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Safeguarding and conservation of Gelati Monastery
World Heritage Property, Georgia

Agreement between LEPL "National Agency for Cultural Heritage Preservation of Georgia" and "ReStruere ltd, Florence University spin-off"

EMERGENCY PHASE E.1
West Arm Emergency Uncovering: supervision of the implementation

Deliverable E.1.B
Executive summary of activities and reports of the phases E.1.2 (*Monitoring of the evaporation*) and E.1.3 (*Technical support for submitting the summary of the implemented works to WHC*)

December 29th, 2022

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Definition of the Terms

AGSS: "Associazione Giovanni Secco Suardo".

GET: "Georgian Expert Team". It is the team in charge of carrying out the activities in Georgia related to the safeguard project of Gelati Monastery, World Heritage Property. The Team is composed of Tariel Kiparoidze and Lasha Shartava.

IAB: "International Advisory Board" invited by the Patriarchate to inspect the conservation works of the wall painting of the Church of the Nativity of the Virgin in the Gelati Monastery Complex from 1-2 May 2022. The IAB is composed by Austin Nevin, Sarah Staniforth, Lorinda Wong, Francesca Piquè (served as an external reviewer on the report).

MCSY: "Ministry of Culture, Sport and Youth of Georgia".

MCT: "Microclimate Consultancy Team". It is the team in charge of carrying out the activities relating to microclimatic issues. The Team is constituted by Studio Massari.

NACHP: "National Agency for Cultural Heritage Preservation of Georgia".

RET: "Restoration Expert Team". It is the Italian Restorers Team. The Team in charge of carrying out the restoration of frescoes and paintings, joined with Georgian Restorers. The Team is constituted by Marco Pulieri and Vincenzo Centanni.

RS: "ReStruere Team". The Team is composed of Ugo Tonietti, Sara Stefanini and Arash Boostani.

WHC: "World Heritage Center".

WHC AM: "WHC/ICOMOS/ICCROM Advisory Mission".

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Mr Lasha Shartava, Architect
Mr Alessandro Massari, Architect, Microclimatic expert
Mr Marco Pulieri, Restorator

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Mr Lanfranco Secco Suardo, President of AGSS;
Mr Marco Pulieri, Restorator
Mr Alessandro Massari, Architect, Microclimatic expert
Mrs Shorena Tsitsagi, Head of International Relations Department
Mrs Salome Jamburia, Senior Specialist for International Relations Department
Mrs Tato (Tamar) Ketiladze, Head of the UNESCO and International Relations Unit

1 - Phase E.1.2 - Monitoring of the evaporation

As already anticipated in the Deliverable E.1.A (December 2022), the removal of the external layer of the West Arm (WA) roofing was accompanied by monitoring activity of the hygrometric conditions of the WA masonry system, carried out by MCT. Such activity has been indispensable in order to assess the quality and intensity of the evaporation process.

The investigations carried out during the mission conducted by MCT between 28th May and 1st June 2022[1] took place in conjunction with the first cover removal and light temporary cover installation operations on the WA[2]. These investigations confirmed the serious hygrometric condition which emerged during the previous investigation, dated November 2021[3], and evidenced by the widespread damage to the vault paintings. In particular, the May-June 2022 investigations confirmed:

- the diagnosis of the origin of the damage to the paintings of the vault of WA, that is infiltrations through the glazed tile covering before the temporary metal sheet covering was put in place;
- the need to remove the glazed tile covering of WA of the Church to allow the structures to dry outward and not toward the intrados of the vault.
- the lack of improvement in the hygrometric condition of the vault in the previous five months, but rather the slight increase of the hygroscopic component (particularly sulphates).

In this report, MCT stated that "*the elimination of infiltration and the gradual draining of the structures to the outside (thanks to the interventions currently being carried out) will prevent a further contribution of salts to the internal surfaces but will not lead to a reduction of those (very abundant) now already deposited*".

After a few months of removing the outer layers of the WA roofing, in October 2022 MCT took on a new mission to verify the evolution of the hygrometric state of the structure[4].
As regards specifically the WA evaporation process, MCT very clearly states that:

- "(…) the work carried out in June 2022 on the roof of the west arm of the church certainly favored the process of drying out the structures towards the outside of the vault (...), avoiding a further contribution of salts on the intrados surfaces, but it cannot reduce the salts already deposited on the internal surfaces."
- "(...) In fact, not only is there a clear reduction in the maximum water content (...), but the samples taken at different depths at point C' are characterized by a considerable reduction of the water content towards the extrados of the vault confirming the effectiveness of the interventions started in May 2022 to rearrange the roof (removal of tiles, raising the metal roof, etc.) aimed, not only at drying out the vault, but also at favoring (as far as possible) the migration of soluble salts towards the exterior."

MCT recorded "the persistence of a non-positive hygrometric situation at the surface level" and stated that this situation is "due both to a residual humidity of the structure (in the drying phase) and, above all, to a widespread presence of hygroscopic salts, presumably brought inside the structures and distributed on the internal surfaces by the infiltration water". Despite this, it is vital to remember that "although the

[1] "*West arm of the Main Church of the World Heritage site – Gelati Monastery. Examination of hygrometric state of the structures. Mission Arch. Alessandro Massari of 28/05 – 01/06 2022*" by MCT (June 2022), report and technical sheets.

[2] Please, for the description of the operations regarding the WA temporary covering implementation works refer to "*Deliverable E.1.A - Executive summary of activities and report of the phase E.1.1 (West Arm covering removal. Supervision of the implementation of the emergency temporary covering)*".

[3] "*Investigations on the structural hygrometric and micro environmental state aimed at safeguarding the internal wall paintings, Mission Arch. Alessandro Massari of: 06 12 November 2021*", report and technical Sheets, (December 2021).

[4] "*West arm of the Main Church of the World Heritage site – Gelati Monastery. Examination of hygrometric state of the structures. Mission Arch. Alessandro Massari, Arch. Simona Balsamo of: 04-08/10/2022*" by MCT (November 2022), report and technical sheets.

hygroscopic salts have been transported to the surfaces by past infiltrations, the degradation phenomena due to their presence are not directly connected to the structural humidity and therefore may persist even after the complete drying of the vault structure (i.e. after the complete elimination of the water that has entered with the infiltrations from the roof)."
Finally, MCT identified an "evident deterioration phenomena even in the north arm of the church, which as far as we know has not been affected by recent infiltrations".

In conclusion, the monitoring of the evaporation process testifies to us the positive outcome of the WA temporary covering implementation.

2 - Phase E.1.3 - Technical support for submitting the summary of the implemented works to WHC

The need to activate an Emergency Phase, due to the consequences on the integrity of the paintings caused by the humidity present in the walls, has forced the NACHP and MCSY to inform the WHC of all new needful initiatives. RS gave its support as regards the part of the information pertaining to the adopted technical choices and the implementation phases. Also the preparation of the reports concerning the contents of the Safeguard project[5] and of the subsequent Meeting on September 28th[6] with the list of shared design elements (completed on November 15th by NACHP and MCSY through the decision on issues still open at that time[7]), were drawn up to be sent to the WHC.

In fact, the entire Emergency Phase was conditioned by the need to demonstrate that what was planned for the correct conservation of the Monastery was appropriate. In particular, at the end of July 2022, RS was informed about the presence of a concern, on the part of the Patriarchate, about the conservative approach adopted by the team of restorers for the cycle of paintings. Such concern had been supported by a Report (at that time still unknown by RS and RET), signed by three international experts and sent to Patriarchate as "International Advisory Board" (IAB). The report, indeed, dealt with the entire restoration approach, involving the timing and the adopted on-site procedures.

In order to direct this initiative towards a useful outcome for the Monument, RS, at the request of Madam the Minister, deemed it necessary:

1. to activate a channel of communication with the Patriarchate (through the Ministry), which had as an outcome a direct interview via a remote meeting on August 11th 2022 at the presence of the Georgian Patriarch and Madam the Minister;

2. to ask for the sharing of the IAB report, the contents of which were unknown even to the Georgian Authorities at that time;

3. to prepare, always in agreement with the Ministry, a joint report between all the teams involved in the general conservation project (RS, AGSS, MCT, RET) in which the arguments contained in the IAB report were discussed and evaluated point by point. This report[8], attached to this document in the Annex,

[5] "*Deliverable 2 - Findings of the analysis: keynotes based on the results of the studies conducted by RS and GET - Preparatory material for the remote meeting (organised on a PowerPoint presentation) with all teams, foreseen for the end of August-beginning of September 2022*" (July 29th, 2022).

[6] "*Deliverable 2 - Findings of the analysis: keynotes based on the results of the studies conducted by RS and GET - Remote meeting PowerPoint Presentation*" (September 28th, 2022).

[7] "*Decisions adopted by the Ministry of Culture and the National Agency for Cultural Heritage Preservation (NACHP) regarding the critical points outlined in Deliverable 2*" (transmitted on November 15th, 2022).

[8] "COMMENTS ON THE "Report of the International Advisory Board (IAB) on the Safeguarding and Conservation of Gelati Monastery - World Heritage" (IAB report), transmitted by the Ministry of Culture, Sport and Youth - National

was delivered to NACHP and the Ministry with a request that it would be forwarded to the Patriarchate.

