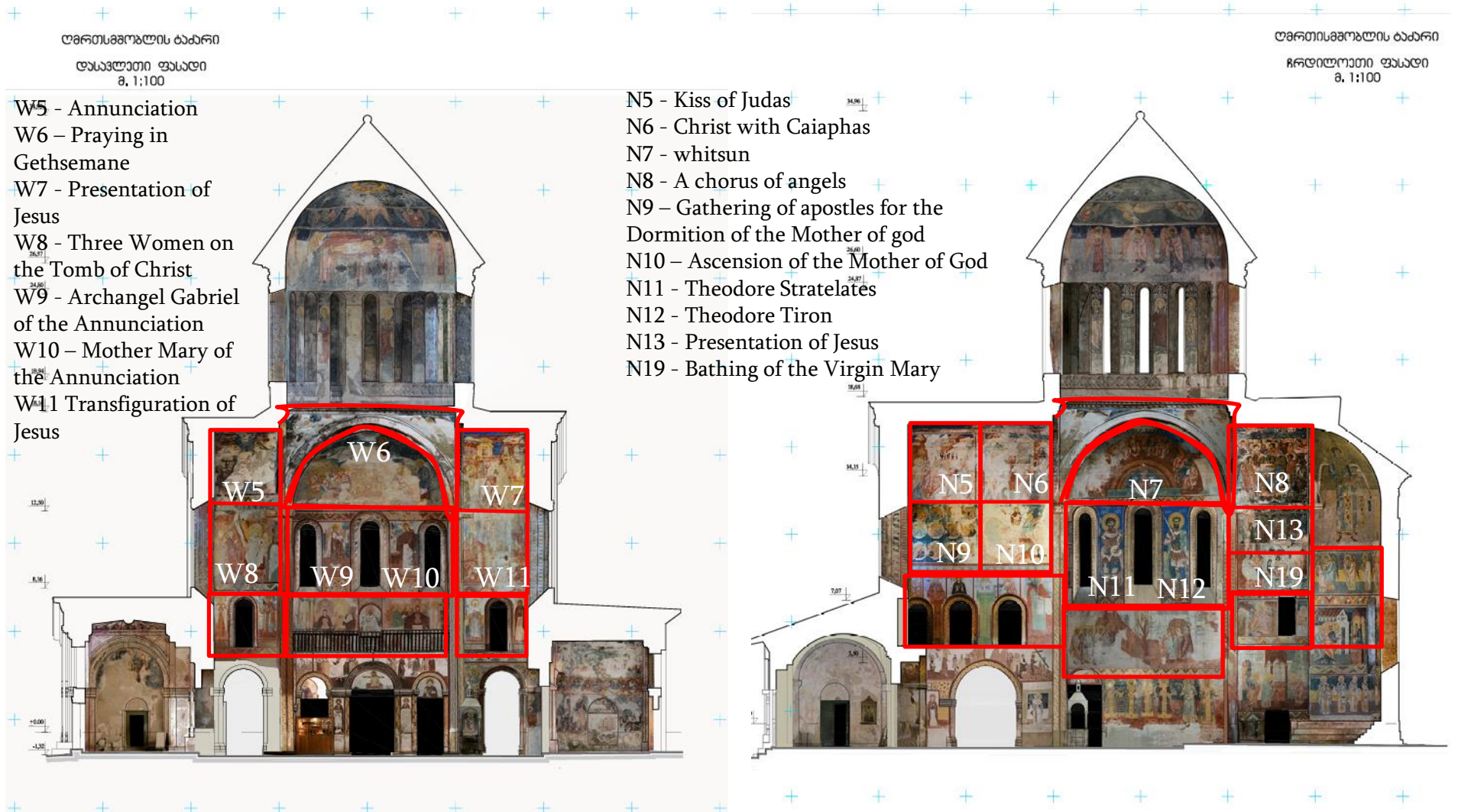
3. Summary



Source of the schemes: National Agency of Cultural Heritage of Georgia



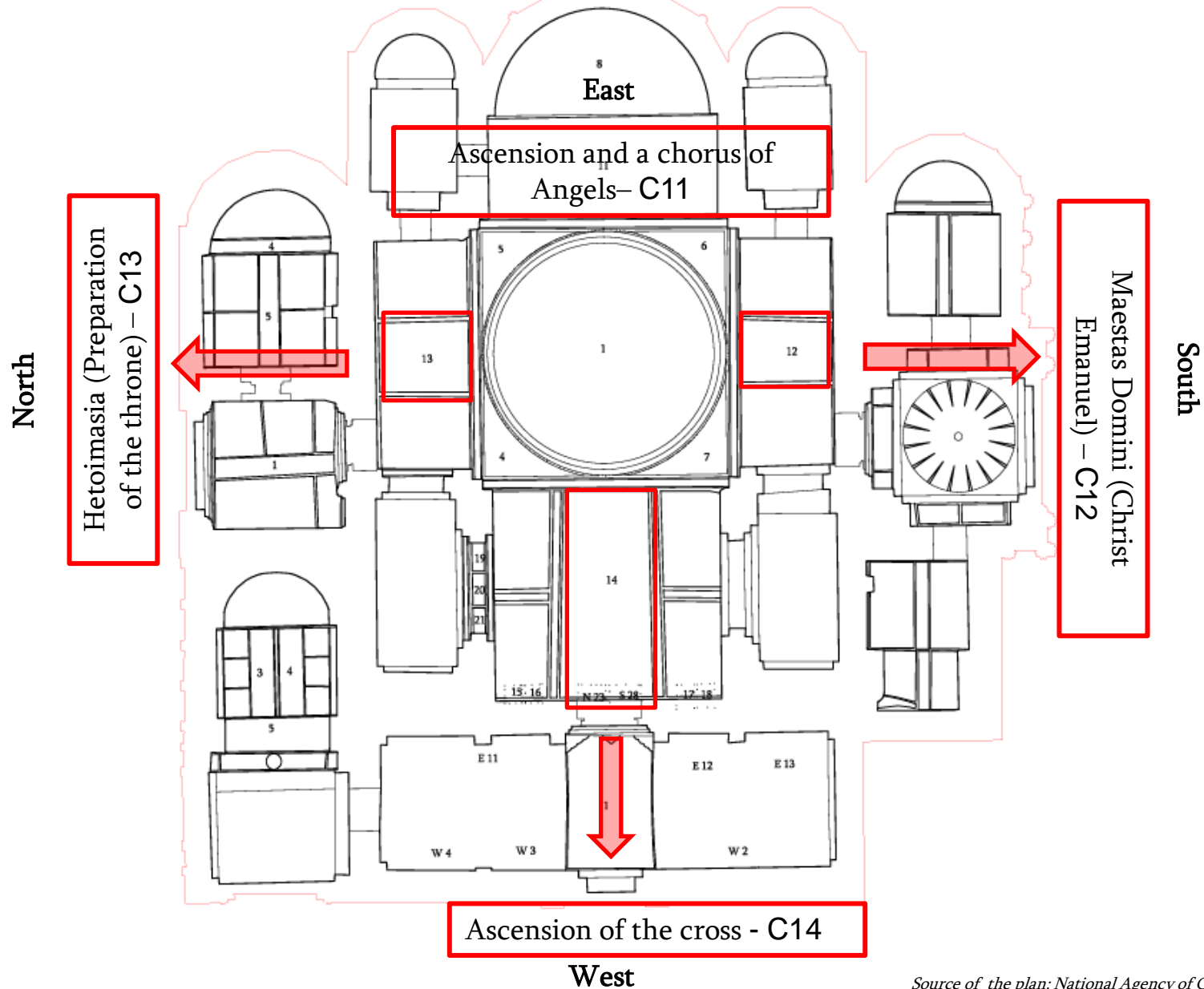
3. Summary



Source of the schemes: National Agency of Cultural Heritage of Georgia



3. Summary



Source of the plan: National Agency of Cultural Heritage of Georgia

3. Summary

A brief overview of the condition of wall painting based on the data from December 2023

The condition of the wall paintings in the Church of the Nativity of the Virgin Mary and St. George, of the Gelati monastery complex is severe. Both stable and active deteriorations can be seen. According to the activity of wall paintings deterioration, active (with rapid change), ongoing (with relatively slow change) and stable (visually no change from 2017 or before) areas can be found. The following areas of the main space of the Church of the Nativity of the Virgin Mary are especially critical: the southern wall of the western arm (S7, S8), the western Pendentive and the adjacent arches, as well as certain sections in the northern (W7, W9, E5, E7, E9) and southern arms (W8, S12), see Appendix 4 (Critical Areas). Among the locations at risk of wall painting collapse, worth noting are the North-West (2 sections) and North-East (1 section) chapel, as well as South-West chapel (St. Marine). The condition of the portrait of the donor on the northern wall of St. George's church is critical.

In the above-mentioned locations, the process of wall painting deterioration is ongoing, especially noteworthy is the process of degradation. The observation of the condition, revealed a significant change in the salts of the mural. The Crystallization-deliquescence cycles of salts and the sensitivity of the materials to moisture, led to the deterioration of the condition of the plaster and the paint layer - decomposition and subsequent loss.

It should be noted, that the deterioration process is ongoing in the areas, which has temporarily stabilised in 2019-21, and in the areas permanently stabilised and restored in 2021-22. (See examples below):

„ფერხობანა“, ფრაგმენტი



კონსერვაციამდე

„ფერხობანა“, ფრაგმენტი



კონსერვაციამდე



კონსერვაციის შემდეგ



კონსერვაციის შემდეგ

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To the left: photos taken before and after conservation. Buchukuri M. the Church of the Nativity of the Virgin Mary, Gelati - report of the conservation/restoration works of the XVI century wall paintings in the west arm arch 2022, pages. 22,23

Bottom left photos: Photos taken at the same locations on October 14, 2023. Preserved areas show more severe forms of deterioration.



3. Summary of the Condition of the wall painting

A general summary of the condition of the wall paintings (II, III, IV) of the east, west, north and south arms of the main church of the Gelati monastery complex.

Introduction

The condition of the walls of certain sections of the upper registers of the east, west, north and south arms of the Church of the Nativity of the Virgin Mary of the Gelati monastery complex is severe. There are both, historical and relatively newly occurred deteriorations, which are related not only to the architectural problems of the centuries-old building, but also to the infiltration of water from the roof into the interior during the roof rehabilitation in 2015-2018 (in the case of the western arm- until August 2020), the impact of unstable climatic conditions, the original painting technology and the restoration/conservation interventions carried out on the wall paintings (in 2021-22).

Based on the visual observation of the wall painting condition and the analysis of the graphic documentation, it can be said that the damage and deterioration to the wall paintings covers almost all scenes with uneven severity and scale, although the largest extent of deterioration is dispersed on: the upper two compositions of the southern wall of the western arm (the scenes of the last supper and foot washing), the north- Western Pendentive and the west (Presentation of Jesus) and east (The raising of Lazarus) scenes of the Northern arm.

List of types of deteriorations and damages

Based on the visual examination, the main types of deteriorations in the research area are:

- For the primary support – loss of mortar, stone decohesion, stone cracks;
- For the plaster layer – loss, decohesion, delamination, pitting and cracks;
- For the paint layer – loss, cohesion and adhesion failures, washed drips of paint;
- Biological activity;
- Surface deposition;
- Pigment alteration;
- Salts



3. Summary of the Condition of the wall painting

The distribution of deteriorations

As a result of visual observation and analysis of graphic documentation, two main groups of wall painting deterioration were distinguished according to the scale of distribution:

1. Widespread deteriorations - they are spread on the research area of the wall painting and cover areas in a large scale.
2. Locally spread deteriorations - they appear locally, in specific locations.

Widespread deteriorations are:

- Pitting of the organic inclusions (of plaster), net type cracks
- Salts
- decohesion of plaster and paint layers, flaking of paint layer (esp. blue for powdering, and for salts: mainly red and yellow)
- Complete and partial loss of plaster and paint layers, both historical and new losses.
- Paint alteration, which occurs mainly where white/black and blue colors are located
- Biodeterioration: Pink spots, that appear most of lower tiers both on paint and plaster layers

Locally spread deteriorations are:

- Biodeterioration
 - Black deposition, which can be seen locally on the southern wall of the western arm, the southern part of the Vault and the Vault of the northern arm.
 - Pink spots that appear in the form point groups locally on the western wall of the northern arm
- Delamination of the plaster layer (open and closed), which can be seen locally in all three arms, in the pendentives and in arches between the pendentives.
- Blistering of paint layer, which can be found locally, in small sections, in almost every scene.
- Washed drips of paint, which can be seen on the western and eastern walls of the northern arm, as well as on the southern wall of the western arm.



3. Summary of the Condition of the wall painting

Correlation between deteriorations

As a result of visual observation and analysis of graphic documentation, the correlation between the following deteriorations was revealed:

Plaster decohesion, decohesion, flaking and blistering of the paint layer, as well as losses of wall painting are related to the problem of salts.

