

# Report on the Safeguarding and Conservation of Gelati Monastery

## World Heritage Site, Georgia

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### Overview

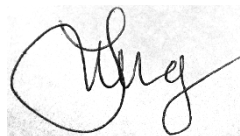
At the invitation of the Patriarchate of Georgia, the International Advisory Board visited Gelati Monastery from 1-2 May 2022. This report is the result of the on-site visit to the Church of the Nativity of the Virgin and review of documents and reports provided by the National Agency for Cultural Heritage of Georgia (see Appendix A). The scope of work as requested by the Patriarchate included the following areas:

- Undertake general empirical assessment of the condition and technology of accessible wall paintings along with recent emergency interventions at the main space of the Church of the Nativity of the Virgin.
- Determine possible causes of deterioration of the wall paintings.
- Assess the investigation, conservation plan and emergency interventions undertaken by Pulieri and Centanni based on on-site observations and assessment of the provided documentation and reports.
- Recommend appropriate conservation approaches and interventions in Gelati moving forward.

The response is presented here in three parts: the first considers the *Building and Environment* and its contribution to the current observed deterioration of the paintings, the second addresses the *Wall Paintings*, and the third includes overall *Recommendations*. The objective of the report is to provide the Patriarchate of Georgia with an independent assessment of the situation at Gelati and the proposed conservation approaches and interventions that will help to ensure the future preservation of this important UNESCO World Heritage Site.



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<sup>1</sup> Served as an external reviewer on the report.

## **Executive Summary**

This report is based on information acquired during a brief on-site assessment of the Church of the Nativity of the Virgin at Gelati, undertaken from 1-2 May 2022, and a review of available documentation.

The wall paintings at Gelati are suffering from serious ongoing deterioration and loss due to the destructive presence of moisture and soluble salts. Solving the moisture problem is an essential first step followed by the controlled drying out of the walls. This process will take time and the Church and its wall paintings require a program of long-term care. It is therefore recommended that the current emergency treatment plan be revised.

The new conservation plan will closely integrate work on the building with that of the wall paintings and include limited and localized remedial treatment and environmental control to minimize further destructive salt activity. Given the severity of ongoing deterioration, emergency treatments need to be extremely limited and only undertaken when absolutely necessary. Some treatments risk putting the paintings in increased danger. Determining how much treatment can safely be undertaken requires a flexible and adaptable conservation plan that responds to changing conditions (i.e. the drying out of the building).

Furthermore, the paintings at Gelati differ from area to area, in their period of decoration (including materials and painting technology), previous treatment history, and current condition—therefore a single treatment approach is not suitable. The choice of materials and approaches must be adjusted accordingly based on the condition and situation of each individual area. The importance of the Gelati paintings for Georgia demands this careful and conservative approach which involves more thorough investigations to understand and document the condition, processes of deterioration, painting technology and later interventions.

This work will be best undertaken by an on-site team of conservation experts. Developing in-country expertise is recommended rather than relying on foreign teams who do not have a regular presence in Georgia, nor possess familiarity with traditional Georgian building techniques and knowledge of local painting materials and technology. The International Advisory Board can continue to serve as an independent body to encourage transparent and open discussion amongst all those involved in safeguarding and conserving Gelati. The Board could benefit from a wider range of professional expertise (including architecture, engineering, and environmental science) as well as representation from international conservation organisations (e.g. ICOMOS International Scientific Committee on Mural Painting).

## 1 Building and Environment

### 1.1 Building conservation

It is essential for the preservation of the wall paintings that the building is made watertight. The report by Tonietti and Stefanini have a series of recommendations of how this might be achieved, including removal of the defective glazed roof tiles and drying out of the fill material before replacement with new tiles and better sealing where the roof connects with the stone walls. Given the proximity of the roof repairs to the wall paintings and the magnitude of these interventions they need to be carried out with extreme caution, in close collaboration with wall painting conservators, and with careful monitoring of the paintings.

### 1.2 Drying out of building

At present, the water-saturated fill material and walls is driving moisture through the wall paintings along with a cocktail of soluble salts. Ideally, the flow of moisture should be modified during the drying out process so that the salts do not continue to crystallise and redissolve in the structure of the wall paintings.