Since the reply of the Patriarchate had been positive thanks to the granted sharing of the IAB document[9], RS, always in agreement with NACHP and the MCSY, thought it important to indicate in the "Comments" the opportunity to encourage the implementation of an in situ WHC mission. In fact, WHC had already produced two reports, signed by a commission in charge of ICOMOS (Icomos Technical Review) on February 2022, on the activities of the restorers and on the actions undertaken by RS (all based on extensive use of tests and investigations), both with extremely positive evaluations on the work carried out.
NACHP and MCSY, in agreement with the Paris offices of the WHC, activated in order to make possible an official WHC/ICOMOS/ICCROM Advisory Mission (AM) as soon as possible.

The WHC/ICOMOS/ICCROM Advisory Mission was held from November 28th to December 2nd 2022 with the presence, in Gelati, of the Teams RS, AGSS, MCT and RET. During the Advisory Mission developed on-site, the Advisory members had the opportunity to speak with the various Teams, exploring the construction site, and entering into the merits of the initiatives taken and of what was planned for the safeguarding of the Monument. On that occasion, the members of the AM received extensive documentation on the investigations carried out and on the procedures adopted, contained in extracts from the reports that had been carefully selected and aggregated[10].

As exposed in the Executive Summary of the mission, RS had the opportunity to show, in the direct joint inspection, the execution of the uncovering of the WA, the creation of the temporary cover, the investigative and diagnostic procedures at the basis of the future design guidelines that are intended to be implemented for the conservation of the Monument. The assessments on the causes of the damage suffered by the failling coverage system and on the evidence of some structural damages that emerged with the opening of the WA (and probably present in the other wings) were shared. It was agreed with the members of the AM on the need to immediately implement a study aimed at identifying suitable lines of structural consolidation. The Monument shows episodes of suffering, almost certainly due to dynamic actions, that must be brought under control in the lightest but also most effective way. Mention was also made, as already highlighted in the latest reports, of the initiative to involve the Layher Company in order to create a hangar structure to allow safe and easy implementation of the works.

The understanding, on this as on the other points, with the members of the AM was entirely positive. We are now expecting to receive their report by January 2023.

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Agency for Cultural Heritage Preservation of Georgia on August 15th, 2022 AND EVALUATION ON THE STATE OF THE WORK" (September, 14th 2022).

[9] The cited IAB report was officially transmitted by Nikoloz Aznaurashvili, Director-General of NACHP, to Mr. Ugo Tonietti as President of RS, and CC Mr Lanfranco Secco Suardo as President of AGSS, on August 15th 2022.

[10] *"Executive Summary on the mission carried out at Gelati Monastery and Tbilisi (Georgia) from November 27th until December 2nd 2022 in occasion of the joint World Heritage Centre (WHC)/ ICOMOS/ ICRROM Advisory Mission to the World Heritage Sit*e, by Ugo Tonietti and Giulia Misseri" (December 2022).

Annex

COMMENTS ON THE

"Report of the International Advisory Board (IAB) on the Safeguarding and Conservation of Gelati Monastery - World Heritage" (IAB report)

transmitted by the Ministry of Culture, Sport and Youth - National Agency for Cultural Heritage Preservation of Georgia on August 15th, 2022

AND EVALUATION ON THE STATE OF THE WORK

September, 14th 2022

RESTRUERE
STRUCTURE AND RESTORATION

COMMENTS ON THE
***"Report of the International Advisory Board (IAB) on the Safeguarding and Conservation of Gelati Monastery - World Heritage"* (IAB report)**
transmitted by the Ministry of Culture, Sport and Youth - National Agency for Cultural Heritage Preservation of Georgia on August 15th, 2022
AND EVALUATION ON THE STATE OF THE WORK

September, 14th 2022

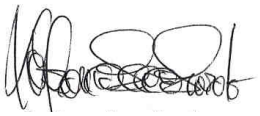
This document is prepared by the Teams involved in the Project "Safeguarding and conservation of Gelati Monastery World Heritage Property, Georgia". The teams are:

- **Restruere** Ltd, spin-off of the University of Florence, whose task is to propose Guidelines for the resolution of water infiltrations and strategies to be adopted for the Conservation of the monument. The team Restruere is here represented by Prof Ugo Tonietti (President) and PhD Arch Sara Stefanini.

- **Associazione Giovanni Secco Suardo** ETS, responsible for the Conservation and First Aid of the painted surfaces of the Monastery, which makes use of the skills of restorers with proven experience in the field and the contribution of Studio Massari, expert in Structural Hygrometric and environmental state. The team is here represented by Lanfranco Secco Suardo (President of Associazione), by Marco Pulieri (head conservator-restorer), by Davide Melica conservation scientist and geologist, and by Dr Arch Alessandro Massari expert of hygrometric control.

The document is based on the acquisition of the available documentation, on the direct investigations and tests carried out on the Monastery during the last year and on the first actions aimed at the conservation and securing both of the architecture and of the paintings. It includes the following sections: I. Premise; II. Punctual comments of technical nature on the IAB report; III. Last remarks, conclusions and perspectives; Appendix A, "A path for a hygrometric rehabilitation of Gelati (with particular reference to the vault of the West Arm of the Church of the Nativity of the Virgin)"; Appendix B, Available documentation submitted on Gelati Project, in chronological order until now.

For ReStruere: Ugo Tonietti  Sara Stefanini 

For Associazione Giovanni Secco Suardo: Lanfranco Secco Suardo 

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Considering

- The legitimate and dutiful reports and concerns by UNESCO on the precarious condition of the murals of the Church of the Nativity of the Virgin in the Monastery of Gelati and, consequently, the high risk for the conservation of an important Monument inscribed in the UNESCO List of Sites;
- the commitment of the Ministry of Culture, Sport and Youth of Georgia for the proper conservation and restoration of the Church of the Nativity of the Virgin in the Monastery of Gelati;
- the legitimate and meritorious concern of the Patriarchate of Georgia for the proper preservation and restoration of the Church of the Nativity of the Virgin in the Gelati Monastery;

and considering that

- on 15 August 2022 Restruere and the Associazione Giovanni Secco Suardo received the IAB report from the Minister of Culture, Sport and Youth - National Agency for Cultural Heritage Preservation of Georgia with a request to respond to various comments;

All this considered

- in the sole interest of the most correct conservation-restoration of the monument;
- in full compliance with the commitments and contracts signed with the Ministry of Culture, Sport and Youth of Georgia - National Agency for Cultural Heritage Preservation of Georgia;
- in full compliance of the power of the Patriarch and the Patriarchate of Georgia as a spiritual and temporal body, the highest expression of Georgia's spirituality and religious history;

so, we advance our evaluation on the matter:

This document condenses a series of comments and observations on the report written by the "International Advisory Board" (IAB), sent by the Patriarchate to the National Agency for Cultural Heritage Preservation of Georgia and finally to us by the Agency itself on 15th August.
We consider our duty to expose the evaluations of the teams working on the Monastery to the National Agency and to the Ministry of Culture who have honoured us with their esteem and trust.
Since the beginning of the relationships with the Minister of Culture - National Agency for Cultural Heritage Preservation of Georgia, Restruere and the Associazione Giovanni Secco Suardo expressed the willingness and interest of being able to illustrate the technical-scientific methodologies, the theoretical approaches and the decisions taken and to be taken with other international and Georgian experts.
In this regard, we regret not having been able to welcome IAB colleagues at the Gelati Monastery and therefore not have been able to provide them with all the elements and information and materials useful for in-depth analysis and have a scientific comparison with the expert architects, the expert chemist, the expert in microclimate and humidity problems, the expert in restoration theory and history and the conservator-restorers international and Georgian already engaged.

The document starts with a Premise, containing a summary of some decisive methodological aspects strictly connected to the main issues that emerged during the Gelati Safeguarding Project. On these bases and their taking root in the principles shared by the International Scientific community, all our approach, practical and theoretical, is founded. After this introduction, the document addresses, section by section, the paragraphs of the IAB report transmitted by the Patriarchate discussing the crucial points.
In the end, as a conclusion, we try to identify a sort of possible evolution of the situation looking at the next months.

I. Premise

As is well known, any intervention in Cultural Heritage requires an approach that is always different, since we are dealing with completely original objects (be they architecture or paintings) whose materials, techniques, whose history differentiates them from all the others. For these reasons, even masterpieces belonging to the same country or territorial context often require a specific approach.
This approach needs to develop a knowledge path founded on existing documentation, direct survey and investigations, tests on materials in situ and at laboratories, understanding of the implementation techniques and of the interventions that have taken place. Unfortunately, in many situations, like the one we are experiencing, we must operate in emergency conditions, which require immediate actions to safeguard parts of the Heritage to be protected. In these cases, we are forced to move according to a double track:

- on the one hand, understanding what to do on the parts at high risk of loss (first aid) by implementing targeted known strategies and exploiting the clinical experience;
- on the other hand, keeping the knowledge design open and capable of guiding long-term interventions.