Small losses of the paint and plaster layers are associated with the pitting of the organic inclusions.

The problem of delamination of the plaster, is related to liner cracks, partial and/or complete losses and deformation.

Possible correlation between deterioration and technology:

Net type cracks in the plaster layer are related to the plaster technology, and deep cracks are related to the architecture structure (wall ties and masonry).

Decoherence of the paint layer (e.g. blue) may be related to the inherent susceptibility of the material.

Pitting in plaster, loss of the paint layer and blistering are related to the organic inclusion used in the plaster technology.

Small rounded shaped losses of plaster and paint layers might be correlated with pink dots (biodeterioration).

Overview of Salts

In the context of wall painting condition, the phenomenon of salt deterioration (the process of salt efflorescence from the wall structure to the surface) should be emphasized. The intensity and scale and distribution of salts includes the upper register (vault level) surfaces of all three arms, the north-west and south-west arms, and the arches between the arms.

Salts occur in 4 main forms*. The most widespread form of salt efflorescence is newly crystallized salts (flakes), that can be seen on the southern wall of the western arm in the scenes of the Washing of the Feet and the Last Supper. The scene on the central and eastern wall of the north arm (Resurrection of Lazarus) is worth noting. In this scene and in the north-western Pendentive and surrounding areas, different forms of salts are distributed together in a fairly large scale and intensity. In almost all locations where there is salts, we find deterioration of the painting (decohesion/flaking/loss) and plaster (decohesion, partial loss) layers. The internal salts of the structure (the process of crystallization in and under the layer) should be connected with the separation of the coating layer and the peeling of the painting layer.

* 1. Flakes - freshly crystallized salt; 2. Crystalline dots- relatively hard and aged salt; 3. Crust - a layer of hard salt deposits, relatively old; 4. White haze - old solid particles well embedded in the structure.



3. Summary of the Condition of the wall painting

Overview of the condition of the plaster layer

The condition of the plaster in the research areas is mostly unstable, critical sections also can be seen, which are mainly manifested in the decohesion and local delamination of the plaster layer. The decohesion is mostly visible on the Vault of the western arm and its adjacent southern and western walls, as well as on the western wall of the northern arm (in the sections where the conservation interventions were carried out in 2021-2022).

Attention-grabbing sections of the plaster are delaminated areas, where the loss or weakening of the connection between the plaster and the primary support and/or between the plaster layers is observed. Such areas are found on the west wall of the west arm, the west wall of the south arm, the east wall of the north arm, and the adjacent sections of the west pendentive. In this regard, difficult places were also revealed on the scenes of the third and second tiers.

Among the types of plaster deterioration, pitting (loss of the organic inclusions/plant fibers) can be highlighted, which occur massively over large areas of wall painting, mostly together with plaster decohesion.

Historical and new losses of various sizes (both total and partial) are also worth noting.

Significant are the deep cracks of the plaster layer, which are presented on the border of the western, southern and northern walls of the western arm.

On the western edge of the vault of the western arm, relatively short diagonal cracks are developed.

Relatively thin and shallow cracks are present in the western vault of the eastern arm, in which the cracks mainly transversely cross the upper layers of the plaster.

There is also one relatively deep vertical crack in the western part of the northern wall of the western arm-the scene of Kiss of Judas and the west wall of the north arm.

In the church, on the plaster of all the scenes, net-like cracks can be found, which are related to the technology- the problem of shrinkage during the drying of the plaster (the mentioned cracks are not marked on the graphic documentation).



3. Summary of the Condition of the wall painting

Overview of the condition of the paint layer

An unstable condition, similar to the plaster layer, can be seen on the paint layer as well. Moreover, the scale of critical locations is relatively large. Among the types of deterioration of the paint layer, the flaking and decohesion can be seen on quite wide sections of the painted surface. However, it should be noted that the degree/severity of these deteriorations is unevenly distributed. There are specific sections where we find blistering of the paint layer, weakening and/or loss of the connection with the plaster layer. Losses of paint layer are almost equally widespread; we find cases of both complete and partial loss.

Particularly complex forms of deteriorations were observed on the eastern apse, where the technology (the overpainted layer) includes oil paint. In the mentioned place, we find complex forms of loss and flaking.

Conservation materials left on the painting

Noteworthy are the parts of the wall painting, where within the framework of the last conservation/restoration works (2021-22), the planned work was not completed (the western wall of the western arm and the arch between the pendentives). In this area, we find the intervention layer used for the temporary stabilisation of the plaster layer and small holes specifically made for injections.

Summary

As a result of the visual study of the condition of the wall painting and the analysis of the graphic documentation, an unstable condition of the wall painting was revealed, the extent of which is large and includes certain sections of the upper two registers of the western, northern and southern arms. Both severe and minor deteriorations are noted on the paintings in the mentioned parts. Some of the deteriorations are active (rapid change) and ongoing (relatively slow change), although we often find stable conditions of the deteriorations (historical).

There are clear correlations between the deteriorations of paint layer. There are often cases where two or more different types of deteriorations are spread on one particular section. Correlation between deteriorations of the plaster and paint layers is also common.

It should be noted that almost everywhere, both in the plaster and paint layer deteriorations, some of the main provoking factors are pink dots (biodeterioration) and salts. The constant action of salt accelerates both the deterioration of the plaster and the flaking or decohesion of the paint layer, which eventually ends with the loss of the painting.

Note: At this stage, it is not the mission's goal to identify and locate the wall painting interventions done in the 2020s.



3. Summary of the Condition of the wall painting

Critical areas

On the wall painting of the interior arms of the main space, we find sections of the painting in critical condition. Wall paintings on the south wall of the west arm, on the west and east walls of the north arm, as well as on the arches between the pendentives and the pendentives themselves, show a high risk of paint loss. The dynamics of deterioration puts the wall painting in danger of being lost. Such sections are intersected both in the areas of conservation interventions carried out in 2021-2022, and in those parts of the western, northern and southern arms, where probably no intervention took place in recent years. In these sections, both the paint layer and the plaster layer are deteriorated, and we also see the crystallization process of salt, both on the surface and inside the structure.

The critical areas can be observed in the North-east and North-West chapels, South-east chapel and the north wall of Church of St. George.

The dynamics of wall painting deterioration, changing and unstable sections are clearly visible in the monitoring of October 31, December 27, 2022 and March 9, July 5, and October 14, 2023, December 15, 2023.

For detailed locations of critical areas, see graphic documentation N4 - Critical Areas



3. Summary

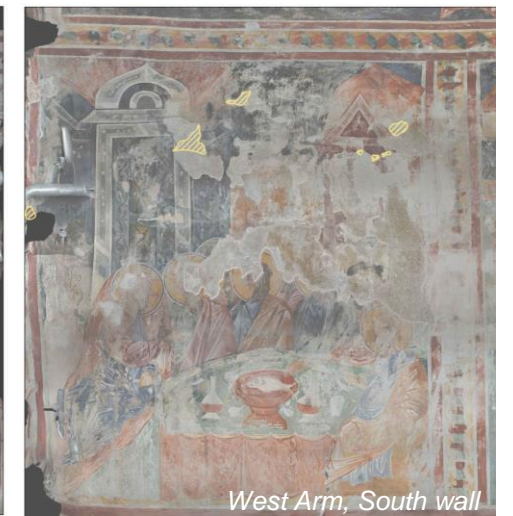
Summary of wall painting technology

Observation of the existing wall paintings in the research areas revealed a layer of early paintings under the well-known painted scheme of the 16th century. The revealed painting is not only stylistically and programmatically different from the 16th century layer, but also technologically. Visual observation revealed that there is a different composition and types of modelling techniques of the plaster and paint layer between the schemes.

The earliest layer of painting is found on the vault of west arm (the Ascension of the cross), the south wall (The Last Supper) and the north wall (Christ with Caiaphas). While the fragments of early layer paintings presented on the Vault and the south wall are monochrome, a figurative scheme can be read under the scene with Christ with Caiaphas, which is fragmentary and requires interdisciplinary (art historic and technological) research.

The stratigraphic complexity of the wall painting became more evident with the discovery of the early layer.

See the table for a list of stratigraphic layers of wall paintings of the arms and painting periods.

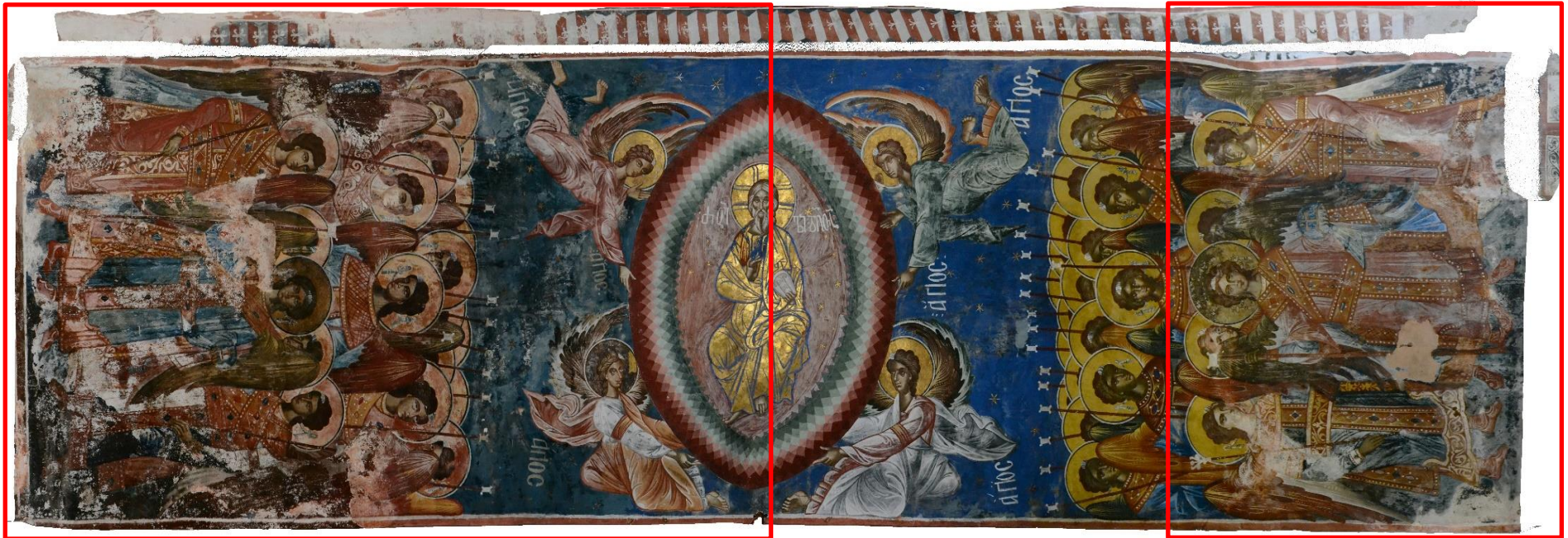


above: Areas of early paint layer distribution are marked in yellow



3. Summary

Based on the visual observations of the original technology, it can be said that on the northern and southern walls and vault of the eastern arm, the layer of the later wall painting (XVI) has been overpainted in places. The overpaint layer of painting differs in technology and style from the painting of all three arms (XVI century). Later paint layer - painting scheme, in some places is applied directly on the plaster.



3. Summary

Based on the visual study of the original technology, a complex stratigraphy of wall painting was revealed, which is chronologically presented in the table below.

Wall Painting Technology

Stratigraphic table

4.1 Primary support

4.1.1 Stone

4.1.2 Mortar

West arm		South arm		North arm	
4.2 Paint layer1 (early layer)		4.3 Paint layer 2 (XVI)		4.3 Paint layer 2 (XVI)	
4.2.1 Plaster layer	4.2.1.1 Unidentified fragments of extant plaster	4.3.1 plaster layer	4.3.1.3 type - bottom	4.3.1 plaster layer	4.3.1.2 type - top
	4.2.1.1 Primary plaster		4.3.1.4 type - top		4.3.1.5 type
	4.2.1.1 preparatory layer	4.3.2 preparatory technique	Underdrawings	4.3.2 preparatory technique	Underdrawings
4.2.2 Preparatory technique	Underdrawings (red contour with a brush)		Setting out geometry		Setting out geometry
4.2.3 Paint layer		4.3.3 paint layer		4.3.3 paint layer	

4.3 Paint layer 2 (XVI)	
4.3.1 Plaster layer	4.3.1.1 type - bottom
	4.3.1.2. type - top
	4.3.1.5 type - top
4.3.2 Preparatory technique	Underdrawings
	Setting out geometry
4.3.3 Paint layer	

East arm	
4.4 Paint layer 3 (XIX)	
4.4.1 plaster layer	
4.4.2 preparatory technique	
4.4.3 paint layer	



3. Summary

Summary of technology by stratigraphic layers:

Primary support (Stone/Mortar)

In the interior of the main church (on the vaults of the western, northern and southern arms, adjacent walls and pendentives), the primary support can be observed only where the wall painting is lost (in sections with complete loss of painting). Therefore, the given descriptions represent only the results of visual observation of these sections.