Currently, the glazed tiles prevent the drying out of the structure toward the exterior. The glazed tiles need to be removed, as recommended by Massari and Tonietti/Stefanini. A temporary roof will need to be installed with sufficient head room to allow ventilation and air circulation. A perforated wrap will be helpful in preventing driving rain from re-wetting the fill material; this should be installed to allow good air circulation and ventilation within the wrap. Perforating the wrap has the added advantage of reducing the risk of the wrap itself being damaged by high winds.

Once the building is watertight, the drying out of saturated building fabric may take *many years*. A rule of thumb is that it can take up to one year for each 25 cm of building fabric to dry. It is possible that it will take three to five years for the church to dry after the building has been made watertight. Given the risk to the wall paintings it is recommended that the drying out of the wall take place gradually to ensure avoidance of destructive salt activity, and with regular monitoring. Accelerating the drying process through heating of the wall, as suggested by Pulieri and Centanni, is not recommended.

### 1.3 Environmental conditions<sup>2</sup>

The church interior temperature is relatively stable as the thermal mass of the building fabric buffers the daily outside temperature fluctuations. In the summer the average temperature in the church is 25°C falling as low as 5°C in the middle of the winter. Daily fluctuations are very small, less than 2°C.

However, there is a very clear relationship between inside and outside relative humidity (RH). Data from sensors near the ceiling in the west arm and in the Narthex, near the west door,

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<sup>2</sup> Evidence for the environmental conditions of the interior of the Church of the Nativity of the Virgin has been provided from monitoring carried out by Mariam Sagaradze from 5 December 2020 – 18 September 2021 (Sagaradze 2021), and from observations of readings from dataloggers on site.

show that when outside RH drops on warm days in the summer, the interior RH follows closely and there is little difference between the RH in the Narthex and the west arm ceiling. This suggests that there is rapid infiltration of outside air, through the west door and the unglazed windows.

The RH can drop to a low of 50% before rapidly rising again to average values between 70-90% as outside RH rises at night. Depending on the nature of the salts, RH fluctuations can result in continued damaging cycles of salt crystallisation and dissolution on or below the surface of the wall paintings resulting in further powdering and loss of paint and plaster. It is noted that at the high RH of 78% during the Advisory Board visit in May 2022, salts were observed to have crystallized on the surface of wall paintings, and other species of salts may appear as RH decreases.

To avoid these damaging cycles, particularly while the walls and ceilings are drying out, but also over time, it is advised to limit RH fluctuations inside the church by reducing the infiltration of external air through the west door and windows. The origin and nature of the soluble salts in the wall paintings also requires a complete further study. Additional information regarding the composition of salts is necessary in order to develop preventive and passive control measures that will inform the threshold RH that needs to be respected within the building during drying and in the long term in order to avoid further destructive salt activity.

The possibility of warmer/damper air infiltrating the church and condensing on cold surfaces at certain times of the year needs to be assessed. This is particularly likely to occur in spring when the building fabric is cold after the winter months. As well as causing damage to the paint layers the condensation may trigger germination of mould spores and promote their growth. Gradual changes in temperature could be achieved by decreasing air exchange between the exterior and the interior.

It is highly recommended that the environmental monitoring work (Sagaradze 2021) which concluded in September 2021 be continued.

## 2 The Wall Paintings<sup>3</sup>

### 2.1 Condition and causes of deterioration of wall paintings

Deterioration of the wall paintings is active, ongoing and severe due to problems associated with moisture and salts. Water infiltration caused by a faulty roof has led to extensive moisture damage to the wall paintings and was also responsible for the transport of soluble salts through the masonry and into the wall painting (see also 1.1 Building Conservation). Based on observed conditions, it is presumed that the walls are still wet and that further loss from destructive salt activity will continue to occur as the walls dry out and when relative humidity fluctuates (see also 1.3 Environmental Conditions).

Repeated cycles of salt activity through deliquescence (dissolution) and crystallization have had a dramatic impact on the condition of the paintings leading to decohesive paint and plaster layers and significant areas of loss. The worsening deterioration of the wall paintings in Gelati, first noted in February-March 2020, can clearly be seen through the photographic monitoring of large areas of the painting scheme. Church guardians also witnessed concerning amounts of fallen material found on the ground.