A further consideration concerns how to illustrate and explain to the scientific community what is better to do in the given situation. We have already explained in our reports the reasons for the interventions, connecting them to the studies carried out. However, as it is well known, there is not always a solution shared by all; there are so many variables involved and different experiences of the authors. For this reason, we are happy to have the opportunity to explain our work and its scientific and methodological basis.

The case of the conservation-restoration of mural paintings is characterised by a further specificity. In fact, in the work of the conservator-restorer, in no case can the purely theoretical justification be invoked as the only justification: the conservation-restoration depends also on the direct action and manual operation of the person who activates it.
There is a knowledge of the materials and of the most suitable technique for the intervention that is based exclusively on the training of the restorers and their clinical experience, supported by chemical and physical tests.
They understand, based on their experience and competence, what is better to do and how they must proceed within a theoretical framework of reference. No one becomes a restorer for a simple academic path, but by intertwining theoretical knowledge with the clinic competence and experience.
After having recalled this reference pattern, which we believe is shared by the entire scientific community, we would like to deal with some underlying methodological issues that characterised - from our point of view and according to the reading we have made of it - the IAB report transmitted by the Patriarchate.

a) *Importance of the path of knowledge and the direct relationship with the artwork*
It is crucial to underline that an effective knowledge path can be developed through an extended presence on-site, face-to-face with the paintings, carrying out tests and investigations, and observing the reactions to localized surveys. We are open to receive suggestions on the work we are doing. We would have been glad to speak with the expert extenders of the IAB report by sharing our in-situ experiences, the main questions and possible solutions. The small amount of time spent in Gelati by the IAB report drafters did not allow a profitable exchange. A direct dialogue would also have allowed the sharing of our numerous scientific reports. In fact, in the list of documentary material that is cited at the end of the IAB report, the documentation of all the investigations and deductions conducted in autumn-winter ‘21 and the first months of '22 does not appear. For complete available documentation at today's date, we list it in the Appendix B of this response.

b) *Considerations on the relationship between the emergency phase and the long-term intervention design*

As already mentioned, the Italian restorers' team was invited to go to Gelati with the utmost urgency. In fact, on May '21, the Georgian Ministry of Culture asked Prof. Tonietti and Restruere - just involved, thanks to a suggestion from Unesco, in the project for the defence against meteoric infiltrations of the Monastery - to find a team of expert restorers willing to intervene immediately on site, due to the irrepressible acceleration in the deterioration process of the paintings. It is important to underline that four weeks later the team was already studying and working in the Monastery. As will be better explained in the following sections, the team had to immediately deal with the massive damage present in the West Arm.[1]

Considerations have been developed on a complete picture of the situation: what is the history, what are the techniques, what is the type of degradation, and what are the specific tests to be implemented.

The restorers had to face a terrible situation of damage to the paintings. They had to identify where the most urgent intervention had to be done (at stake the loss of some paintings). Therefore, a quick map of the paintings in danger was carried out and immediately restores took care of them. Complete and in-depth documentation, regarding all the conservation-restoration interventions that took place in the Monastery and on the murals, would have been extremely useful, in order to be able to reconstructing the conservation history. Currently, a comprehensive and reliable documentation, capable of shedding light on the aspects described, is not yet traceable. We are confident of being able to study this documentation, if existing, including the possibility that it be kept in some archives of the Patriarchate.

The restorers focused on the seriously ill patient (first aid) by drawing up a general data acquisition plan for stabilisation, but a long-term plan was prepared despite the urgent conditions (as many subsequent reports exhibit). If they had simply studied (for how long?) we would have lost part of the paintings. Anyway, we think it useful to improve synergy with the Patriarchate and its experts to make possible deeper knowledge.

c) *On the need for the involvement of Georgian workers and experts*

We think that we are facing a crucial issue. Such normal and shared aspiration has to be confronted with the need to provide the best possible team for the conservation of the paintings. All of us, sincerely, wish to guarantee the team of experts most appropriate for the safeguarding of the Monument. Such a position implies a selection of the teams through evaluation of experiences in the field, competence, CV, and recognition of the scientific community.

However, in any case, the issue to involve a local team is certainly a good aspiration and follow all the recent indication related to the Safeguarding of World Heritage. For this reason, Italian restorers

[1] The situation of the wall paintings of the Church of the Nativity of the Virgin was so dramatic and a urgent and serious conservation-restoration - measure up with the great value of the paintings – was so necessary that in the month of May 2021 the Georgian Ministry of Culture wrote to the World Heritage Centre denouncing the situation:

"…Due to the active and ongoing deterioration of the wall paintings, immediate actions to study and stabilize the process are strongly demanded.

As you are already aware, from our previous communication, the water infiltration in the West-south corner of the West arm of the main church that has occurred in March 2020, is heavily influencing the condition of the wall paintings, due to which the state of conservation is critical and requires immediate actions!

According to the results of the monitoring of the condition of the paintings, undertaken since 11 March 2020, the visually identified types of deterioration are decohesion of the stone, plaster and paint layer, salt efflorescence, flaking of the paint layer, biological patina, decohesion and loss of fills and edge repairs done during the previous interventions, constant loss of the wall painting pieces from different parts of the church (the more detailed information is provided in the attached annex).

Taking into account the seriousness of the situation and the critically unstable condition of the wall painting of the Gelati Monastery, which might cause the loss of one of the main attributes of the outstanding universal value of the World Heritage property, I would like once again to appeal to your kind consideration to suggest to us the high-profile experts with profound knowledge and experience in Medieval wall paintings conservation within the earliest possible time and permitting us to communicate directly with them to urgently start the arrangement of the field mission to the Gelati Monastery, Georgia."

immediately, and under the suggestion of the Ministry itself, started their work in synergy with a local restorers team, in order to share competence, experience, conservation strategies, methodological approach, analyses and tests typology. Only such kind of behaviour can guarantee an improvement in the long-term capacity of protection of the monuments. As well known, also the work of Restruere–(that concerns the constructive and architectonic conservation issues) is organised in close contact with the Georgian experts' team (and attributable to the term "supervision", a term that cannot be adopted for the restorers work that requires an almost continuous presence on site). So, from this point of view, we wish to improve any kind of collaboration.

d) ***Last consideration concerns the relationship with the International Institution that has the responsibility of safeguarding Gelati Monastery ie the World Heritage Centre (WHC) and its technical reviewers***

If we want the guarantee the maximum protection of the monument, there is no doubt that the work of those responsible for the intervention must be constantly illustrated and monitored. Every observation, as long as it is free from conflicts of interest, plays a useful role.

Consequently, we must take the utmost care in correctly informing the WHC and in establishing periodic exchange procedures with this body.

II. Punctual comments of technical nature on IAB report

IAB 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.

Comment:

With regard to this point, we agree with the identification of humidity as a central problem of the suffering of Gelati's paintings and that the environmental rehabilitation requires a long process; however, it should be noted that this observation was already identified by the conservator-restorers Pulieri and Centanni in the missions of June and September 2021, in which the Emergency Phase began, which has not yet been completed. In the following other three missions (lasting one week each) a study and design process was activated to address over time the problem of the paintings on the South wall of the West Arm linked to humidity.

In fact, right from the first mission (June 2021), in front of the unexpected seriousness of the degradation in which the paintings poured and after having found a widespread presence of saline efflorescence and carried out a first measurement of the humidity, even if superficial, of the South wall of the West Arm which recorded very high values, we have tried since then to understand how to deal with and solve this problem.

It was immediately clear that the most urgent intervention was to evaluate the possibility of activating a plan to be able to open the roof which, due to its structure, kept the masonry wet, preventing its evaporation.

The idea of removing the glazed tiles and the screed substrate on which they were installed began to be considered with the aim of activating a process of evaporation of the humidity from above, making it, as far as possible, come out where it had come from.

This project was intended to slow down the migration of humidity and salts present in the masonry toward the interior, until stopped them completely.

It was precisely the observation of an extremely critical condition that gave rise to the need to involve in the conservation-restoration plan of the paintings an international expert on microclimate and humidity who, in addition to structurally fine-tuning how to realize the idea of opening the roof, also studied all the necessary measures to monitor and solve the problem of humidity in the West Arm and in general of the whole monastery.

In agreement with the supervisor appointed, Prof. Arch. Ugo Tonietti, coordinator of the Restruere team, responsible for the conservation intervention on the Monastery, including the resolution of the multiple causes of water infiltration, the involvement of the microclimate expert Dr Arch Alessandro Massari was immediately thought of (see the first reports from Restruere and Associazione Giovanni Secco Suardo, cited in Appendix B). Alessandro Massari in November 2021 carried out a complete diagnostic investigation (including detection of humidity values on the surface and in-depth with coring of the masonry, sampling of saline efflorescences to identify their nature and quantity and design and installation of data loggers to activate continuous monitoring of the trend of the relative humidity of the environment.

IAB Report:

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 far 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.