Visual observation shows only one type of rock (similar to sedimentary carbonate rock).

Three subtypes can be distinguished:

1. **having an even surface;**
2. **hollow;**
3. **Fine-porous (for details, see Visual Glossary 4.1.1)**

The differences in the surface (even, hollow and fine-porous) are either genesis characteristics of the rock, or are caused by alteration processes and are related to the deterioration process).

Colour of stones: light whitish-brown surface, darkened in places, rust-coloured in places, with reddish-yellow spots and stripes. In addition to this natural (genesis and/or changing processes occurring in the rock) colour of the rock, different causes visually change the colour on the surface of the stone.

The structure of the rock is mostly even, closely packed aggregates, pelitic or granular-pelitic structure, mostly with a dense surface, in certain places with weakened stone density (decohesion) and smoothed surface (erosion). Also, in certain places, the even structure of the stone is disturbed by genesis microcracks.

The masonry consists of stone blocks of various sizes, mostly rectangular in shape. Triangular stones are used in the pendentives, the shape of the stones in the arches of the arms of the church is curved, on the surrounding walls semi-curved, and at the edges of the pendentives, they are semi-columnar, rounded, in accordance with the architectural elements.

The topography of the wall is uneven, which determines the topography of the paint layer as well. On the surface of the stone blocks, traces of tool marks can be seen, thin, multiple incisions.

Mortar

Mortar between stones can be seen only in a few places. The stone blocks in the wall structure are usually closely (close to each other) connected, so the gap/joint between them are either not visible or very thin (up to 5-10 mm).

The mortar in between the stone joints is characterized by greyish-white colour, strong, dense, multiple inorganic fillers, organic inclusions are not detected. It is worth noting that the mortar is similar to the plaster of the lower paint layer, revealed in the western arm (see plaster type 4.2.1.1 and 4.2.1.2).



3. Summary

Primary support (stone) subtype 1 and subtype 2



Left and bottom: North wall of the west arm of the main space (scene N6), context and macro photos. The photo illustrates an example of sub-type 1 of the primary support (stone).

Right and bottom: North wall of the west arm of the main space (Scene N6), context, detail and macro photographs. The photo illustrates an example of sub-type 2 of the primary support (stone).



Gel23_VM_MS_N6_3012_Mr



Direct light

Gel23_VM_MS_N6_3009_C



Direct light

Gel23_VM_MS_N6_3009_M2_sc



Direct light

Gel23_VM_MS_N6_3012_C_sc



Direct light

Gel23_VM_MS_N6_3012_M



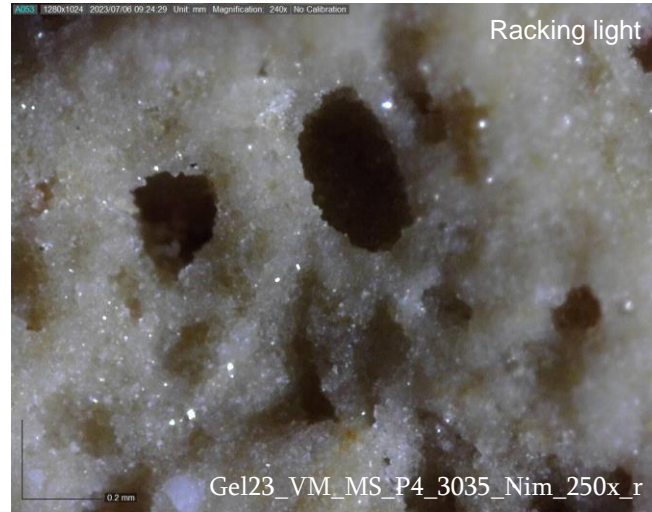
Direct light

Gel23_VM_MS_N6_3012_D

3. Summary

Primary support (stone) subtype 3

Right and bottom : North part of the arch of the west arm of the main space, context and macro photos, as well as microscopic photos at 50x and 250x magnification. The photos illustrate an example of sub-type 3 of the primary support (stone).

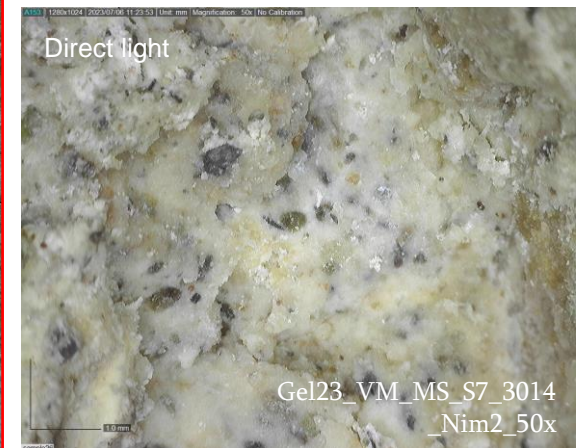
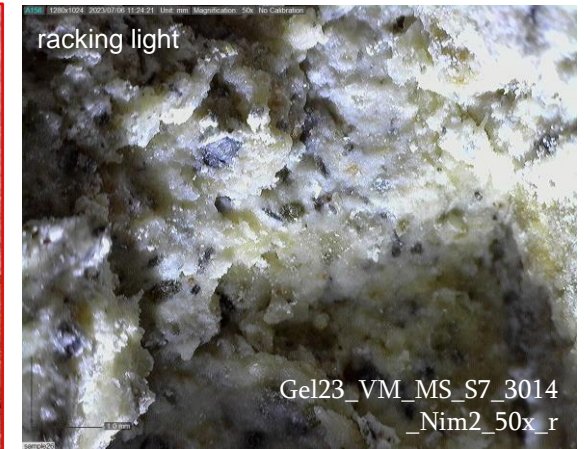
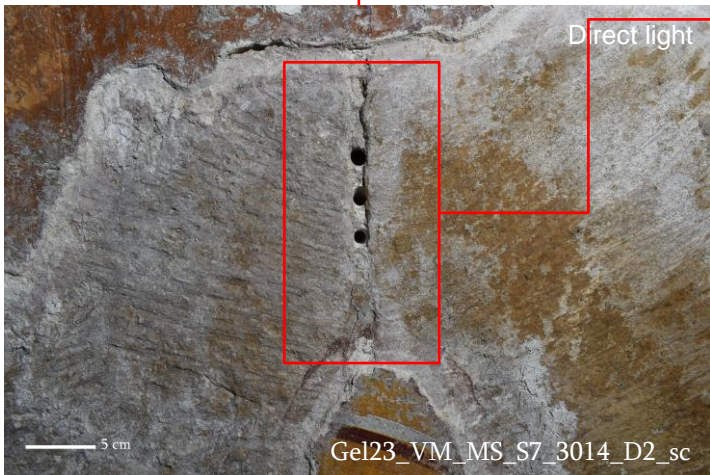


3. Summary

Mortar

photos: South wall of the west arm of the main space, context, detail and macro photos. Also, microscopic photos at 50x and 250x magnification. The photos illustrate the mortar in the stone joints (similar to the plaster of early wall painting, see the plaster type 4.2.1.2)

Note: The holes shown in the photos are traces of invasive studies carried out by Studio Massar in 2021-22.



3. Summary

Summary of technology by stratigraphic layers:

Plaster layer- Painted scheme 1

Based on the visual study of the original technology, on the northern and southern walls of the western arm and the vault, an early layer of painting was revealed in the areas of loss of the later paint layer (XVI), and on the northern wall of the western arm (N6) fragments of plaster without the painting.

3 main categories are distinguished in the early painting layer: 4.2.1.1 Unidentified fragments of preserved layer, 4.2.1.2 The main plaster layer and 4.2.1.3 Preparatory layer.

By visual observation, the composition of type 4.2.1.1 plaster is similar to the main layer of plaster with painting, however, whether the plaster fragments represent a stratigraphic layer of an early painting is unknown at this stage and requires additional research.

According to the preliminary observation, the locations of the unidentified fragments of plaster are seen in the middle part of the N6 scene. See the photo of the N6 scene on the right with the locations of the fragments marked with red.

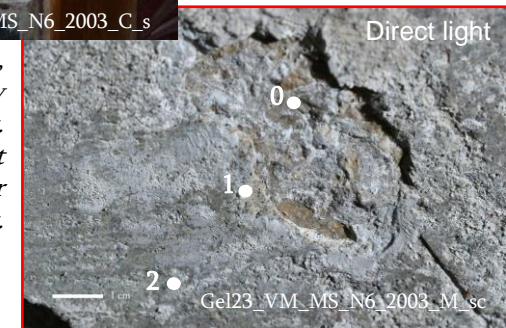
The stratigraphy of the early painting is represented by a light gray layer up to 1 cm thickness, characterized by clear and fine-grained inorganic aggregate filler of various colours and morphologies.

In places of the main plaster layer there is a preparatory layer of uneven thickness, mostly up to 0.2 cm, with an inorganic aggregate filler. The surface is well carved, has a smooth, even texture. In terms of composition, the material is similar to the main plaster layer, therefore in some places it is difficult to visually separate these two layers.

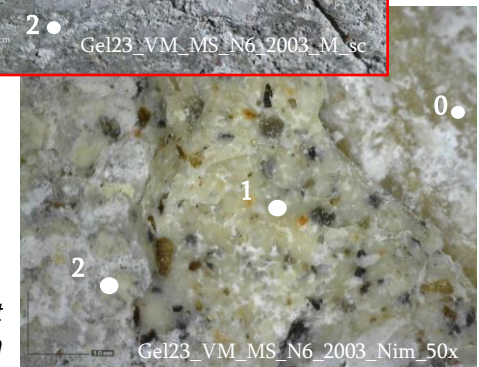


left: Context photo of a fragment of an early layer of the wall painting, west arm, north wall, scene N6.

*right: Macro photo, stratigraphy of the early paint layer.
0 - primary support
1 - the main layer
2 - preparatory layer.*



right: microscopic photo at 50x magnification

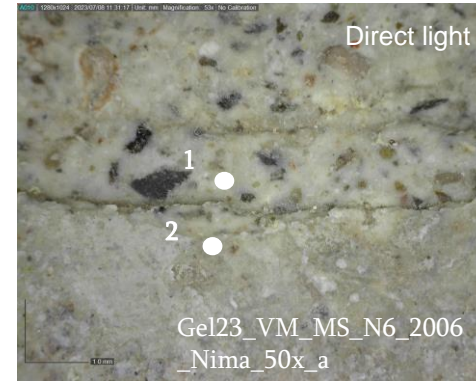
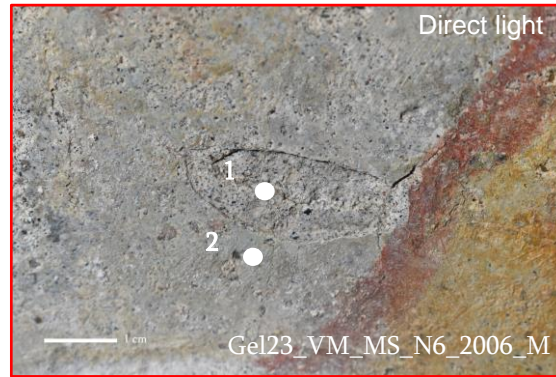


3. Summary

Summary of technology by stratigraphic layers:

Plaster layer- Painted scheme 1

An example of the stratigraphy of the layers of early wall painting:

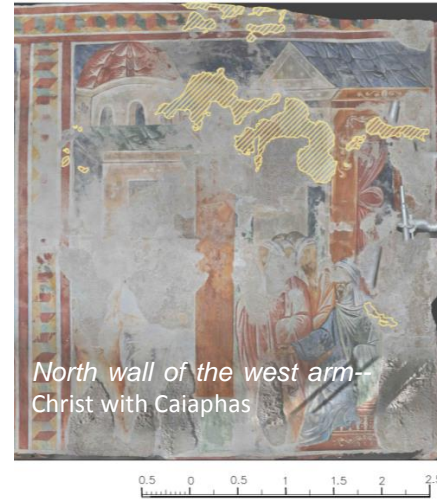
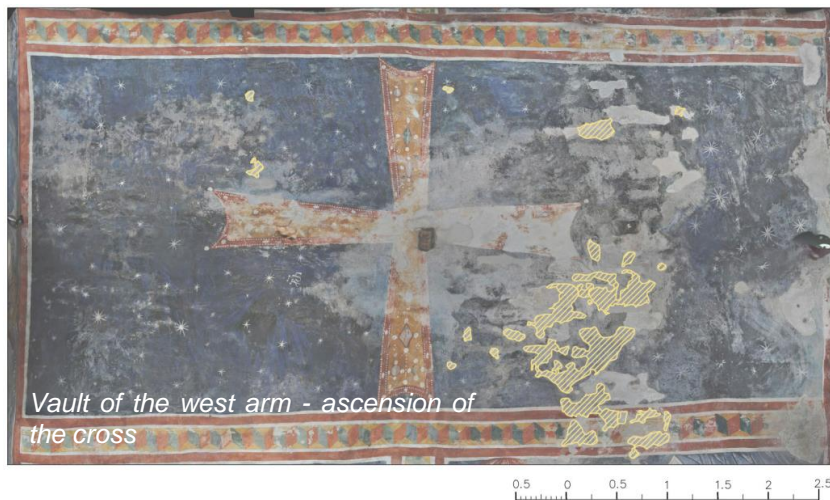


left: Microscopic photo at 50X magnification Stratigraphy of the plaster layer.
1 - the main plaster layer
2 - preparatory layer.