Specific conditions noted during the on-site inspection included widespread surface salt efflorescence on areas of paint and plaster, decohesion of paint and plaster layers, flaking of the paint layer, delamination of plaster layers, and evidence of microbiological growth. A full condition investigation is recommended in significantly greater detail than that undertaken by Pulieri, Centanni, Potskhishvili and Ninoshvili in June 2021 to include detailed graphic documentation of conditions (types of deterioration and their distribution) and of all previous treatment interventions conducted (what was done and when). In addition, regular monitoring of the paintings through visual observations and photographic surveys at macro resolution are necessary to better assess the extent and gravity of the ongoing deterioration.<sup>4</sup> As stated in an ICOMOS report, dated February 2022: “ICOMOS advises that the State Party conduct a detailed assessment of the condition of all the murals under Stage II of the programme, prior to the submission of comprehensive proposals to address the key issues.”

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<sup>3</sup> Information that informs this section of the report was obtained from on-site observations and review of provided documentation listed above. Close examination of the wall paintings was limited to the vault of the west arm of the church where scaffolding access was available. However, a full evaluation of the paintings in this area was problematic due to emergency treatment undertaken by Pulieri and Centanni in June 2021 (initial testing) and September 2021. The June and September reports did not describe the specific locations and details of the interventions undertaken. Therefore, due to the lack of information provided in June’s and September’s reports complete assessment of the current state of conservation of the paintings was difficult to carry out. As no additional report describing the specific locations and details of the interventions undertaken was provided, a complete assessment of the current state of conservation of the paintings and the assessment of the treatments applied was therefore difficult to carry out.

<sup>4</sup> We were not provided with the continuous monitoring that was referenced in Pulieri and Centanni’s September 2021 report.

## 2.2 Assessment of the investigation, conservation plan and recommended emergency interventions

An assessment of the investigation, conservation plan and emergency interventions by Pulieri and Centanni was undertaken based on on-site evaluation and review of provided documentation and reports.

The conclusion by the International Advisory Board is that the plan for emergency treatments proposed by Pulieri and Centanni (in the report dated 1 July 2021) was made without consideration or prior to the completion of key investigations on the wall paintings and their contexts. The information gained from the subsequent reports by Massari and Tonietti now demands a reassessment of proposed emergency treatment to the wall paintings including both in approach and timeline. The subsequent reports address the prevention of water infiltration into the Church of the Nativity of the Virgin (Tonietti and Stefanini report, dated 30 July 2021) and understanding the current mechanisms of damaging moisture and salt deterioration (Massari report, dated 1 December 2021). These investigations are fundamental as they provide a more complete understanding of the situation at Gelati and indicate that the moisture and salt problem must first be addressed *before* undertaking emergency stabilization interventions to the wall paintings.

This is in adherence with Article 2 of the *ICOMOS Principles for the Preservation and Conservation-Restoration of Wall Paintings (2003)*, “All conservation projects should begin with substantial scholarly investigations. The aim of such investigations is to find out as much as possible about the fabric of the structure...Prerequisites for any conservation program are the scientific investigation of decay mechanisms on macro and micro scale, the material analysis and the diagnosis of the condition.”

Massari’s report states, “In order to preserve the wall paintings, especially those invaded by hygroscopic salts, it is necessary to ensure the stability of the microclimatic parameters and in particular of the relative humidity...Throughout the drying process, the state of health of the plasters must be monitored, taking the precautions that the restorers deem appropriate and necessary. Once drying is complete (the drying process can be monitored with instruments for hygrometric measurement of the materials or by taking samples for laboratory analysis), it will be possible to proceed with the restoration/stabilisation of the plasters and, subsequently, with the reconstruction of the roofs” (Massari 2021, 36).

The emergency treatment proposed and undertaken on the west arm vault (Pulieri and Centanni report, dated September 2021) was done before a full understanding of the moisture and salt issue had been achieved. Furthermore, given the severity of conditions and ongoing nature of the problems at Gelati, a period of only three months between the application of emergency treatments in June 2021 and the assessment of their efficacy in September 2021 is an insufficient timeframe to fully evaluate the efficacy of the treatments applied by conservators. Instead a far longer period of monitoring of treatments would be necessary to assess conservation measures.

The proposed emergency interventions are therefore concerning, including the extent of planned flake fixing, consolidation, salt reduction, grouting, and edging repairs, and the

materials and methods proposed. The Pulieri and Centanni report suggested a range of possible materials and methods for treating plasters and paint, based on acrylics, nanomaterials, silicates, phosphates and oxalates but not all of these materials are compatible with the original technology of the paintings or suitable given the ongoing moisture and salt problem (see also 2.2.1 Technology of the Paintings). For example, the use of polymers can reduce significantly water vapor permeability causing the salts to crystallize below the paint layer or within the plaster. Furthermore, though materials suggested have been tested and used previously at sites elsewhere they have not been adequately studied or assessed for the particular conditions of the wall paintings at Gelati. The selection of treatment approaches for emergency treatment and for conservation generally should reflect an understanding of their compatibility and appropriateness for the fragile and unique composition and situation of these paintings.