Comment:
With regard to these statements, we agree that Gelati's pictorial cycle developed in different historical periods and with different techniques, and that knowledge of the work is essential in order to be able to conserve and restore it. In fact, the complexity of the decorative apparatus requires an in-depth study of the iconography and, in terms of conservation-restoration, of the executive technique and of the identification of the previous interventions. It is no coincidence that the team of expert Italian conservator-restorers was enriched in the last mission of July 2022 with the contribution of an expert Italian scholar in the history and theory of restoration, Dr Giulia Bordi, Professor at the University of Rome Tre, specialised in the historical period to which the oldest part of the Monastery's paintings dates back, precisely with the aim of reconstructing the chronology of the paintings and above all of the previous conservation-restoration interventions. This need, however, had already appeared in the May-June 2022 mission when a more in-depth visual investigation of the pictorial cycle of the West Arm highlighted, in addition to various elements attributable to previous restorations, also the signs of an evident quite drastic cleaning intervention on the scene located on the West wall, depicting Jesus in the Garden of Gethsemane, an ancient conservation-restoration intervention of which unfortunately there is no certain documentary trace.
After this anomaly was reported by the conservator-restorer Marco Pulieri at the end of his mission and having forwarded to the local authorities for the protection of cultural heritage the request to be able to access and view any archival, bibliographic and photographic documentation in their possession, that could be useful in identifying old restoration campaigns, the material thus obtained, although interesting, unfortunately, it turned out to be insufficient.
In the mission of July 2022, the research launched on site by Dr Bordi highlighted how difficult it is to find, even at an international level, texts and information material on the history of Gelati's paintings that do not refer to the apse, on which there is in fact a good bibliography. Gradually, however, the deepening of the study began to produce some encouraging results regarding the dating of the previous restorations, data that are now being processed and will be published shortly.

IAB Report:
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 lnternational 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 organizations (e.g. ICOMOS lnternational Scientific Committee on Mural Painting).

Comment:
We would like to underline in this regard that we are pleased with the collaborative spirit that has been established so far between the team of Italian experts and that of Georgian conservators.
Such a collaboration was cemented with a view to sharing knowledge and long professional experience in the possession of the Italian team, which is why it was invited to intervene with the utmost urgency to save Gelati's paintings.
This professional synergy is being translated into a constructive training of Georgian workers, which has animated all the missions carried out so far and which is proving for them a significant source of professional

growth, thanks to which some theoretical, but above all practical, shortcomings, which have emerged during the various phases of the work carried out up to now, will be gradually filled. We believe that this process will quickly lead to the acquisition of the specific skills necessary to collaborate concretely and with awareness with the Italian team in the complex and delicate restoration intervention such as that of Gelati, continuing an experience of on-site training.

In light of these objective professional considerations and on the basis of the explicit suggestion by the International Advisory Board to continue the conservation-restoration of the monastery's paintings with only a local team, we would like to call the attention of the IAB to the indispensable necessity to propose and share with the current conservation-restoration project responsible the professional curricula of such operators, which obviously must correspond to a very high profile.

We agree with the proposal contained in the IAB report to broaden the range of interdisciplinary professional skills that include however professionals recognized internationally, with a specific working (and executive) experience in the conservation-restoration of wall paintings. In fact, we believe that is extremely constructive the cognitive contribution of conservator-restorers who during their professional career have faced and solved problems similar to those present in Gelati.

IAB Report:

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.

Comment:

We fully agree with this analysis, as it is established from what has already been expressed previously on this aspect.

In the reports and technical documents exchanged by both Restruere and the Associazione Giovanni Secco Suardo, with the Ministry of Culture and the National Agency for Cultural Heritage Preservation of Georgia at the end of 2021 and for the first months of 2022, it is possible to follow the analysis path that led to identifying the state of absolute emergency in the West Arm and the subsequent design of the uncovering of the roof in that area of the church together with the creation of a temporary protection system. The proposal for the removal of the roof and a new temporary covering structure (now completed and installed) was approved on March 25. The concerns expressed in the IAB Report, together with other decisive factors inherent in the cultural and professional background of those who have been operating on the site for more than one year, are at the basis of the development of the strategies adopted to resolve the emergency situation.

It should be emphasized that the need to remove the current tile roofing system (totally inefficient) affects the entire monument as well as the removal of the filling material from the spaces under the roof.

This provision will constitute one of the basic points of the new roofing project. Nevertheless, it was deemed essential to proceed without delay with the safety of the West Arm, making it a pilot operation. In the time and manner that will be necessary, this strategy will then be extended to the entire monumental structure, taking into account specific needs, and following a map of priorities dictated by

the state of the underlying paintings. In the meantime, the architectural evaluations that will lead to the identification of a new roof coherent with the history and protection needs of the Monastery are being finalized.
The removal of the roof of the West Arm, and the application of a new provisional slightly elevated with respect to the current altitude, was carried out precisely in order to try to reverse the migratory flow of the soluble salts present in the masonry of the South wall. The filling material of the space between the extrados of the vault and the roof structure, which in an instrumental analysis conducted by Dr Arch Massari was extremely humid after the copious water infiltrations suffered, it was almost completely removed because it helped to maintain a constant degree of moisture that was transmitted downwards to the vault and to the painted walls.
With this emergency intervention, the ventilation process created by the circulation of air inside a sort of cavity thus obtained. A process that the original roof structure most likely had. The migration of moisture towards the interior of the Church - which was the cause of the accumulation of the soluble salts carried by the water on the painted surface and on that of the immediate substrate - slowed down. The evaporation of the moisture from above started in at the end of May with the removal of the tiles and the filler material and towards the end of August, so after only about three months of evaporation, we recorded a significant stabilization of the spill on the painted surface of saline efflorescence compared to the autumn period, when have been done the last monitoring by the Italian team.

IAB Report:
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.

Comment:
With regard to this point, relating to drying times, we would like to disagree. In fact, it is not clear which masonry the IAB refers to. The specific situation of the West Arm concerns to a more critical extent the vaulted system, whose thickness is about 40 cm. The state of the supporting walls of the vault is different (thicker but slightly less exposed as you move away from the level of the roof), but the condition of imbibition of the vaults and of the walls in the other arms and in the walls of the entire building is still different. In a general perspective, but comforted by Dr Arch Massari's assessments, which suggest a very diversified picture so far, it will be the map of the vulnerability to the water of the supporting surfaces of the paintings together with the condition of the walls that host them, which will define the priorities and the timing of the interventions.
So today we face the greatest criticality but the knowledge path is already aimed at the whole. As for the West Arm, the strong solar irradiation of the summer months to which it was/is subjected together with the uncovering carried out, support the belief that the times to obtain an acceptable degree of drying that allows the conservation-restoration of the South wall to be started - with great prudence - can be significantly shorter, in the order of 4 / 5 months (see Dr Arch Massari notes and reports listed in Appendix B).
Therefore, although the evaporation proceeds fairly quickly, it seems significant and encouraging that it does not seem to correspond to an equally rapid phenomenon of crystallization of the salts inside the South wall.

IAB Report:
1.3 Environmental conditions[2]
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, show that when outside RH drops on warm days in the summer, the interior RH follows closely and there is little difference between the R H 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 R H rises at night. Depending on the nature of the salts, R H 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. lt 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 R H that needs to be respected within the building during drying and in the long term in order to avoid further destructive salt activity.

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[2] 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.

Comment:

We fully agree with the suggestion made in the IAB report on the need to limit the relative humidity fluctuations within the church as much as possible as it causes the crystallization and solubilization process of the soluble salts to be activated. In the report by Dr Arch. Massari, this recommendation has in fact already been widely foreseen and put in place as a fundamental issue for the conservation of the paintings (see Dr Arch Massari report).

It should be noted that the nature of the soluble salts has been exhaustively analyzed through a series of instrumental investigations since the first mission in June 2021 by the Geologist Dr Davide Melica (see report) and then resumed in the two subsequent Dr Arch Massari missions, in November and June 2022.

The results of the laboratory analyses confirmed and deepened those carried out on site which had already identified three main types of salts, sulphates (hydrated magnesium sulphate), nitrates and carbonates.

The knowledge of the nature and quantity of the different salts is necessary precisely to establish the degree of danger that they bring to the paintings since a considerable increase in relative humidity corresponds to an increase in the volume of sulphates, which is very dangerous due to the mechanical action they can exert on the pictorial film and on the support. The study of the various saline typologies will be necessary therefore to identify the maximum achievable threshold of relative humidity inside the church (identifiable in the highest value that determines the swelling of the most hygroscopic salt present) so that the highly hygroscopic property of some salts does not trigger the mechanical process of the crumbling and lifting of the colour. It will also be useful to Dr Arch Massari to evaluate the adoption of measures aimed at controlling and stabilizing the internal relative humidity.

All these considerations lead to a further reflection of a methodological nature: it will not be possible, as Dr Arch Massari himself agrees, study and implement a specific microclimatic stabilization intervention until the drying process of the structures and surfaces and stabilization of the salts present on the surface will be completed.

In other words, using a clinical metaphor, it makes no sense to prescribe rehabilitation therapy to a patient during the course of a very serious heart attack.