above: context photo, fragment of an early layer, painting of a figure, west arm, north wall, scene N6.

above: Macro photo, stratigraphy of the early painting layer. 1 - the main plaster layer
2 - preparatory layer.

below: the areas of of early pain layer distribution are marked in yellow on the graphic documentation



3. Summary

Plaster layer – Painted scheme 2 (XVI)

Based on the visual study of the original technology, the number and composition of the layers of the later painting (XVI) differ, depending on the arms. A difference within the arm scenes can also be observed. The composition of the later paintings is significantly different from the earlier paintings. Based on visual observation, according to the composition, it is possible to distinguish at least 5 main types of plaster:

Arm	Scene	Painted scheme 2 (XVI) plaster layer				
		Type 1 Inclusions: Relatively large amount of inorganic aggregates + yellow organic inclusions	type 2 Inclusions: *Relatively large amount of inorganic aggregates + yellow organic inclusion + transparent white organic inclusion	type 3 inclusions: Only the yellow organic inclusion	type 4 inclusions: Small amount of inorganic aggregates + transparent white organic inclusion	type 5 inclusions: A large number of inorganic aggregates + transparent white organic inclusions
South arm	Annunciation - E6				✓ Visible layer	
	Nativity - S6				✓ Visible layer	
	Annunciation - W5			✓ Bottom	✓ top	
	Maestas Domini (Christ Emanuel) – C12				✓ Visible layer	
	Saint George- S10 (plaster is not visible)					
	Saint Demetrius- S11 (plaster is not visible)					
	Deposition - E8				✓ Top visible layer	
	Three Women on the Tomb of Christ - W8				✓ Top visible layer	
West arm	The last supper- S7	✓ bottom	✓ top			
	Feett washing- S8		✓ Top visible layer			
	Praying in Gethsemane - W6	✓ Top visible layer				
	Kiss of Judas- N5	✓ bottom				✓ top
	Christ with Caiaphas - N6	✓ bottom				✓ top
	Ascension of the cross- C14	✓ bottom	✓ top			



3. Summary

Plaster layer – paint layer 2 (XVI)

Arm	Scene	Paint later 2 (XVI) plaster layer				
		Type 1 Inclusions: Relatively large amount of inorganic aggregates + yellow organic inclusions	type 2 Inclusions: *Relatively large amount of inorganic aggregates + yellow organic inclusion + transparent white organic inclusion	type 3 inclusions: Only the yellow organic inclusion	type 4 inclusions: Small amount of inorganic aggregates + transparent white organic inclusion	type 5 inclusions: A large number of inorganic aggregates + transparent white organic inclusions
West arm	Archangel Gabriel of the Annunciation - W9 (plaster is not visible)					
	Mother Mary of the Annunciation - W10 (plaster is not visible)					
	Supper of the Mother of God - S12 (plaster is not visible)					
	Foot washing by the Mother of god - S13			✓ Visible layer		
	Gathering of apostles for the Dormition of the Mother of god- N9			✓ Visible layer		
	Ascension of the Mother of God - N10			✓ Visible layer		
North arm	Presentation of Jesus - W7					✓ 1 Plaster layer
	whitsun - N7					✓ 1 Plaster layer
	Raising of Lazarus - E5					✓ 1 Plaster layer
	Hetoimasia (Preparation of the throne) – C13	✓ Top visible layer				
	Theodore Stratelates - N11					
	Theodore Tiron - N12					
	Crucifixion - E7					✓ Top layer
	Transfiguration of Jesus - W11					✓ Top visible layer
East arm	Ascension - C11 A chorus of angels - N8, S5					✓ Top visible layer

See the distribution of plasters in the research areas according to stratigraphic and typical composition.

3. Summary

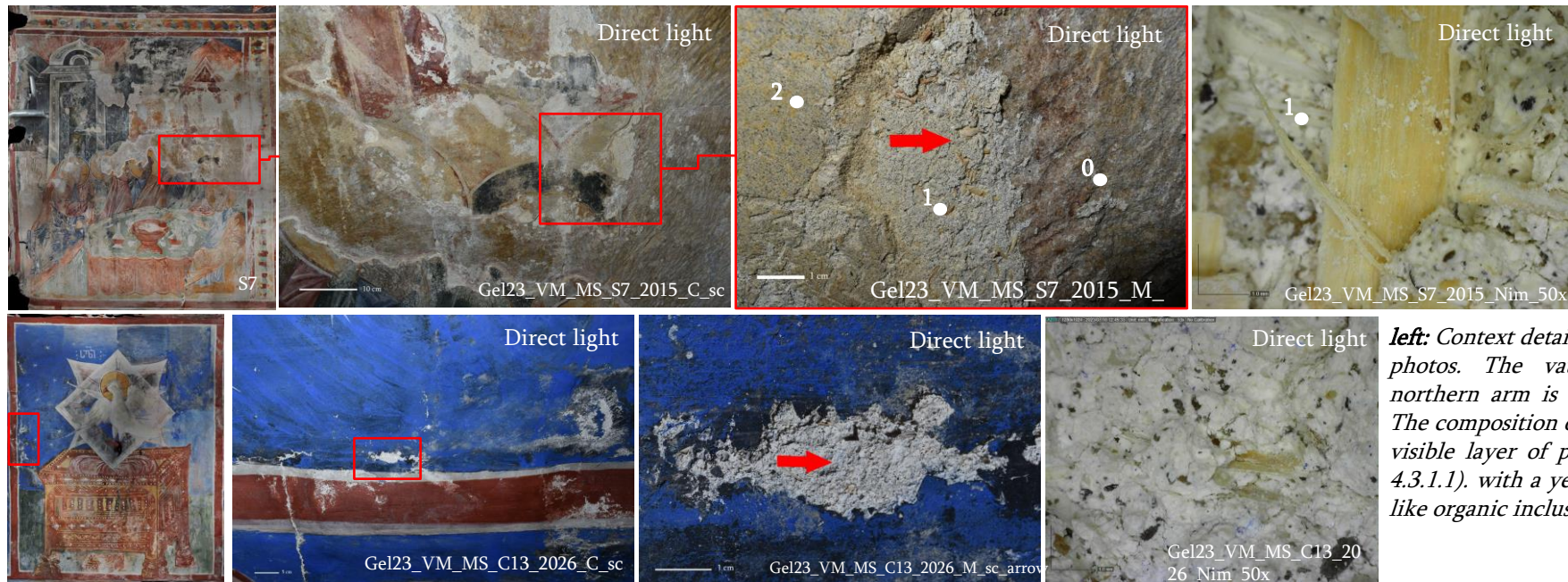
Summary of technology by stratigraphic layer:

Plaster layer- Painted scheme 2

On the basis of visual observation (using a portable microscope and macro photography), 5 main types of plaster can be distinguished according to the composition:

Type 1 – plaster layer, which together with the binder contains a large amount of inorganic aggregate inclusions and organic, yellow-coloured straw like plant-based inclusions. Distribution: The West Arm mostly has a lower plaster layer, and the Garden of Gethsemane scene is probably an upper plaster layer. Also, the upper visible plaster layer of the North Arm arch.

On the bottom: South wall of the western arm, S7 Stratigraphy: Lower layer (1) of plaster - type 4.3.1.1 - macro and micro photos.

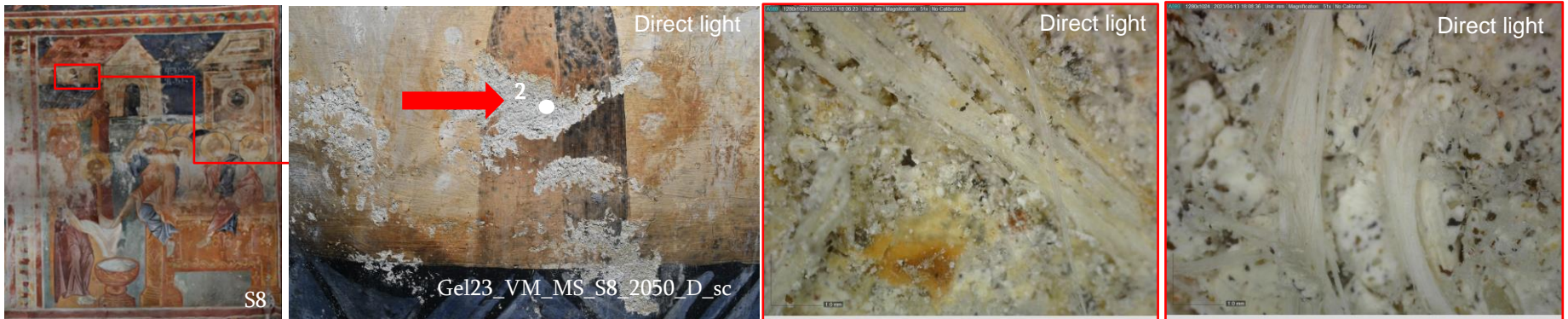


3. Summary

Summary of technology by stratigraphic layer:

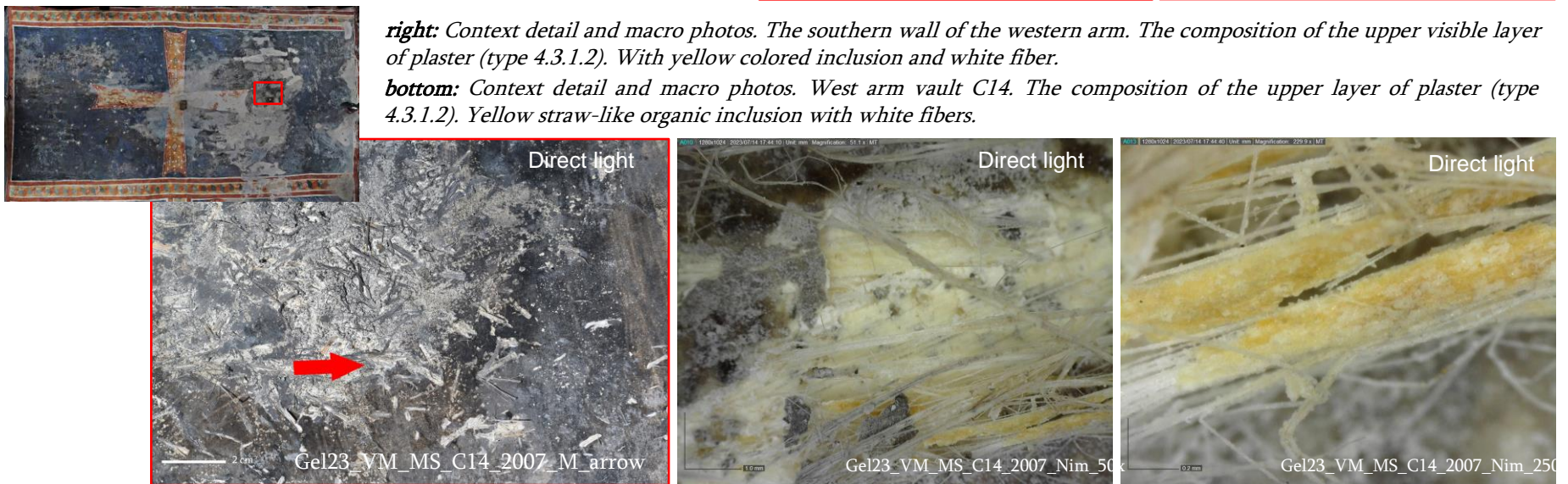
Plaster layer – Painted scheme 2

Type 2 - plaster, along with the binder, contains a large amount of inorganic aggregate inclusions and organic, yellow straw-like, plate-based inclusion and whitish coloured, transparent organic fibres. Distribution: Upper plaster layer of West Arm. See examples below.



right: Context detail and macro photos. The southern wall of the western arm. The composition of the upper visible layer of plaster (type 4.3.1.2). With yellow colored inclusion and white fiber.

bottom: Context detail and macro photos. West arm vault C14. The composition of the upper layer of plaster (type 4.3.1.2). Yellow straw-like organic inclusion with white fibers.