Comments on the unsuitability of specific emergency treatments are as follows:

- **Salt Reduction:** Pulieri and Centanni suggested salt reduction procedures that include removal of surface salt efflorescence with soft brushes followed by poulticing of the surface using Japanese paper and three layers of absorbent pure cellulose paper and one trial using sepiolite to extract solubilized salts. However, without a complete understanding of the multiple salt species and their origin the use of water can lead to the mobilisation and redistribution of additional salts that may cause increased deterioration.<sup>5</sup>
- **Flake-Fixing and Consolidation:** Pulieri and Centanni suggested the “relaying of lifted layers and consolidation, using an acrylic resin in aqueous emulsions (3% Acrill 33/EA-MMA, ethyl acrylate - methyl methacrylate in deionized water) applied through an intervention layer of Japanese paper and using soft pads to gently press back areas. In thicker areas of painting where ground and plaster may be part of the delaminated stratigraphy a higher percentage of 5% Acrill 33 in deionized water was injected behind lifted areas.” The use of water-based and film forming materials where active deterioration is occurring because of the presence of salts is not advised. Moreover, added material, including acrylic consolidants, is an inherent risk as it will change the properties of the painting, reducing the water vapor transmission of the painting, causing salts to crystallize deeper in the porous materials (behind the paint layer, and within the plaster) leading to more serious problems when the building and walls dry.
- **Grouting and Edging Repairs:** Other trials carried out by Pulieri and Centanni included grouting with PLM A and PLM AL with consolidation of the paintings and application of Japanese tissue using a 10% solution of Paraloid B-72 (EMA-MA, ethyl methacrylate - methyl acrylate) dissolved in acetone. Edging repairs were also undertaken with a plaster composed of slaked lime and siliceous aggregates. The widespread use of water-based grouts and repair plasters on currently fragile, decohesive, and still damp and salt laden paintings, is not recommended. As stated above, these treatments will

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<sup>5</sup> Pel, L., Sawdy, A. & Voronina, V., 2010. Journal of cultural heritage, 11(1), pp.59–67.

contribute to an already serious problem, they risk reactivating soluble salts and leading to worsened deterioration when the building and walls are dried.

Though complete documentation of treatments undertaken in June and September 2021 was not available, salt efflorescence was observed in one of the recently treated areas during the May 2022 on-site inspection (see Figures 4a-c). Close monitoring of the condition of all treated areas was not provided and should be regularly undertaken and fully documented with macrophotography and raking light images.<sup>6</sup>

### 2.2.1. Technology of the paintings

As highlighted by the ICOMOS Principles, the technology of the paintings needs to be understood before a suitable conservation intervention is developed. Understanding the techniques of execution and materials in Georgian wall paintings and the Gelati wall paintings in particular is important for the development of appropriate treatments and approaches that considers different periods of painting and does not cause harm to the paintings themselves.

From visual observation and in consultation with art historical analysis, it is clear in the areas investigated by the Advisory Board that there are multiple periods of painting present in the areas investigated and they present differing paint/plaster technology. The current heterogeneous condition and the impact and presence of soluble salts may reflect technological differences in the painting (e.g. the thickness of the plaster and paint layers). As a consequence of the differences in technology in the painting schemes any treatment adopted need to be selected based on the inherent susceptibility of the paint layers, and especially the water solubility of the paint and binders.

In situ observations revealed the presence of very thin paint layers on plasters which were rich in organic fibres and inclusions. Scientific data in the report by Pulieri and Centanni suggests that the wall paintings are not fresco, and contain epsomite and significant soluble salts, yet water-based treatments were suggested for their treatment. The wall paintings in Gelati contain a very high proportion of inorganic binder (lime, with gypsum and magnesium carbonates), unidentified organic binders,<sup>7</sup> and natural fibres. The sensitivity of the paintings and plaster to water-based methods needs to be established. Water may cause the dissolution and redistribution and hydration of salts and paint layers, and components of paint layers, and may swell the painting, ultimately leading to loss of paint.