For this reason, the team of Italian experts agrees that - although all team members are aware that dealing with the issue of salts always constitutes a methodological dilemma that proposes each time the opportunity of their removal or not - in this specific case, given their extent and the deterioration of the pictorial film and the plaster they were causing, the alteration of the surface instrumental hygrometric measurements they determine, the limitation they entail on the design measures for the stabilization of

the microclimate, all this considered, it is considered more appropriate to proceed with the removal of salts on the surface or immediately below it, also relying on the fact that moisture, having reversed the direction of migration upwards with evaporation from the roof, will bring less and less salts to the surface. In particular, it seemed urgent to remove potassium nitrates and hydrated magnesium sulphate (hexahydrite and epsomite) which are very dangerous for wall paintings as they are highly hygroscopic.
It was also evaluated whether it was appropriate or not to leave the salts, waiting for the phenomenon of moisture to stabilize, thanks to the progress of the drying process for the opening of the roof; but this inactivity, which would have required a long time, would certainly have led to the continuation of the fall of the paint film and plaster, for the reasons described above. Therefore, due to the risk that the salts constituted and still represent to the already very compromised state of conservation of the paintings, the first option was opted for, that is their removal. When the wall will be finally dried and the relative humidity conditions stabilized, the residual presence of salts inside the masonry will no longer be a source of danger.

IAB Report:
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.
lt is highly recommended that the environmental monitoring work (Sagaradze 2021) which concluded in September 2021 be continued.

2 The Wall Paintings[3]

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.[4] As stated in an ICOMOS report, dated February 202 2: "ICOMOS advises that the State Party conduct a detailed assessment of the condition of all the murals under Stage Il of the programme, prior to the submission of comprehensive proposals to address the key issues."

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 pian 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.

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[3] 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.

[4] We were not provided with the continuous monitoring that was referenced in Pulieri and Centanni's Septembcr 2021 report.

Comment:

We allow ourselves to differ with this statement since a careful reading of all the available reports, both those of Pulieri and Centanni, of Massari and of the conservation scientist Davide Melica, reveal that in reality the cognitive investigations of the wall paintings and the environment in which are located, have been completely carried out since the beginning of the missions, progressively obtaining data on the nature of the executive technique of the pictorial cycle. These investigations concerned the nature of the pigments, the binders and the material constitution of the plaster, the constructive typology of the masonry of the walls and vault, the fluctuation values of the relative humidity of the environment and of the walls, on the nature and type of soluble salts. Therefore, it is not fully understood what this observation refers to.

Regarding the observation in the note 3 on page 5 of the IAB report, all the locations and data of the interventions carried out were painstakingly recorded, even if they were not part of the report of that specific mission.

IAB Report:

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.

Comment:

With regard to this point, what has been described above is reiterated, namely that the stabilization of humidity, although necessary and indispensable, is a long-term process in an environment as vast as that of the interior of the Church of the Nativity of the Virgin, which could require measures not easy and immediate to apply. At present, and to be extremely practical, as suggested by Dr Arch Massari himself who shares the observations of the IAB, as well as intervening in the prevention of relative humidity fluctuations through the exchange of the internal/external environment and monitoring its progress, (interventions for other things already in progress), and to study a possible microclimatic control system through the installation of windows with adjustable opening, a subject that obviously requires an in-depth and separate study. Not much else can be done at the moment, other than the opening of the roof, a subject already extensively treated and implemented.

Since extreme solutions such as the isolation of the West Arm from the rest of the church or the climatic control of the entire environment with special equipment are certainly not immediately feasible, it seems reasonable to say that the problem of moisture has actually been seriously faced in the best possible way considering the emergency situation given.

This, of course, does not exclude, indeed it makes it desirable, that once the presence of salts has been remedied, further environmental improvements can be undertaken subsequently.

IAB Report:

This is in adherence with Article 2 of the ICOMOS Principles for the Preservation and Conservation-Restoration of Wall Paintings (2003), "Ali 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 time frame 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.

Comment:
As already underlined, it is reiterated once again that the situation of absolute emergency that was presented to the conservators-restorers, at the beginning of the first 2021 survey, due to the dramatic situation in which large and widespread portions of colour and plaster poured into the South wall and the vault of the West Arm, still hanging on the wall in a "miraculous" way but about to fall, it prompted the conservators-restorers to carry out the first exploratory tests to consolidate the pictorial film, checking with the utmost attention the reaction and feasibility of the intervention.
Considering the excellent result achieved in terms of the re-adhesion of the colour flakes, continuous monitoring of the results obtained has begun. The IAB report speaks of a too-limited period of verification time (three months), but in reality, already in the subsequent reports, drawn up after six months and subsequently updated to the missions of June 2022 - therefore after one year - it is highlighted the perfect maintenance of the adhesion of the colour to its support on the various tests carried out and so far no problems have arisen. It has also been verified that on the South wall the process of appearance of new efflorescences and sub-efflorescences has considerably reduced until it almost disappears, a clear sign that the evaporation process from the roof is producing some success and the quantity of salts still present in the masonry it's shrinking a lot.

IAB Report:
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 crystalize 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:
<u>Salt Reduction</u>: Pulieri and Centanni suggest ed 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 mobilization and redistribution of additional salts that may cause increased deterioration.[5]

[5] *Pel, L., Sa wdy, A. & Voronina, V., 2010. Journal of cultural heritage, 11(1), pp.59-67.*

Comment:
On this point, we intend to premise that the methodological procedure tested on Gelati's paintings has now been consolidated for decades all over the world (also for example in the restoration campaign of Giotto's frescoes in the Scrovegni Chapel in Padua where the writer has worked directly) and that it has been developed by one of the major international authorities in the field of conservation-restoration, the Istituto Centrale per il Restauro of Rome.
While theoretically sharing the observation of the IAB report regarding the salt reduction intervention, we allow not to agree with the formulation of the criticism regarding the extraction process, as it appears partial in its evaluation. If on one hand, it is true that the salts can initially solubilize by coming into contact with the water applied through the extractive poultice (which in Gelati's case it was decided to perform with the affixing of several layers of Japanese paper tissues and not with a sepiolite and cellulose pulp to minimize the water intake) it is equally true that in this way, having no time to penetrate deeply, any dissolved salts that still remain in place are then attracted to the surface and completely reabsorbed by the action of the extractive medium, kept in contact until completely dry.

When the removal of salts cannot be done simply dry using small brushes, as in this case, it must necessarily be done through an aqueous medium. In fact, the various methods that have been in use since long time - whether by means of poultices or with ion exchange resins or with the application of barium hydroxide – they always have in common water as an application medium. One therefore wonders what exactly was meant by the observation relating to the technique adopted regarding the reduction of salts.
The extraction of soluble salts using poultices allows the removal of saline efflorescence not only from the painted surfaces but also from the immediately underlying layers.
The use of poultices, which have an adsorbent nature, also prevents the solubilized products from being carried by the solvent inside the masonry structure.
The action exerted by the adsorbent poultices is mainly of a physical type but there is also a chemical component and, in particular, the physical action is linked to the ability of the adsorbent material to attract the soluble salts towards the outside; the chemical action is instead linked to the solvent capacity of water towards many salts (sulphates and nitrates).
In the case of using water as a solvent, the removal action is particularly effective if the deposits are made up in whole or in part of water-soluble materials and especially if the water used is deionized.

IAB Report:
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% Acri li 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.

Comment:
1. With regard to the observation about the use of acrylic substances for the consolidation of the paint film, premising that the observation is basically shared, we wish to expose here some methodological considerations:

- the methodology tested for colour consolidation has certainly taken into account the contraindications that in principle it may entail;
- the Italian conservators-restorers are well aware - and share - the suggestion that the use of acrylic emulsions, even at extremely low concentrations (3%) where possible it should always be avoided (and used only in extreme cases, such as ours)

- however, for the sake of completeness of the data, it must be said that Acryl 33 is an extremely stable substance in the presence of salts and high relative humidity and these characteristics can paradoxically be useful, even in perspective, because they are resistant to any aggression of saline efflorescence;
- Furthermore, it must be considered that its application at such a low percentage (3%) and with a very porous substrate as in the case of Gelati, very limitedly compromises the transpiration of the colour and smooth pargeting (*intonachino*). This behaviour was verified with the so-called "brush and water test", an empirical measurement appropriate to evaluate the degree of “wettability” of a surface, which showed a permeability to the aqueous medium almost unchanged compared to before the application of the resin;
- despite the extreme urgency that was imposed and the very short time available in the individual missions (penalizing aspects that we will never tire of reiterating) which did not facilitate the execution of samples with various usable products, except for polyvinyl alcohol which will be discussed shortly, in any case, other alternative methodologies have been evaluated in addition to those of the use of acrylic resins;
- first of all, a general consideration must be made: the extremely urgent intervention that was immediately imposed in the first mission (June 2021), under the risk of the conspicuous loss of colour and plaster, required a very urgent intervention to reinstate the adhesion of the pictorial film. Nothing else could be done since we constantly witnessed fragments of the pictorial film falling onto the scaffolding. In any case, with this intervention numerous fragments were saved from losing and today they are retained and stable.

  Therefore, in this extraordinary case, the product to be used - in addition to the canonical requirements of compatibility, reversibility, breathability, stability normally required for use in the conservation-restoration - had to have an immediate and strong enough adhesive power, considering the thickness and the wide diffusion of colour lifts.