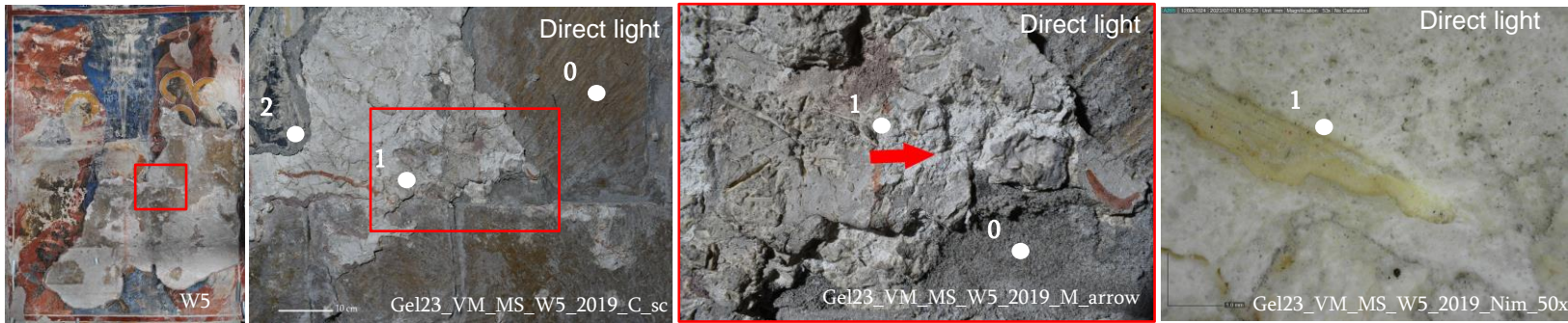


3. Summary

Summary of technology by stratigraphic layer:

Plaster layer – Painted scheme 2

type 3 plaster - consists of a white binder and plant-based straw-like inclusions. Distribution: lower plaster layer of the west wall of the south arm, scenes of the third register of the west arm. See examples below.



left: The only filling of the lower layer of the western wall of the southern arm (type 4.3.1.3) is a yellow plant inclusion.

type 4 plaster, along with the binder, it contains a small amount of inorganic aggregate inclusions and organic white transparent fibres. Distribution: Upper south Arm. See examples below.



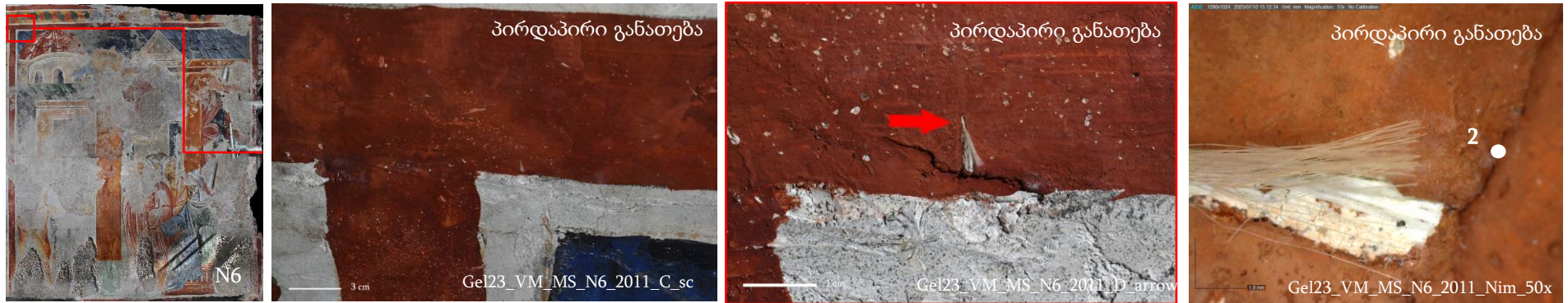
left: The plaster layer (type 4.3.1.4) of the southern wall of the southern arm. A small amount of inorganic aggregates and white/transparent organic fibres are used as fillers.

3. Summary

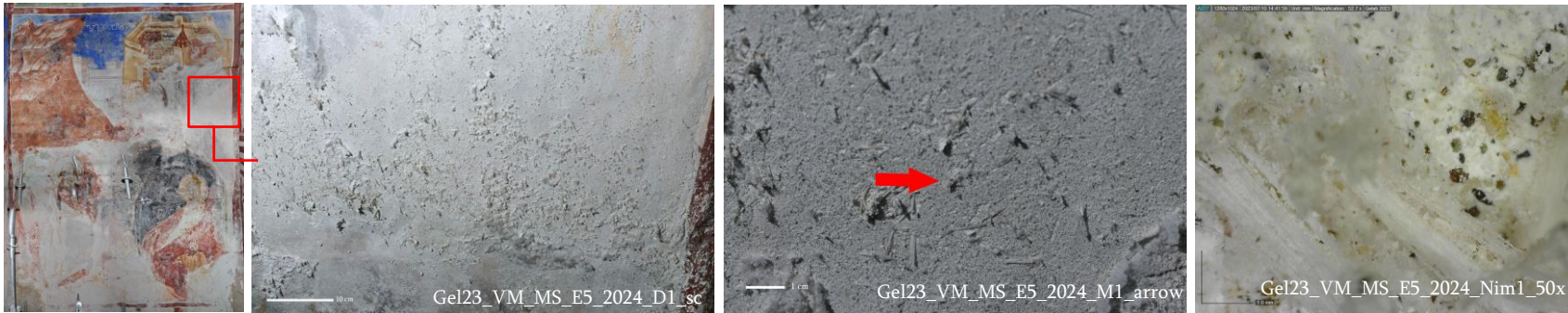
Summary of technology by stratigraphic layer:

Plaster layer – Painted scheme 2

type 5 plaster - Along with the binder, it contains a large amount of inorganic aggregate inclusions and transparent organic fibres of whitish colour. Distribution: Upper layer of the northern wall of the western arm, the walls of the northern arm and the bema of the eastern arm. See examples below.



Up : The upper layer of the north wall of the western arm (type 4.3.1.5). A large amount of inorganic aggregates and white/transparent organic fibres are used as fillers. The inorganic components of the plaster are similar to types 3.2.1.1 and 4.3.1.2.



Up : The layer of plaster (type 4.3.1.5) of the northern wall of the northern arm. A large amount of inorganic aggregates and white/transparent organic fibres are used as fillers. The inorganic components of the plaster are similar to types 3.2.1.1 and 4.3.1.2.

3. Summary

Paint layer :

Painted scheme 1 - Early paintings

The earliest layer of painting can be found fragmentally in the western arm. As a result of previous conservation interventions, the research of the original paint layer is limited: there are many undocumented reintegrated areas, making it difficult to separate the original and reconstruction layers added in 2021-22. In addition, it is noteworthy that only a small part of the stratigraphy of the complete painted layer has survived.

In the pictorial layer of earlier period, the colour palette is limited: each tone of blue, green, red and yellow is distinguished. The layer is pastel, transparent.

Painted scheme 2 (XVI)

A large part of the main space of the Cathedral of the Virgin Mary, is covered with a layer of the 16th century painting. Several layers of different periods of the 16th century have been named in the existing art historical studies. However, as a result of the observations carried out by our group up to now (see methodology), for this stage we will consider the paintings of the upper 3 registers of the study area, the eastern, western, southern and northern arms (except for the early layer) as one layer, and here we will note in detail the common or distinguishing signs between the different parts.

Blue

With the visual observation of the colour palette of the painting of the upper two registers of the west, south and north arms of the main space of the Church of the Nativity of the Virgin Mary in Gelati, blue colour was mainly revealed on the backgrounds of the scenes depicting the sky. In addition, blue is used: abundantly for the clothes of the figures, as a primary colour as well as for modeling for the facial features, architectural elements and various small details of the composition.

Three types of blue are visually distinguished on the paint layer: **dark blue** (type 1), **light blue** (type 2) and **greenish blue** (type 3).



left: A scene on the north wall of register IV of the north arm with different types of blue

3. Summary

Dark blue (type 1) occurs in transitional gradations into black or blue. The colour does not have a glossy surface, although it has a slight shine. The thickness of the layer is uneven, created by large strokes of the brush. While observing the pigment with a portable microscope, dark blue and light blue particles are distinguished, which are perceived as a single layer. In undamaged areas, the ratio of pigment to binder is high.

Distribution: Dark blue is present in all scenes of register IV of the western arm (on backgrounds, draperies and architectural details). It should be noted that at the first stage of observations, no other type of blue was detected in this arm, which indicates the technological specificity of the arm. We find a relatively small-scale use of dark blue in the scenes of register IV of the north and south arms, mainly on the draperies. Dark blue is also used in pendentives, in combination with other types of blue.

Light Blue (Type 2), is a matte type, less shiny intense blue. The thickness of the paint layer is uneven. The particles are not separated from each other, the colour is presented as a single matter.

Distribution: Light blue is used abundantly in the fourth register compositions of the South and North Arms, mainly for the sky background, but also on draperies and other small elements of the composition.

Greenish Blue (Type 3) is a dull, less shiny blue that often has a green undertone. The thickness of the paint layer is uneven. Pigment particles are large and separated from each other. Under the greenish blue, ground can always be found, which plays a decisive role in the visual perception of this paint layer colour.

Distribution: Greenish blue is used in all scenes of register III and II of the western, northern and southern arms for the sky background, clothing, architectural elements and other small details of the compositions, also in scenes of register IV of the southern and northern arms for clothing and architectural details.

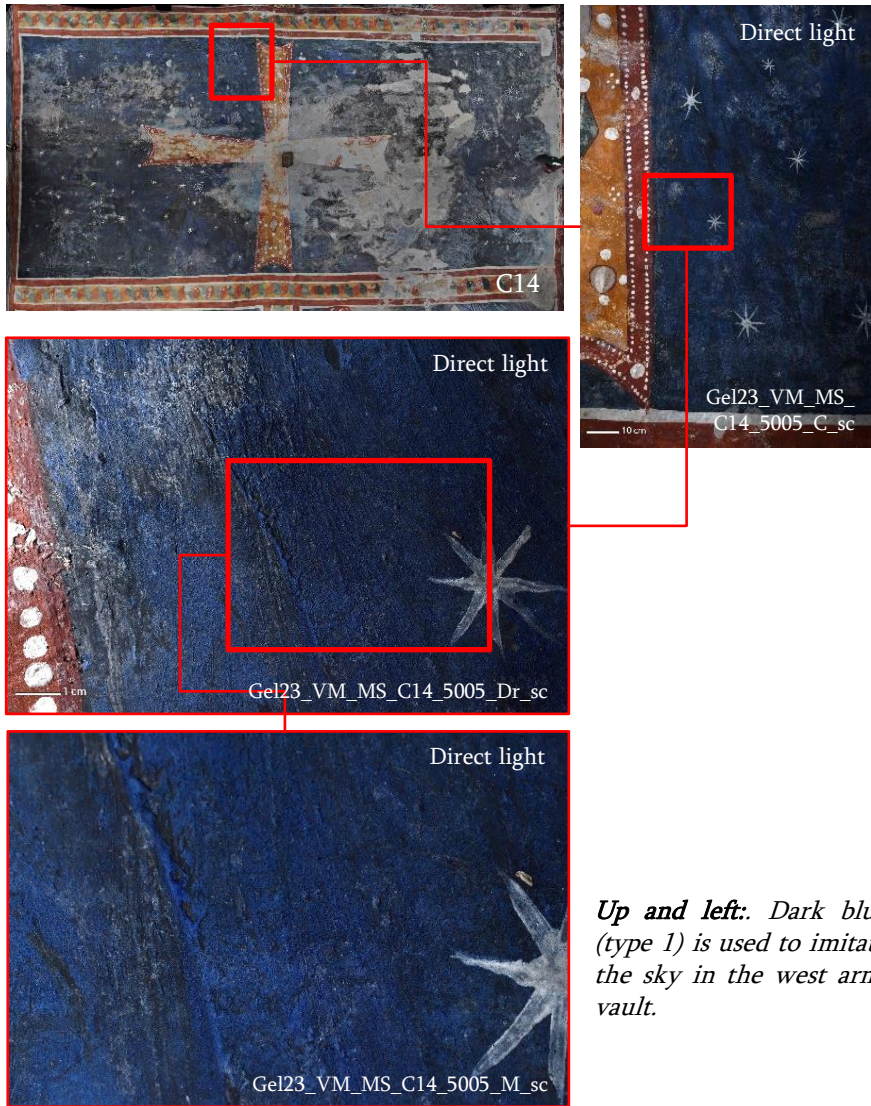
It should be noted that:

- Light blue (type 2) is not used in the scenes of the upper two registers of the west arm;
- dark (type 1), light (type 2) and greenish (type 3) blue are used together on the draperies of the figures of the south and north arms;
- The three register scenes of all three arms (west, south and north) mainly use greenish (type 3) blue.