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<sup>6</sup> Furthermore, it is concerning that according to the September 2021, "Article on the emergency conservation-restoration of the Frescoes", "very small color re-adhesion tests, as well as small consolidation tests of plaster detachments, or removal and superficial saline efflorescences and a first extraction of the salts found in the most superficial layers of the plasters" were apparently undertaken during the June 2021 campaign prior to any scholarly investigation on painting technology and causes of deterioration that would normally inform treatment design.

<sup>7</sup> Further analysis of organic materials present in the paint and plaster is required.



### 3 Recommendations

#### 3.1 Summary of conservation approach and interventions for Gelati

The Church of the Nativity of the Virgin and its wall paintings require a program of long-term care. It is therefore recommended that the current emergency treatment plan be revised. The situation at Gelati demands a change in mindset and practice and a need to balance immediate requirements to stabilize areas at risk of imminent loss with preventive measures to stop further salt deterioration from occurring.

The following recommendations and principles are advised:

- Stop further water ingress into the building
  - Construct shelter/temporary roofing that protects the entire building with sufficient head room to allow ventilation and air circulation. A perforated wrap will be helpful to prevent entry of driving rain
  - Remove temporary roofing
  - Repair roof
- The drying out of the walls should happen gradually and be accompanied with:
  - Control of evaporation to prevent moisture and salts from causing deterioration of the paintings
  - Regularly assessment of moisture levels to evaluate drying of wall
- A programme of environmental monitoring should be continued to understand interior and exterior climate to create a stable environment
- Preventive measures should be implemented to stabilize the environment within the building to prevent further salt deterioration from occurring.
  - Undertake complete salt analysis to identify salt species in order to understand source, treatments and determine preventive measures
  - Limit infiltration of external air
    - These measures need to be carefully assessed by an expert as recommendations (i.e. closing the west doors and window shutters can also promote microbiological activity).
- Keep scaffolding in place to allow for continued:
  - Photographic monitoring at the macro scale of the condition of wall paintings on a routine basis
  - Localized emergency interventions to avoid further loss of material
- Thorough investigations of the periods of decoration and painting technology, identification and mapping of past interventions
- Develop emergency treatment to be:
  - Minimal, localized, and undertaken in stages rather than completing large areas within a short period of time, to allow for review and evaluation of treatment. Once the wall is dry requirements for wall painting interventions can be modified and reassessed
  - Treatments should be undertaken with materials that are:

- Selected based on compatibility to painting technology and will not change the properties of the paintings, particularly water and vapor movement
  - Should completely avoid or minimize water content and take into consideration methods that will reduce risk of further solubilizing and redistributing salts
    - Thoroughly tested and evaluated systematically
    - Comprehensively documented with location and materials, and regular inspections to assess condition of treated areas
- Any decisions about the building will have a direct impact on the wall paintings. Future planning at Gelati must consider the exterior and interior together with close collaboration and communication between the project teams including architects, environmental engineers, wall paintings conservators and art historians. This means that during planning and implementation of future interventions on the building, consultation with experts is required and any changes in condition of the paintings following modifications of the built environment are closely monitored.
- Establish an on-site team of conservation experts and develop and utilize in country expertise
- Expand International Advisory Board to include wider range of relevant expertise to advise on Gelati

## Appendix A. Documentation

The following documents were provided by the National Agency for Cultural Heritage of Georgia which informed the contents of this report:

Associazione Giovanni Secco Suardo, *“Report on the State of Conservation of the Gelati Monastery World Heritage Property, Georgia, Mission of 22-28 June 2021”*, 1 July 2021.

Ugo Tonietti and Sara Stefanini, *“Report on the Mission and Preliminary Suggestions on the Reasons for the Water Infiltration and the Initial Recommendations for the Protection from Water Infiltration, Mission carried out in Kutaisi (Georgia) at Gelati Monastery, 25-29 June 2021, 30 July 2021.*

Vincenzo Centanni, Marco Pulieri, *“Article on the Emergency Conservation-Restoration Intervention of the Frescoes of the Church of the Nativity, Gelati Monastery”*, September 2021.

Rickerby & Shekede wall painting conservation, *“Comments on the Gelati Monastery Wall Painting Report”*, 15 September 2021.