  For this reason, the range of products that could be used was actually greatly reduced, due to the fact that they were not available rapidly in Gelati at that moment.

  Then, in addition to the low-concentration acrylic emulsion, polyvinyl alcohol at 3% in deionized water was also tested, the behaviour of which was known having already been used elsewhere (and based also on the technical requirements indicated in the manufacturer's technical data sheet) also suitable in environments with high relative humidity.

  Also, in this case, the result was excellent in terms of the adhesion obtained and - after having had the opportunity to check with the Head of the Scientific Technical Office of CTS Europe Dr Leonardo Borgioli the stability of the product even in saline environments and high relative humidity, as long as they are not wet - it is now being considered to apply it as an alternative to acrylic resin.

  In addition, polyvinyl alcohol has the property of being diluted in a hydroalcoholic solution, or even only in alcohol, which would considerably reduce the amount of water, a measure suggested by the IAB report.

  Finally, polyvinyl alcohol has the great advantage of being completely reversible, fully respecting one of the fundamental requirements of the substances used in conservation-restoration.

  Other existing products on the market, while being recommended for the important feature of greater compatibility with the original material, however, may in turn have limitations or side effects that may not be optimal for the conservative state of the painting.
- Although recommended, for example, the use of nanotechnological substances, such as nanocalce (Nanorestore, nanocalce in isopropyl alcohol) due to their maximum material compatibility with the original carbonate substrate, these products still have some drawbacks such as the disadvantage of having extremely long application and especially setting times that require repeated applications, a mild adhesive power compared to what is necessary in the case of Gelati and finally the risk (recorded in several cases in which they have been applied) of producing with the product residues in excess a whitish patina almost irreversible on the “hair” of the colour. By virtue of these possible drawbacks, especially the last one listed, which would involve the risk of having to act with mechanical or chemical means in an extremely degraded situation, its use is not recommended.

- Ammonium caseinate was also taken into consideration, widely used on wall paintings, given that compared to nanocalce it has a slightly higher adhesive power, but it was decided not to use it due to the possible risk of the reaction of the product's casein base with a highly humid environment such as the Gelati Monastery at this time and therefore of a consequent possible fungal attack.
  It is also well known that the setting times of ammonium caseinate are also quite long and, moreover, the use of this product produces total insolubility of the excess residues that are formed once the product has dried and set. This side effect that it was considered appropriate to avoid in order not to incur the operation of their removal which, as for the nanocalce, could be very dangerous on such a strongly disintegrated surface.
  Furthermore, ammonium caseinate is also a water-based product, therefore with all the contraindications that this application means would entail in the case of Gelati.

2. We do not even understand the observations reported in the IAB Report regarding the use of ammonium oxalate, which was applied exclusively as a consolidating agent for the uncoated plaster, as an alternative to acrylic resin.
   There is a vast literature[2] and several cases in which it has been used, that illustrate the excellent results achieved, both as a consolidator of the stone and stucco matrix and, as a secondary reaction, as a converter of calcium sulphate through a chemical reaction that renders the calcium sulfate transforming it into calcium oxalate.
   The tested treatment with ammonium oxalate which transforms calcite into calcium oxalate, increasing the cohesion of the plasters, starting from a pack of ammonium oxalate solution and demineralized water at 5-7%, (which in Gelati's case, in order to avoid permanence on the disintegrated surface of a prolonged compress, it has been repeatedly applied through a nebulizer in order to obtain the same result) seems to produce undoubted advantages at a chemical-physical level on carbonate matrix supports. The formation of calcium oxalate in the support does not interfere with its wettability and breathability values. The porosity in the material remains more than sufficient since the CaC03 granules are transformed on the surface without however creating occlusions between granule and granule. However, instrumental investigations were carried out on the treated plaster samples to assess the effectiveness of the penetration and the amount absorbed.

IAB Report:
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 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.[6]

[6] *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.*

Comment:
With regard to this point, some clarifications are necessary:

[2] i.e. the vast bibliography of Mauro Matteini, former director of the Italian Institut for the Conservation of the Cultural Heritage - CNR Consiglio Nazionale delle Ricerche.

- The application of Japanese paper tissues with the acrylic resin Paraloid B 72 concerned only and exclusively some isolated portions of painted plaster which were completely detached from the support and about to fall, taking up, among other things, the method and the products used in the past by some other Georgian operators who, after the damage caused by the copious infiltration of water, intervened for monitoring and safety measures.
  Where it was absolutely necessary to intervene, the extension was only slightly increased, to ensure a greater anchoring surface in relation to those initial ones excessively reduced and therefore ineffective. This methodology was by no means adopted as a systematic consolidation of the paintings, as it would seem instead to be inferred from the content of the IAB Report.
- Regarding the support grouting made on the edges of the plaster loss (*lacune*) made with a compatible mortar similar in composition and colour to the original matrix, it must be said that they had only a temporary function and limited exclusively to the parts of colour and plaster very unsafe that needed a temporary emergency anchorage to then receive, once the lack of salts and an acceptable degree of humidity have been verified, a pre-consolidation with specific injection mortars based on desalinated artificial hydraulic limes. Therefore the surfaces affected by this intervention were minimal, as was consequently the intake of water.
- These considerations of the IAB Report re-propose the long-standing matter of what should have been done in the emergency situation in which it was initially operated.
  Therefore - while understanding and sharing theoretically and methodologically the observation - it was more appropriate to risk the almost certain loss of substantial portions of paint or to put a temporary remedy that perhaps could have had as its only contraindication that of a possible, but not certain, leakage of salts. For this reason, we have decided to intervene with the re-adhesion of the paint film about to fall with the application of Japanese paper and acrylic resin (a matter that will be explored later in this document).
- In any case, it should be noted that to date no salt leaks have been recorded along the grouted (*stuccature*) edges.

IAB Report:

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,[7] 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.

[7] *Further analysis of organic materials present in the paint and plaster is required.*

Comment:

It is certainly acceptable the observation of the IAB report on the need to take into consideration the presence of numerous and varied salts within the layers of paint that can be sensitive to water causing their dissolution, redistribution and hydration which always involves an increase in volume and a

disrupting physical-mechanical action for the pictorial film. But we do not understand the same concern for the influence that humidity or water can negatively exert on the components of the pictorial film.
The chemical nature of the pictorial coat that can be deduced from the diagnostic investigations reveals that it is a technique based on carbonated lime and traditional pigments typical of wall painting (Yellow Ocher, Red Ocher, Green Earth, Carbon Black, Smalt, Lapis Lazuli). Some of these layers contain hydromagnesite, so it is possible that magnesium lime was used as a binder in their execution.
In some cases, calcium oxalates and magnesium oxalates were also detected, which can derive from the mineralization of natural organic compounds of a protein or lipid nature, presumably used as additives in the pictorial film. By virtue of the chemical composition of the paint, the concern expressed in the IAB report about the risk of dissolution of the composition of the paint layer in contact with water seems unfounded, since once carbonated, the magnesium lime is almost insoluble. The problem arises possibly more on a mechanical nature, due to the exclusive action of the salts that could interfere with the *mezzo fresco* technique, which is the nature of the Gelati pictorial cycle, as the lime paint layer, in itself stable by carbonation, it may not be perfectly attached to the fine plaster (*intonachino*), as it happens in the fresco technique. Therefore, the colour losses, that we found upon our first arrival in Gelati's paintings, are not due so much to the dissolution of the colour but to the mechanical action of the salts which, once dehydrated, that is, at the end of their solution and crystallization cycle, have performed a disintegrating action on the colour, which without any support has ended up falling off.
Furthermore, it seems necessary to point out that the conservators-restorers who intervene with the removal of salts or with the consolidation of the pictorial film constantly exercise a very strict control so that no further loss of colour occurs and in fact in the areas where the action was taken, this problem has never occurred (see photos of the various reports).

IAB Report:

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. lt 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.

Comment:

As reiterated several times (see the introduction), both the team responsible for intervening on the construction, on the structures and on the roofing system and the team working on the conservation-restoration of the pictorial cycle, were aware, right away, of the need to move on a double track: on the one hand they are committed to finding quick solutions for a situation of complete emergency (both constructive and decorative), on the other hand they are obliged to get a general picture of vulnerabilities and consequent priorities, and specificities, in the scale of interventions. This second aspect has always been at the center of our concerns even if its management has clashed with a chronic lack of basic information on the history of the multiple interventions on the monument (undertaken before 2021) which has made it difficult to decipher some phases of its transformations.
It should be emphasized, however, that the same pervasive commitment spent to resolve emergency situations, in fact prepares, in terms of knowledge and method, the ground for the strategies to be adopted to address the safety of the remaining parts of the Monastery and to understand its different criticalities in the long-term perspective.