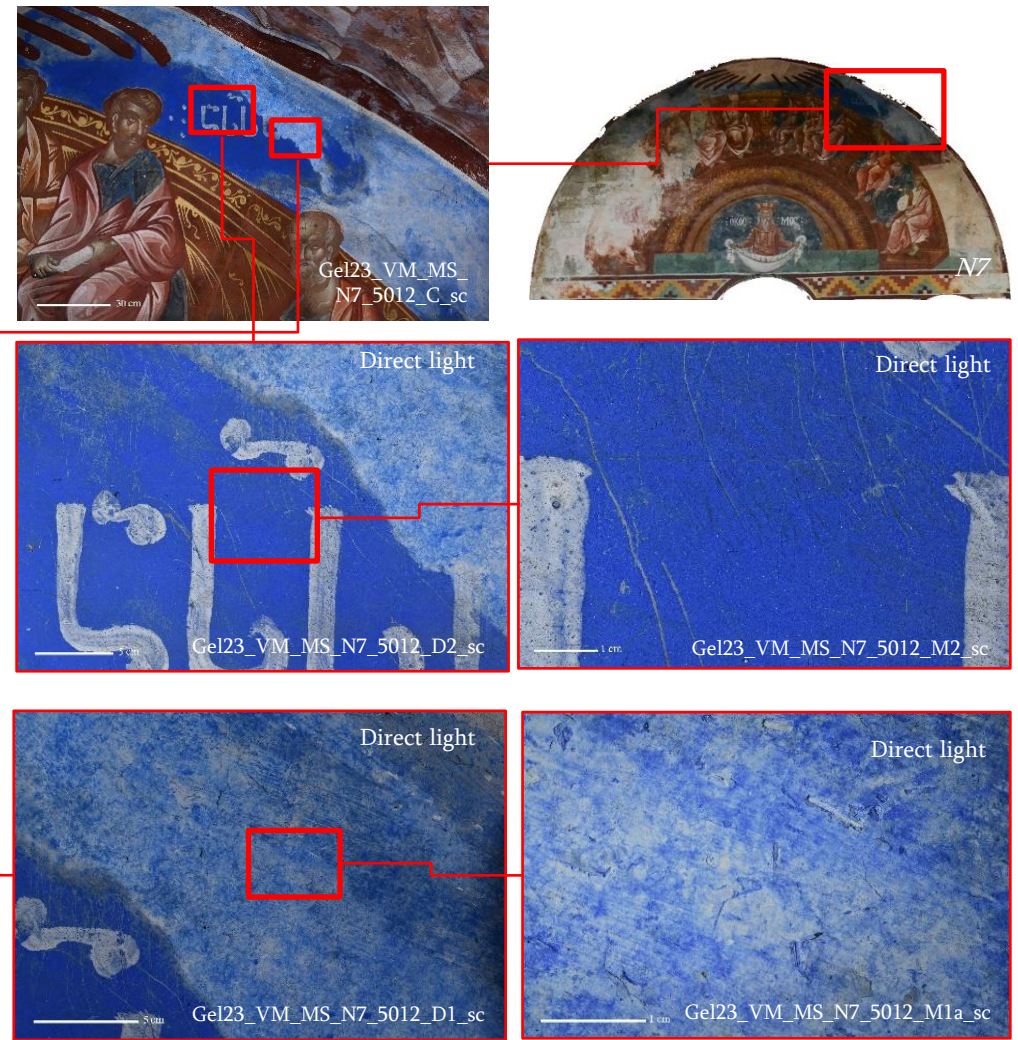
3. Summary

Dark blue (type 1)



Up and left: Dark blue (type 1) is used to imitate the sky in the west arm, vault.

Light blue (type 2)

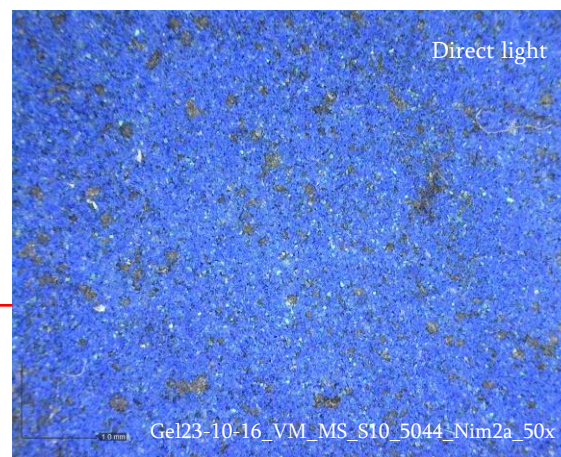
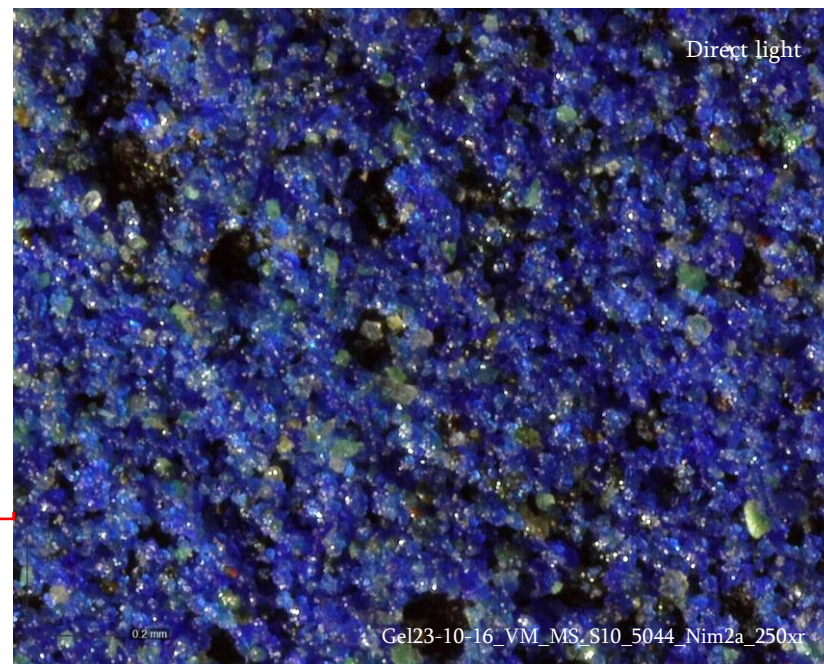
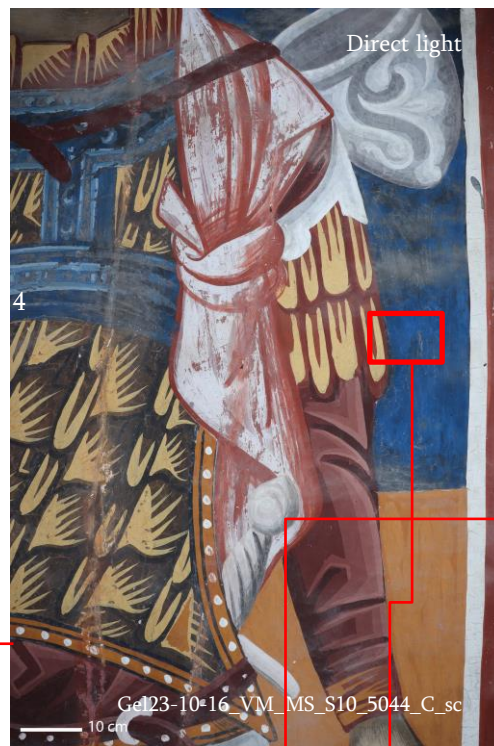


up: On the north wall of the north arm a sky background can be found, which is done in light blue (type 2). The photo clearly shows the difference in the paint layer between damaged and undamaged areas.



3. summary

Greenish blue (type 3)



Up and left: Register III of the south arm, using greenish-blue (type 3) for the background on the south wall. At X250 magnification, the green particles which are typical for this type of blue, are clearly visible.

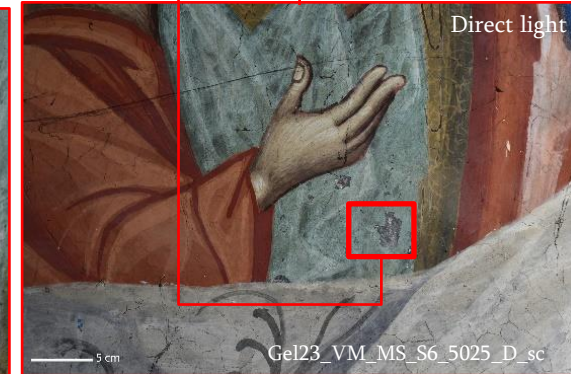
3. Summary

Green

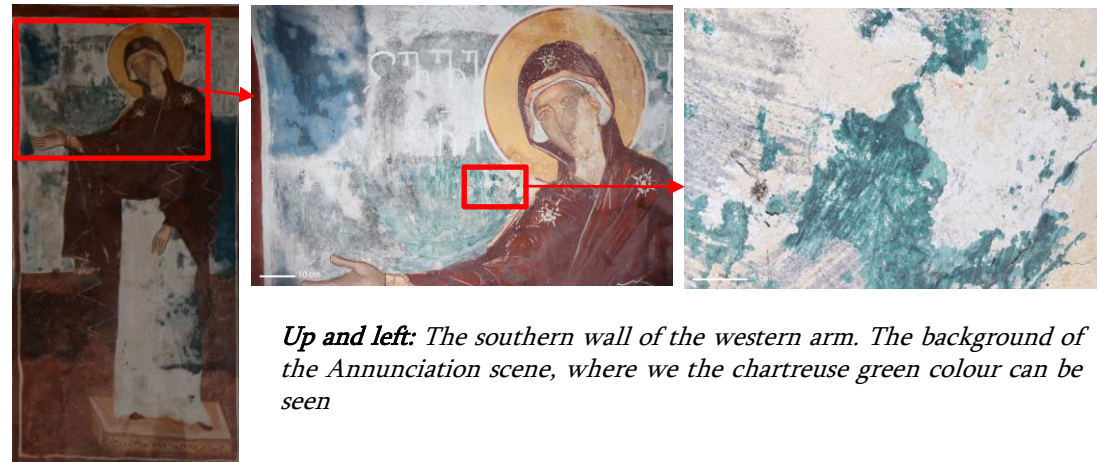
In the research areas, the colour green occurs in four basic gradations: bluish green, yellowish green, dark sharp green, and pastel green transitioning to white. It is an intense, bright, non-transparent green colour of uneven thickness. The painting layer appears to have flat strokes that follow the shapes of the paintings. When observed with a portable microscope, all the mentioned greens are composed of one basic pigment, the tones of which are due to the mixing with another colour pigment (yellow, blue, white or black). In the case of dark green, upper transparent layer is observed, which gives the main colour a relatively glossy and dark effect.

Distribution: green can be found in all three arms, in IV, III and II register scenes as background, draperies, ground and vegetation markings, architectural details.

It is worth noting that on the western wall of the third register of the western arm, on the composition of the Annunciation, chartreuse green can be seen in the background, which is very different both in general tone and in structure from the rest of the paints. Presumably this is the result of later repair or some pigment alteration. Additional studies are needed.



Up.: he southern wall of the southern vault. In the nativity scene, the angel's dress is done with green, on a black suit.



Up and left: The southern wall of the western arm. The background of the Annunciation scene, where we the chartreuse green colour can be seen

3. Summary

Red

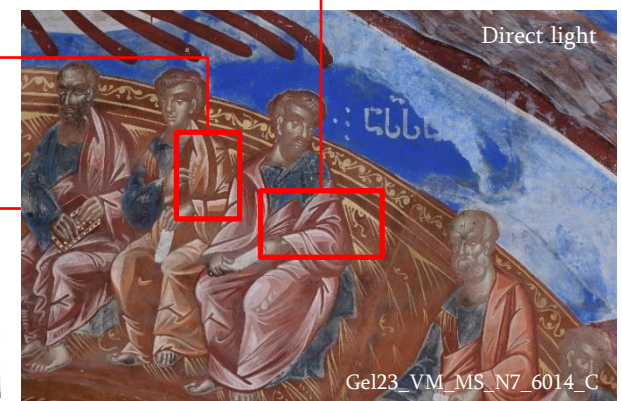
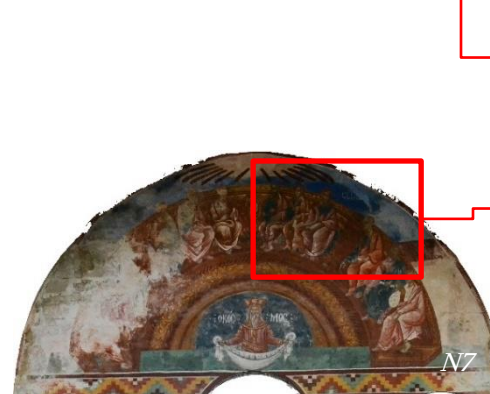
In the research areas of the main space, the west, north and south walls, there are quite a lot of tones of red. It is likely that various pigments were used, as well as their various mixtures: brick red, dark red, crimson red, brownish red and their variations.

Red is abundantly used in all three arms in all scenes: for preparatory painting, architectural elements, drapery, facial details, and various individual details.

The red used for draperies is given both as a pure colour and as a mixture. Different intensities of red mixed with white are used to bring out the tones of the draperies. And for darker tone, dark pigments are added to the same base colour.

In some details, a transparent layer can be seen on top of the red, which gives it a lively and relatively dark hue.