Associazione Giovanni Secco Suardo, *“Comments on the document written by Lisa Shekede and Stephen Rickerby for the Ministry of Culture, Sport and Youth of Georgia and the General Inspectorate for the Protection of Cultural Heritage in response to the “Report on the State of Conservation of the Gelati Monastery World Heritage Property, Georgia”, July 1<sup>st</sup>, 2021, 2 October 2021.*

Alessandro Massari, *“Investigations on the Structural Hygrometric and micro-environmental state aimed at safeguarding the internal wall paintings”*, 6-12 November 2021, December 2021.

The Patriarchate of Georgia (report provided by Mariam Sagaradze), *“Environmental Monitoring: Winter, Spring and Summer Seasons (5.12.2020-18.09.2021), Church of the Nativity of the Virgin Mary, Gelati Monastery Complex”*, 2021.

ICOMOS Technical review, February 2022. Mission report on the state of conservation of the mural paintings of Gelati Monastery (Publicly available document).

ICOMOS Technical review, February 2022. Report on the mission, the preliminary suggestion on the reasons for water infiltration and the initial recommendations for protection from water infiltration (Publicly available document).

## Figures



Figure 1 Active deterioration is apparent with widespread presence of crystallised salts on the surfaces of the paintings and ongoing paint loss, seen here on 2 May 2022 with newly accumulated paint fragments on the plastic sheeting.



Figure 2a and 2b. Area of microbiological growth and salt efflorescence in incident (left) and raking light (right) on the east face of the vault on the west arm.





Figure 3a, 3b and 3c. Images of the west arm vault, south side in December 2017, March 2021 and May 2022 show the severity and ongoing nature of the current deterioration due to moisture and salt activity.



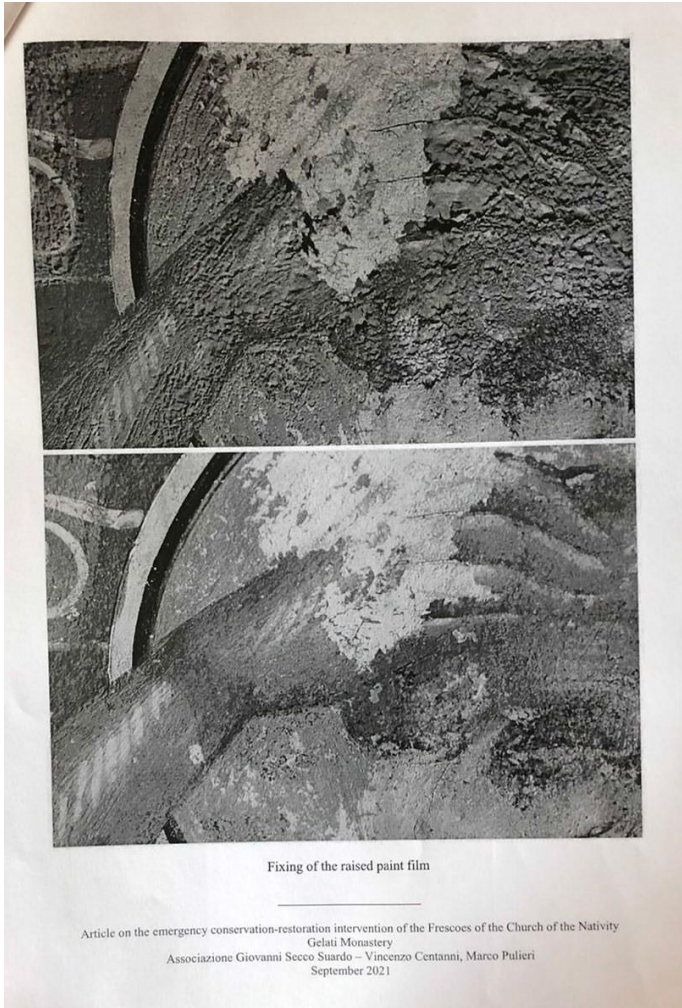


Figure 4a. Black and white images (above, left) show before and after treatment undertaken in September 2021 to desalinate and fix areas of flaking paint. Figure 4b and 4c. Color images (above, right) show the same area in incident (top) and raking light (below) in May 2022. Salt efflorescence appears to be recurring in the lower right raking light image. Moreover, the black areas of microbiological growth on the left of the face suggest that the surface is damp.



Figure 5a. Black and white (above, left) show before and after treatment undertaken in September 2021 to desalinate and fix areas of flaking paint. Figure 5b. Color images (above, right) show the same area (n.b. the black and white images have been flipped) in May 2022. Treated areas should be carefully monitored to assess any change in condition.