IAB Report:

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 headroom 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*

Comment:
These considerations are undoubtedly laden with common sense. It is not clear whether they refer to only to the West Arm or to the entire church (consisting of 36 pitches with the exception of the dome). In reality, the entire West Arm has been uncovered for some time with the construction of a temporary cover capable of allowing evaporation but at the same time preventing the entry of water, a very delicate operation from many points of view, involving the choice of a new light structure, in the adoption of materials and binders compatible with the old masonry but with good mechanical resistance, in the control of loads and resistances. At the same time, efforts were made to design a system of new roofs capable of guaranteeing conditions of impermeability and transpiration suitable for the conservation of the monastery and its precious paintings. The strategy in place wants to make the West Arm a sort of pilot experience that is a forerunner to then measure itself with the involvement of all the roofs of the monument.
In this sense, a monitoring plan on the West Arm has already been prepared, by Dr Arch Massari to monitor the drying process of the South wall and acquiring the humidity values after about four months from the opening of the roof.
As for a vision that takes into account the situation that has arisen to date and how we must face its evolution over time to include long-term management, we invite you to refer to the synthetic document in Appendix A entitled "A path for a hygrometric rehabilitation of Gelati with particular reference to the vault of the West Arm of the Church of the Nativity of the Virgin)".

IAB Report:
- *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*

Comment:
The team of conservator-restorers experts is in fact already oriented in the suggested direction, sharing the basic principle. However, it will also be necessary to take into account all the factors and all the variables that may occur (described in detail in the responses to the observations contained in the IAB report).

In this sense, for example, the problem of water supply in the deep consolidation of the plaster is being studied to minimize the problem of water migration, which moves any salts or other water-soluble materials. The measures that can be adopted in this regard are:

- Pre-wet with injections of alcohol or a water/alcohol mixture, and not with water alone.
- Reduce the amount of water in the mortar. To make such a possibility feasible, the use of a premixed mortar of the PLM series (PLM-A) to which ethyl alcohol and not water can be added is being considered. Of course, the addition of ethyl alcohol alone is ineffective: a certain amount of water is always required for the hydraulic binders to perform their setting reaction correctly.

The optimal water/alcohol ratio has been established to be 25% water and 75% alcohol, with the addition of 40% of fine silica sand. With this formulation, a mortar is obtained that does not significantly vary the setting times, the fluidity and consequently the injectability, but reduces the absorption of capillary water while maintaining the same good resistance to the diffusion of water vapour obtainable with only water or with the hydroalcoholic solution.
Also with regard to the consolidation of the paint film, as we have seen, we are moving towards the use of substances that are certainly less water-carrying and not of an acrylic nature, such as polyvinyl alcohol.

Of course, a graphic and photographic campaign and a mapping of all degradations and conservation-restoration interventions have been underway.

IAB Report:

- *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*

Comment:
The teams involved in the responsibility for the conservation and restoration of the Gelati Monastery by the Minister of Culture - National Agency for Cultural Heritage Preservation of Georgia, composed of architects, engineers, expert conservator-restorers, chemists expert in historical heritage, expert of hygrometric control, expert of theory of restoration and aesthetic restitution of wall paintings, in close connection with the best analysis laboratories of the universities Italians and the CNR, have always proceeded in total coordination, evaluating that the constructive and architectural aspects, the microclimatic ones and those relating to the protection of the paintings are totally interconnected.
We have repeatedly expressed an interest (the need) to receive information and contributions from historians and experts about the life and transformations undergone by the Monument.

III. Last remarks, conclusions and perspectives

1. As regards the crucial issues raised by the IAB report and inherent to the procedures adopted for the conservation of the paintings, we can summarize our position as follows:
   Ultimately, we wanted to highlight that in the evaluation of the methodologies applied up to now, while respecting and understanding the perplexities expressed about the use of acrylic resin or the removal of salts, one cannot ignore the dramatic state of conservation of the paintings, never found elsewhere, which to be fully understood requires careful study and very long on-site observation.

In this sense, we feel we can share the spirit of approval and encouragement present in the ICOMOS report of February 2022 on what up to then had been implemented and reported by the team of Italian restorers[3]. ICOMOS report fully understand the essential problem of the paintings of Gelati and the approach with which it was faced.
We sincerely believe that if we had not taken note of the terrible state of emergency in which the paintings poured, balancing the aspects of general theoretical study, with the need for a reasoned "prompt intervention", we would probably have compromised huge portions of colour and plaster.
We, therefore, believe that a technical-scientific comparison on this level, to which we remain completely open, can certainly be constructive and we hope it will continue in the direction of an effective collaboration aimed at the development in the future of the best methodologies for the conservation of the Monastery of Gelati.

2. A decisive question regarding the conservation-restoration process of the mural paintings concerns the understanding and management of the issue related to hygrometric rehabilitation. This goes hand in hand with the replacement of the roof covering of the monumental complex and requires a long-term vision. We believe it is necessary, and important to share with the Ministry, the Agency and the Patriarchate, to dedicate to this aspect a separated short section of this document. This new contribution is reported, as already mentioned, in Appendix A "A path for a hygrometric rehabilitation of Gelati".

3. As for the general framework in which the work of the different teams fits, we need to tackle a crucial question.
   If we want the guarantee the maximum protection of the monument, there is no doubt that the work of those responsible for the intervention must be constantly reported and monitored. Every observation, as long as it is free from conflicts of interest, plays a useful role. This is why we have taken as a first reference the Ministry of Culture and the National Agency for Cultural Heritage Preservation of Georgia through which to inform directly the WHC and its Committees on what (and how) we were doing for Gelati safeguarding. We sincerely rely on the ICOMOS technical review promoted by WHC, which is responsible for the Gelati Monastery protection. We are working on an architecture belonging to World Heritage and we have the duty to respond to the requests and evaluations of WHC.
   We think it useful, for the sharing of knowledge, to complete the documentation cited at the end of the IAB report (and actually lacking in numerous testimonies), by an Appendix (B) with the list of the reports and the documents that accompanied our work until now.
   Gelati Monastery is crucial as it has an identity meaning for Georgian country, but it belongs to humankind too. It would be good to follow normal and accepted procedures of evaluation in order to guarantee the maximum sharing of our decisions. We must not forget that there is a request from the WHC to carry out a mission (by invitation) in Gelati, at the earliest convenience, to check the progress of the conservation-restoration works on the Monastery. This could represent an opportunity to take stock of the situation and to prepare our next steps in agreement with the Patriarchate and Georgian Institutions who are in charge of this wonderful monument.

[3] In the last WHC report on "*The state of conservation of the mural paintings of Gelati Monastery*" (Charenton-le-Pont, February 2022) the reviewers "*agrees with the recommendations developed by the conservation team*" and (…) "*suggest that the conservation group be encouraged to proceed, following, in the first place, the positive conclusions of the first cleaning and fixing tests*". Of course, many recommendations have been suggested and we have the task to follow their indications.

Appendix A

“A path for a hygrometric rehabilitation of Gelati (with particular reference to the vault of the West Arm of the Church of the Nativity of the Virgin) "

As anticipated in the previously sent reports, the "recent" (from March 2020) very serious deterioration of the paintings of the South Side of the West Vault of the Church of the Nativity of the Virgin are certainly a consequence of the abundant infiltrations that have affected the roofing structures of the church after the re-roofing with glazed tiles (until the temporary metal sheet roofing was made). It is, however, worth mentioning how the conservative state of the paintings of the vault of the West Arm and of the church as a whole is the result of vicissitudes, infiltrations, failures, restorations, etc. that have occurred over more than 8 centuries of the building's "life." In practice, the latest infiltrations have acted on a material that is inherently fragile and locally already deteriorated.

Regardless of past events, it is now essential to act in the best possible way to cope with the phenomena of infiltrations from roofs and their effects (in the short, medium and long term) on the interior decorative apparatus precisely because of the intrinsic weaknesses of plasters and pictorial layers. The main difficulty is being able to find a balance between the need to intervene promptly to cope with an unexpected, sudden and certainly traumatic event (infiltrations) and the due caution that must characterize any restoration intervention.

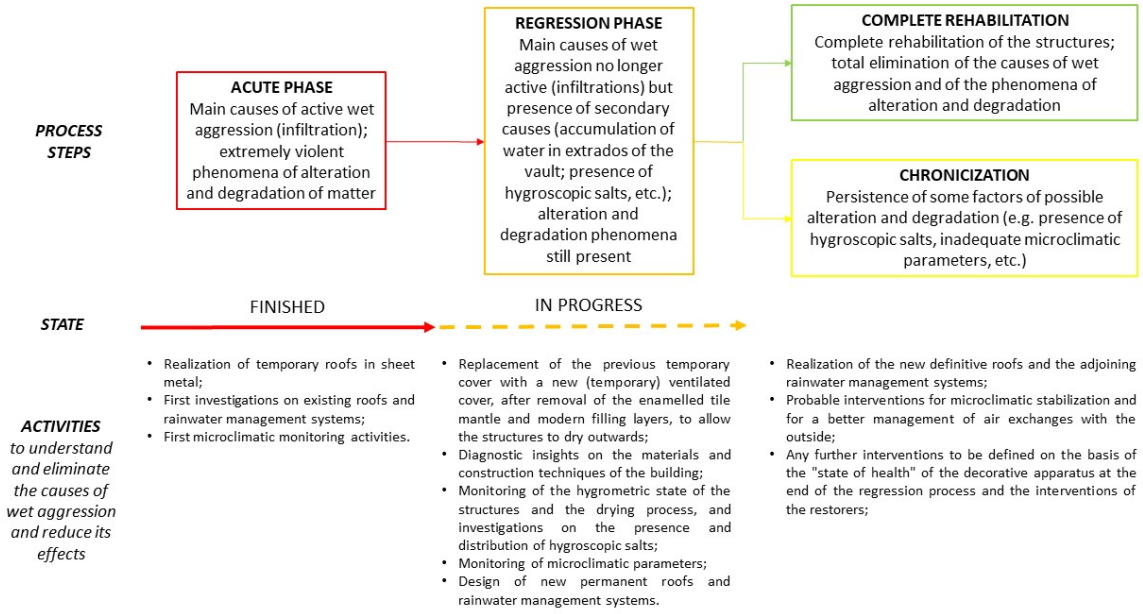
In the area of infiltration elimination, hygrometric rehabilitation of structures and control of microclimatic parameters much has been done to try to reduce damage in the short and medium term, and more will have to be done to cope with degradation phenomena that could persist in the long term. As is well known, in fact, water and moisture are capable of triggering degradation phenomena in very different ways and at very different times: some damage is manifested quickly and evidently (such as those caused by copious infiltration), while others may manifest over time, slowly but with equally devastating results (such as, for example, those caused by crystallization/deliquescence cycles of hygroscopic salts).