Right and up: North wall of north arm, whitsun scene. The clothes of the apostles are made of different shades of red.



3. Summary

Red and Orange

In the research areas of the main space, the west, north and south walls, there are quite a lot of tones of red and orange. Presumably, both different pigments and their various mixtures were used.

Main colours are:

Wine red
Brick red
Reddish orange
Yellowish orange

The colours listed above are used both pure and in the form of different mixtures, tones. All four colours will be considered together, because their structure is the same and they all use the same principle. Small differences can be distinguished only in tone, which is often not easy to differentiate.

Distribution: All four colours of red and brick red are used in abundance in all three arms in all scenes: for preparatory painting, architectural elements, draperies, facial details and various individual details. Most commonly can be seen on clothes, which are modelling according to the following principle:

A pure colour is used as the background, depending on what colour needs to be created. For modelling, mostly different tones of the same colour is used, obtained by mixing white or dark pigments.

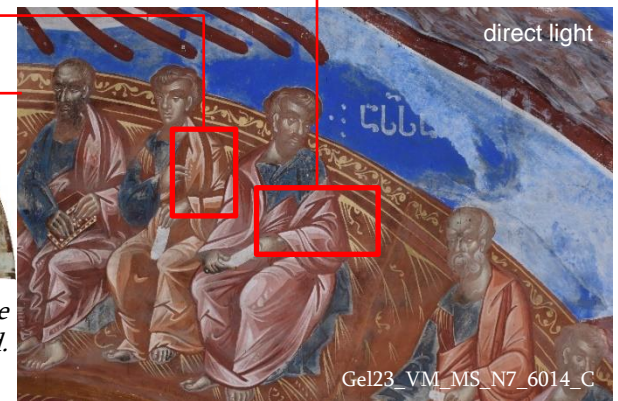
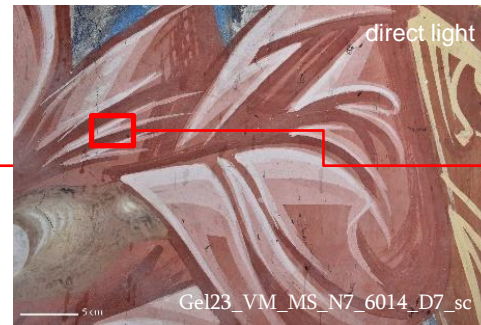
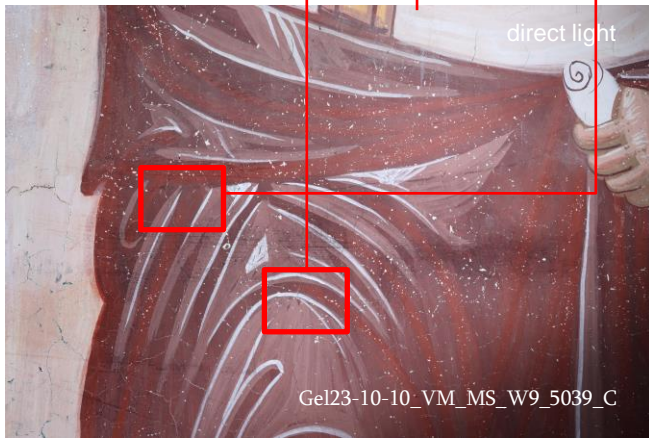
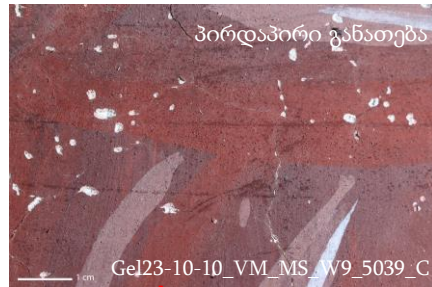
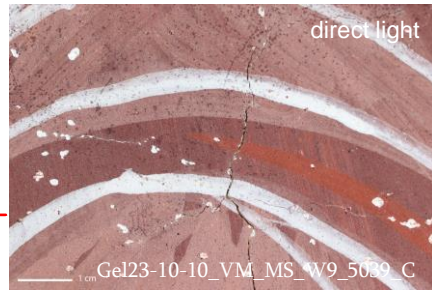
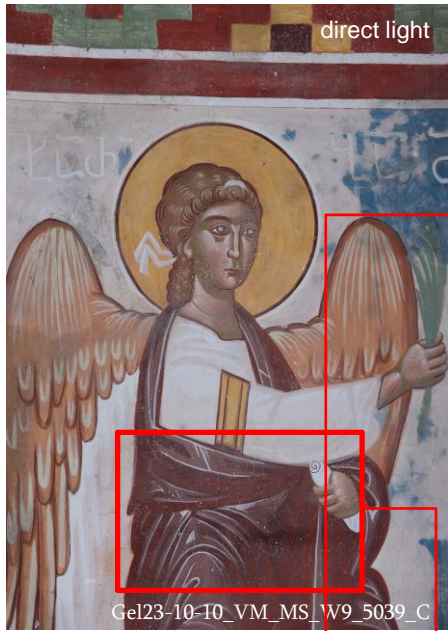
In some details, there is a clear layer on top of the reds and oranges, giving it a vivid and relatively dark hue.

The mixed colours include different shades of pink, composed by mixing wine red with white pigment, as well as many shades of light orange.



up: A scene on the north wall, third register of the west arm with various types of red and orange

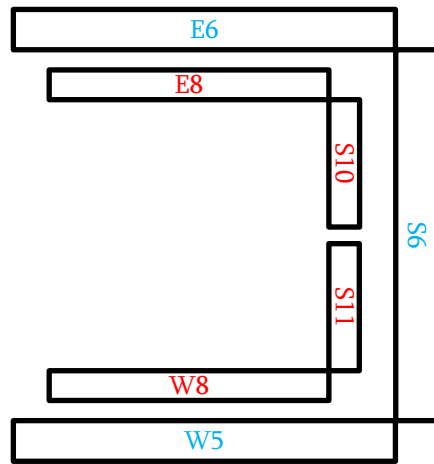
3. Summary



Up and right: North wall of north arm. The clothes of the apostles are made of different shades of red.



Distribution of the colour red in the scenes

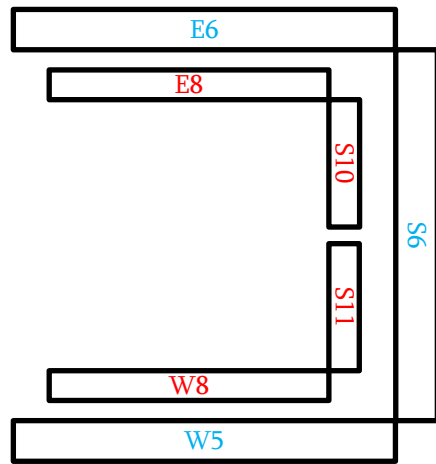


Above: Scheme of the 2 registers of the South Arm

		South Arm							
		E6	S6	W5	E8	S10	S11	W8	C12
„for the base“	clothing								
	architecture								
	“drape“								
	Furniture, dishes							[
	skin, features, hair								
	wings , halo		/					/	
	Background, landscape						∂oʃs		
contours (*) and details (x)	clothing		*		*	*	*		
	architecture	x							
	“drape“								
	Furniture, dishes		*]						
	skin, features, hair				*		*		
	wings , halo				*\	*\			
	Background, landscape								
Shadows and modelling	clothing								
	architecture								
	“drape“								
	Furniture, dishes]					[
	skin, features, hair								
	wings , halo							/	
	Background, landscape								



Name of the colour		Defining colour
Red	Wine red	
	Brick red	
Defining characters for the words	furniture	[
	dishes]
	wings	/
	Halo	\
	background	-

Distribution of the colour red in the scenes

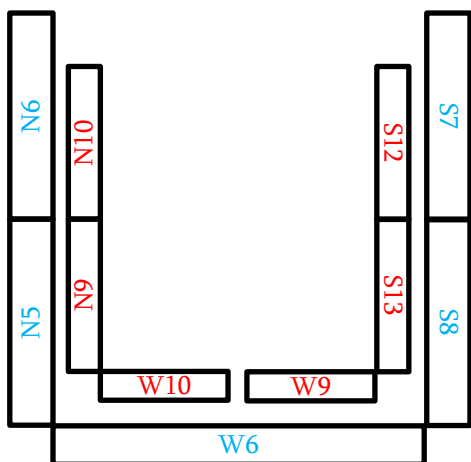


Above: Scheme of the 2 registers of the South Arm

		South Arm							
		E6	S6	W5	E8	S10	S11	W8	C12
„for the base“	animal								
	book								
	Mandorla								
contours (*) and details (x)	animal								*
	book								* *
	Mandorla								
Shadows and modelling	animal								
	book								
	Mandorla								* *

Name of the colour		Defining colour
Red	Wine red	
	Brick red	
Defining characters for the words	furniture	[
	dishes]
	wings	/
	Halo	\
	background	-

Distribution of the colour red in the scenes



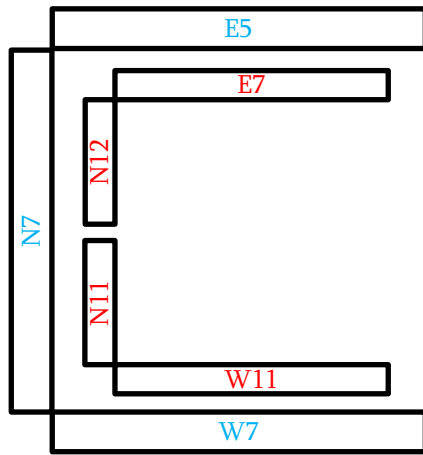
Above: Scheme of the 2 registers of the West Arm

Name of the colour		Defining colour
red	Wine red	
	Brick red	

Defining characters for the words	furniture	[
	dishes]
	wings	/
	Halo	\
	background	-

		West Arm												
		S7	S8	W6	N5	N6	S12	S13	W9 / w10	N9	N 10	C14		
„for the base“	clothing													
	architecture													
	“drape“													
	Furniture, dishes	[]]				[[
	skin, features, hair													
	wings , halo										/			
	Backgr. landsc.													
contours (*) and details (x)	clothing	*	*	*	*	*	*x	*	*		x	x		*
	architecture	*	*			*	x	x	x					
	“drape“	*												
	Furniture, dishes	*]	* x [* x [*	x [
	skin, features, hair						*	*	* \	* \ /	*			*
	wings , halo	* \						* \	* \	* \				
	Backgr. landsc.					x								*
shadows and modelling	clothing													
	architecture													
	“drape“													
	Furniture, dishes													
	skin, features, hair													
	wings , halo													
	Backgr. landsc.													

Distribution of the colour red in the scenes



Above: Scheme of the 2 registers of the North Arm

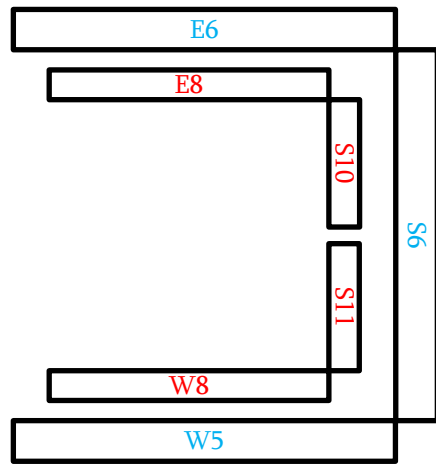
Name of the colour		Defining colour
red	Wine red	
	Brick red	

Defining characters for the words	furniture	[
	dishes]
	wings	/
	Halo	\
	background	-

		North Arm							
		E5	N7	W7	E7	N12	N11	W11	C
„for the. base“	clothing	სავარაუდო							
	architecture								
	“drape“								
	Furniture, dishes								
	skin, features, hair								
	wings , halo								
	Backgr. landsc.				მინა			მინა	
contours (*) and details (x)	clothing	* X	* *	*		* X	* X		
	architecture			X					
	“drape“								
	Furniture, dishes								
	skin, features, hair		*	*			ტუზი *		
	wings , halo			\					
	landscape						X		
shadows and modelling	clothing								
	architecture								
	“drape“								
	Furniture, dishes								[
	skin, features, hair								
	wings , halo								
	landscape		დეკორაცია	მინა					



Distribution of the orange in the scenes



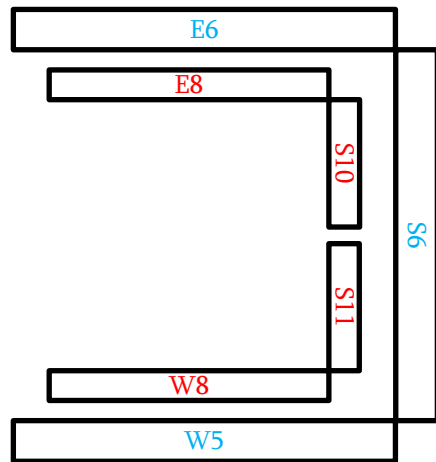
Above: Scheme of the 2 registers of the South Arm

		South Arm							
		E6	S6	W5	E8	S10	S11	W8	C12
„for the base“	clothing								
	architecture								
	“drape“								
	Furniture, dishes	[
	skin, features, hair								
	wings , halo	\	\	\	\				
	Backgr. landsc.					-	-		
contours (*) and details (x)	clothing					x	x		
	architecture								
	“drape“								
	Furniture, dishes		[]						
	skin, features, hair								
	wings , halo								
	Backgr. landsc.								
shadows and modelling	clothing								
	architecture								
	“drape“								
	Furniture, dishes								
	skin, features, hair								
	wings , halo								
	Backgr. landsc.								

Name of the colour		Defining colour
orange	reddish	
	yellowish	

Defining characters for the words	furniture	[
	dishes]
	wings	/
	Halo	\
	background	-

Distribution of the orange in the scenes



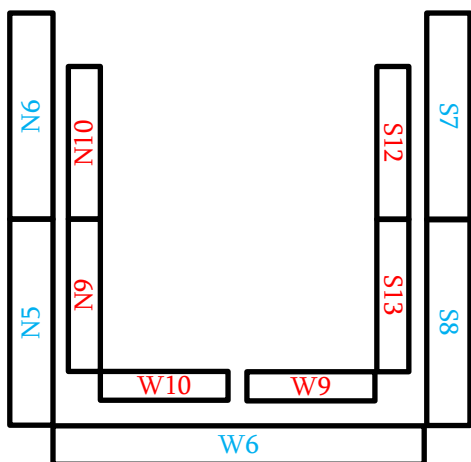
Above: Scheme of the 2 registers of the South Arm

		South Arm							
		E6	S6	W5	E8	S10	S11	W8	C12
„for the base“	Animal								
	Book								
	Mandorla								
contours (*) and details (x)	Animal								
	Book								
	Mandorla								
shadows and modelling	Animal								
	Book								
	Mandorla								

Name of the colour		Defining colour
orange	reddish	
	yellowish	

Defining characters for the words	furniture	[
	dishes]
	wings	/
	Halo	\
	background	-

Distribution of the orange in the scenes



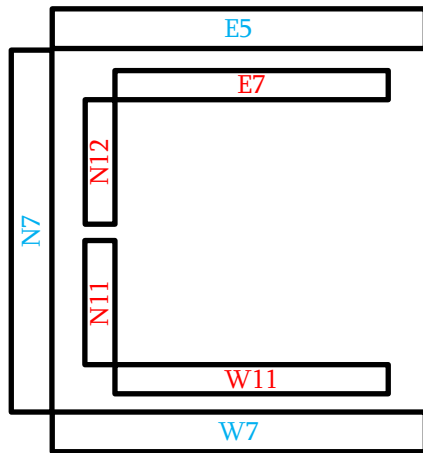
Above: Scheme of the 2 registers of the west Arm

Name of the colour		Defining colour
orange	reddish	
	yellowish	

Defining characters for the words	furniture	[
	dishes]
	wings	/
	Halo	\
	background	-

		West Arm										
		S7	S8	W6	N5	N6	S12	S13	W9 / w10	N9	N10	C14
„for the base“	clothing											
	architecture											
	“drape“											
	Furniture, dishes		[[
	skin, features, hair											
	wings , halo								/ W9	/		
	Backgr. landsc.		-									
contours (*) and details (x)	clothing				?		*		X W10	*	*	
	architecture											
	“drape“						*					
	Furniture, dishes							* [
	skin, features, hair											
	wings , halo									* /		
	Backgr. landsc.											
shadows and modelling	clothing											
	architecture											
	“drape“											
	Furniture, dishes						[
	skin, features, hair											
	wings , halo											
	Backgr. landsc.											

Distribution of the orange in the scenes



Above: Scheme of the 2 registers of the North] Arm

Name of the colour		Defining colour
orange	reddish	
	yellowish	

Defining characters for the words	furniture	[
	dishes]
	wings	/
	Halo	\
	background	-

		North Arm							
		E5	N7	W7	E7	N12	N11	W11	C13
„for the base“	clothing								
	architecture								
	“drape“								
	Furniture, dishes								
	skin, features, hair								
	wings , halo								
	Backgr. landsc.		-	-					
contours (*) and details (x)	clothing								
	architecture								
	“drape“								
	Furniture, dishes								
	skin, features, hair								
	wings , halo								
	Backgr. landsc.								
Shadows and modelling	clothing								
	architecture								
	“drape“								
	Furniture, dishes								
	skin, features, hair								
	wings , halo								
	Backgr. landsc.								

3. Summary

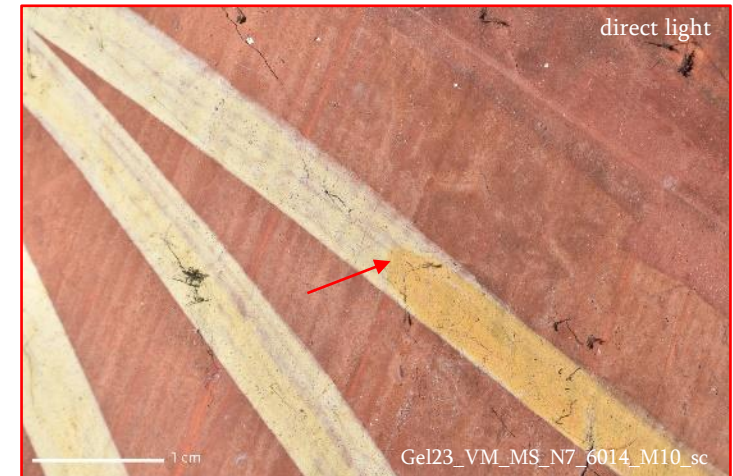
Yellow

Two completely different types of yellow are presented in the research area:

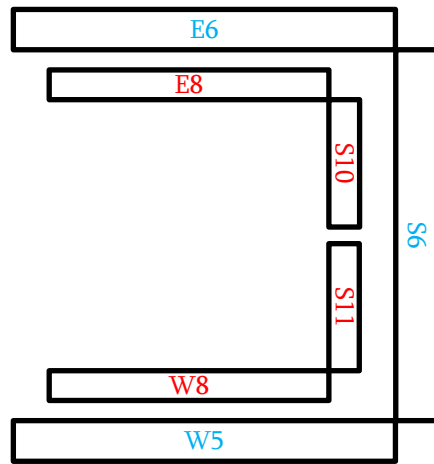
Type 1 belongs to the group of widely used yellow ochres, which can be found both in the preparatory painting and on the main paint layer: for halos, draperies and architectural details. This yellow is presented as an evenly distributed layer with good coverage, where in most cases a sufficient amount of binder is used. Yellow type 1 is used in all three arms, in almost every scene.

type 2 is bright, transitioning to white, yellow. Its variations according to tone, from intense yellow to whitish yellow are presented. As a result of observation with a microscope, the colour is a well-cohesive layer. Type 2 yellow is found in all three arms, in almost every scene: for decorative elements, to indicate the final, brightest strokes, it gives tonal and colour contrasts with other colours, which allows it to be used as a finishing touch.

Down and to the left: whitsun scene on the north wall of the north arm - decorative elements are made with type 2. yellow On the scene we see a plaster joint. It should be noted that its one type of yellow, although different tones are used on different plasters,



Distribution of the colour yellow in the scenes



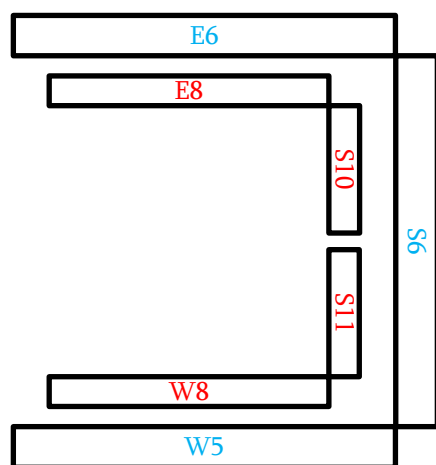
Above: Scheme of the 2 registers of the South Arm

Name of the colour		Defining colour
yellow	type 1	
	Type 2	
	Lighter tone of the type 2	
gold		

Defining characters for the words	furniture	[
	dishes]
	wings	/
	Halo	\
	background	-

		South Arm							
		E6	S6	W5	E8	S10	S11	W8	C12
„for the base“	clothing								
	architecture								
	“drape“								
	Furniture, dishes								
	skin, features, hair								
	wings , halo	\	\	\					\
	Backgr. landsc.								
contours (*) and details (x)	clothing		x						x
	architecture								
	“drape“								
	Furniture, dishes								
	skin, features, hair								
	wings , halo		x \ /						
	Backgr. landsc.								
shadows and modelling	clothing					x	x		
	architecture								
	“drape“								
	Furniture, dishes								
	skin, features, hair								
	wings , halo			\ \		\			\
	Backgr. landsc.								

Distribution of the colour yellow in the scenes



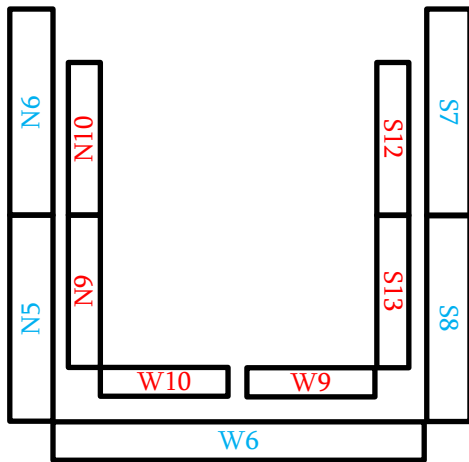
Above: Scheme of the 2 registers of the South Arm

		South Arm							
		E6	S6	W5	E8	S10	S11	W8	C12
„for the base“	animal								
	book								
	Mandorla								
contours (*) and details (x)	animal								
	book								x
	Mandorla								
Shadows and modelling	animal								
	book								
	Mandorla								

Name of the colour		Defining colour
Yellow	Type 1	
	Type 2	
	Lighter tone of the type 2	
Gold		

Defining characters for the words	furniture	[
	dishes]
	wings	/
	Halo	\
	background	-

Distribution of the colour yellow in the scenes



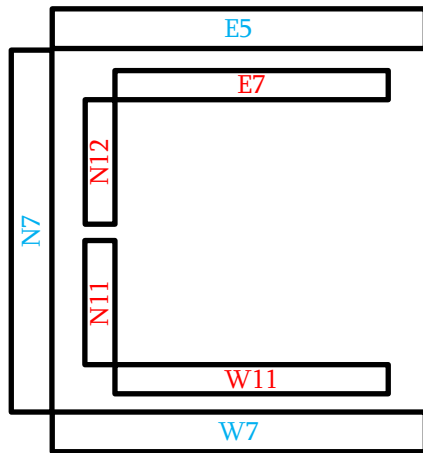
Above: Scheme of the 2 registers of the West Arm

Name of the colour		Defining colour
Yellow	Type 1	
	Type 2	
	Lighter tone of the type 2	
Gold		

Defining characters for the words	furniture	[
	dishes]
	wings	/
	Halo	\
	background	-

		West Arm										
		S7	S8	W6	N5	N6	S12	S13	W9 / w10	N9	N10	C14
„for the base“	clothing											
	architecture											
	“drape“											
	Furniture, dishes											
	skin, features, hair											
	wings , halo	\	\	\	\		\	\	\	\	\	
	Backgr. landsc.											
contours (*) and details (x)	clothing						x *	x W9	*xW10		* X	
	architecture		x			x	x					
	“drape“		x				x [
	Furniture, dishes		* x				x					
	skin, features, hair									*		
	wings , halo										*/	
	Backgr. landsc.											
წრდილები და დამუშავება	clothing											
	architecture											
	“drape“											
	Furniture, dishes											
	skin, features, hair											
	wings , halo	\	\	\	\		\	\	\	\	\	
	Backgr. landsc.											

Distribution of the colour yellow in the scenes



Above: Scheme of the 2 registers of the North Arm

Name of the colour		Defining colour
Yellow	Type 1	
	Type 2	
	Lighter tone of the type 2	
Gold		

Defining characters for the words	furniture	[
	dishes]
	wings	/
	Halo	\
	background	-

		North Arm							
		E5	N7	W7	E7	N12	N11	W11	C13
„საბაზოსო“	clothing								
	architecture								
	“drape“								
	Furniture, dishes								
	skin, features, hair								
	wings , halo	\				\		\	\
	Backgr. landsc.							-	
კონტურები (*) და დეტალები (x)	clothing		x			x		x	
	architecture	x	x	x					
	“drape“								
	Furniture, dishes								x [x [
	skin, features, hair		*						
	wings , halo								
	Backgr. landsc.								
shadows and modelling	clothing								
	architecture								
	“drape“								
	Furniture, dishes								
	skin, features, hair								
	wings , halo	\				\		\	\
	Backgr. landsc.								