Borrowing terminology from medical jargon, we could distinguish deterioration processes into "acute" (i.e., fast-moving, with extremely severe effects) and "chronic" (characterized by prolonged and progressive deterioration of matter).

In the specific case of the west vault of the Church of the Virgin, the deteriorating action of water and moisture should not be seen and addressed as a unique and constant action over a given period of time but as a continuously evolving process, characterized by an initial phase of "acute" deterioration (i.e., very noticeable and traumatic) with structures abundantly wet due to copious infiltration followed by a phase of "regression" of the main degradation factors, which may lead either to the complete repair of the structures (a hypothesis, unfortunately, rather remote in this specific case), or to the onset of a phase of degradation, so to speak, "chronicized" (i.e., destined to last over time) due mainly to the action of hygroscopic salts and microclimatic factors, even though the structures are mostly dry.

Each phase of this process must be addressed with the tools deemed most appropriate based on the knowledge currently available (unfortunately scarce in the initial emergency phase, obligatorily greater in subsequent phases), remembering also that the boundaries between the different phases are often blurred and almost never clearly identifiable.

Referring back to the reports already mentioned for a more detailed description of the state of affairs and suggested interventions, the following is an outline of the phases and critical issues that have characterized and will characterize this long process and the main corrective activities that have already been implemented or are likely to be implemented in the coming months.



With regard to the temporal duration of the individual phases, we can now consider finished the "acute" phase, characterized by the direct action of the water of the seepage coming from the roof, which today has been completely eliminated (although with temporary structures). We are therefore in the "regression" phase of the degradation process where, even in the absence of new infiltrations, phenomena of alteration and degradation of the material are still active, fed by the residual moisture present in the structures and, above all, by the very abundant hygroscopic salts present on the surface and in-depth. On the duration of this regression phase, it is difficult to make predictions. Certainly, the construction of the new ventilated roof and the removal of the glazed tile roofing and modern (wet) materials in the extrados has greatly facilitated the drying of the structures to the outside while also favoring the migration of hygroscopic salts to the extrados of the vault (thus moving them away from the paintings); also taking into account seasonal climatic conditions, the drying out is assumed to be significant. Once again, it is important to emphasize the importance of the fact that the evaporation process takes place outwards (extrados of the vault) and not through the internal surfaces, particularly if decorated; this fact is certainly favored by the internal relative humidity (RH) values, which are generally high, especially in the spring-summer period, thus reducing the possibility of evaporation of the surfaces.

The attainment of "physiological" (i.e., acceptable) moisture values even in the southern part of the vault (i.e., in the area most afflicted by infiltration) can, however, only be verified with in situ instrumental measurements and possible laboratory analyses (verification of water content by weight method) as already indicated in previous reports (a first verification of the drying process of the structures was initially scheduled about four months after the ventilated roof was put in place). In the meantime, it will be up to the conservators/restorers to act in the ways and with the techniques they deem most appropriate to manage this delicate transitional period and to avoid further loss of matter after that which occurred in the "acute" degradation phase.

Leaving aside the unavoidable works of re-roofing and stormwater management systems, the interventions that will have to ensure the long-term preservation of the decorative apparatus will be determined, to a large extent, by the state of health of the paintings at the end of the "regressive phase" and at the completion of the conservative restoration operations. The current situation, for example, portends the need for microclimatic stabilization to cope with possible degradation phenomena due to hygroscopicity and/or surface condensation, however, the level of stabilization that will have to be guaranteed can only be determined by knowing the nature, concentration and distribution of

hygroscopic salts still present at the end of the process of hygrometric rehabilitation of the structures and conservative restoration of the decorative apparatus.
It is also evident that interventions for the long-term conservation of the paintings on the vaulting of the West Arm of the Church will have to take into account the overall situation of the Church, which will therefore have to be studied as a whole and for which an organic long-term restoration and conservation project will have to be drawn up.

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Appendix B

Available documentation submitted on Gelati Project, in chronological order until now

Associazione Giovanni Secco Suardo, Marco Pulieri and Vincenzo Centanni, "*Report on the state of conservation of the Gelati Monastery World Heritage Property, Georgia,* Mission of 22 – 28 June 2021", 1 July 2021;

ReStruere, Ugo Tonietti and Sara Stefanini, *"Report on the mission and preliminary suggestion 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 by Ugo Tonietti and Sara Stefanini, from June 25th until June 29th 2021", 30 July 2021;

Associazione Giovanni Secco Suardo, Davide Melica, Federica Antonelli "*Gelati Monastery (Georgia) Church of the Nativity of the Holy Virgin (1106 Ad) - Scientific Investigation on the mural paintings*", 19 July 2021

Associazione Giovanni Secco Suardo, Vincenzo Centanni "*Monastery of Gelati- Church of the Nativity of the Virgin - Mission of emergency conservation intervention of the Frescoes - Settembre 16/21*", 20 October 2021

Associazione Giovanni Secco Suardo, Marco Pulieri "*Report on the state of conservation of the Gelati Monastery World Heritage Property, Georgia - Mission of 05-12 November 2021*", 6 December 2021

ReStruere, Ugo Tonietti e Sara Stefanini, "*Phase 1 - Developing of knowledge for diagnostic purposes - Tests on material samples taken on-site, Scientific report explaining the results of the tests*", 23 December 2021;

Associazione Giovanni Secco Suardo, Alessandro Massari, "*Investigations on the structural hygrometric and micro environmental state aimed at safeguarding the internal wall paintings, Mission Arch. Alessandro Massari of: 06 12 November 2021*", Report and Technical Sheets, December 2021

Georgian Expert Team, Tariel Kiparoidze and Lasha Shartava, "Technical report with photo and graphic documentation regarding the new sondages", 31 January 2022;

Georgian Expert Team, "*Information on Roofing Materials of Gelati Monastery Buildings Based on Gelati Monastery is crucial as it has an identity meaning for Georgian country, but it belongs to humankind too. Archeological Artefacts and Historical Sources*", provided by Roland Isakadze, 15 February 2022;

Georgian Expert Team, "Historian Documentation of Coeval Covering Systems", written by Art Historian Giorgi Gagoshidze in 2008 and translated in english by Lasha Shartava in January 2022;

Associazione Giovanni Secco Suardo, Marco Pulieri "*Conservation-restoration campaign of the vault and walls of the West Arm of the Church of the Nativity of the Holy Virgin Gelati Monastery*" 3 June 2022

Associazione Giovanni Secco Suardo, Studio Massari, "*Safeguarding and conservation of Gelati Monastery World Heritage Property, Georgia Church of the Virgin - West Arm of the Main Church of the World Heritage site – Gelati Monastery Examination of hygrometric state of the structures - Mission Arch. Alessandro Massari of 28/05 – 01/06 2022*", June 2022

ReStruere, Ugo Tonietti and Sara Stefanini, "*Deliverable 1.5 - Executive summary of Phase 1 activities and reports*", 8 June 2022;

ReStruere, Ugo Tonietti and Sara Stefanini, "*Executive Summary on the mission carried out in Kutaisi (Georgia) at Gelati Monastery from May 25th until May 31st 2022*", 9 June 2022;

Associazione Giovanni Secco Suardo, Alessandro Massari, "*West Arm of the Main Church of the World Heritage site – Gelati Monastery, Examination of hygrometric state of the structures, Mission Arch. Alessandro Massari of 28/05 – 01/06 2022*", Report and Technical Sheets, June 2022;

Associazione Giovanni Secco Suardo, Alessandro Massari, "*Church of St George, Preliminary investigations on the structural hygrometric, Missions Arch. Alessandro Massari of 06 – 12/11/2021 and 28/06 – 01/07/2022*", Report and Technical Sheet, June 2022;

ReStruere, Ugo Tonietti and Sara Stefanini, "*Deliverable 2 - Findings of the analysis: keynotes based on the results of the studies conducted by RS and GET*", 29 July 2022.