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The Importance of Interconnection Between Different Disciplines in the Restoration Process

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The importance of interconnection between different disciplines in the restoration process

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ABSTRACT
The present paper describes a series of restoration theories, which can be applied to the ensemble from Banloc, which would lead to the economic renewal as well as the cultural one. The complex of Banloc includes five buildings: the manor, the kitchen, the stall, the hunting pavilion and the house of the housekeeper. The focus aims the hunting pavilion, which is an octagonal construction, having two floors with late baroque influences, built around 1850's. The article describes studies and microbiologic and composition lab analyzes of materials taken from the scene, which demonstrate through multiple information the correct decision of restoration and also with the aim to demonstrate the importance of the connection between many subjects and for the correct approach of the restoration solutions.

Keywords: restoration, architecture, historical monument, research, analysis, fungi, diffraction, wavelength dispersion, knowledge, intervention

1 INTRODUCTION

To want and to know how to "classify" monuments is one thing. To know how to preserve and how to restore them is another thing, based on vast knowledge. Specific practice, specialized practitioners and architectures of historic monuments are required [1]. The acknowledgement of the object as a work of art is a milestone which predates the becoming of the object a historic monument.

The ensemble of Banloc is mentioned in the List of historic Monuments of the county Timiș on the 154th position with the code TM-II-a-A-06177.01 and on the 156th position is situated the park with the code TM-II-a-A-06177.02.

The purpose of restoration is the maintenance of the monuments as a work of art and as a historic witness [2]. The four apprentices of restoration: Viollet Le Duc, Ruskin, Camillo Boito şi Alois Riegl stay at the base of the demarche and influence ubiquitous and perpetual understanding, examination, inventory and emphasize of the concept of the historic monument, the recognition of it as a work of art, the regulation of the restoration intervention, the conservation, the maintenance and the monitoring of it.

The restoration denotes to the architecture project applied to an existent edifice, which needs to accomplish every necessary operation in order to preserve the material, to reduce and eliminate all the intrinsic and extrinsic factors that are at the base of the material degradation to respond to the new functional needs through minimal indispensable modifications in order to offer a new function, using a preventive study and the project of intervention as a necessary instrument for acquaintance.

2 BANLOC

The piece of work from Banloc needs to be seen concordant with art.1 from the Venice Charter 1964 [3], not as an isolated architectural piece but as a whole context, in relation with the park, in the whole rural context, in which the complex attestation of a significant development and of historic events from the period in which the manor was owned by the Karatsonyi family, by the princess Elisabeth of Romania, the queen of Greece can be found. The conservation of the monument would be facilitated by the allocation of social usage (art.5) through a series of activities which would animate the place, would implicate people from there and most important, would bring financial resources. The monument is inseparable from its history and from the site it is located in (art.7). The relation with the park from the castle domain needs to be maintained and the ensemble needs to be viewed as a whole from an esthetic and historic view as well as regarding the activities which will take place there, in order to achieve a narrative and visual coherence. The purpose of the restoration is to rebuild the esthetic and historic value of the monument and it is based on authentic documents (art.9). The restoration stops where the hypothesis begins, in this case any intervention that becomes indispensable needs to be distinguished from the architectural composition and it will have the cachet of contemporaneity. The addition of new buildings on the park domain, in order to complete the set of needs of the ensemble, will be in a modern manner and it won't try to copy the castle or the hunting pavilion. The unity of style is not the main purpose of the restoration (art.11).

If we replace or add missing parts, these need to be integrated with the whole, but in the same time they need to be distinguished from the original, meaning the restoration should not falsify the historical evidence (art.12). The whole process needs to be executed meticulously in order to maintain the integrity and purity of the subject (art.14).

The addition of enclosed parts with a static function will be delineated and differential materials will be adopted, even though assorted, discernible with the free eye (art.7. Point 1).

At Banloc it will be an approach through restoration (intervention), not a safeguard (art.4 Restoration Charter 1972 [4]), due to the degradation status of the whole ensemble. Buildings as the manner, the stable, the hunting pavilion and the house of the housekeeper will be renewed through anastylosis, the Banloc castle, together with the park and the whole domain, certifying the presence of objects of interest, planimetric speaking, are under the incidence of art.1 and 2 (Restoration Charter 1972).

In essence, there will be a reinterpretation at Banloc, not an identical restoration.

The present paper describes a series of restoration theories, which can be applied to the ensemble from Banloc, which would lead to the economical renewal as well as the cultural one. The complex of Banloc includes five buildings: the manor, the kitchen, the stall, the hunting pavilion and the house of the housekeeper. The focus aims the hunting pavilion, which is an octagonal construction, having two floors with late baroque influences, built around 1850's. The article describes studies and microbiologic and composition lab analyzes of materials taken from the scene, which demonstrate through multiple information the correct decision of restoration and also with the aim to demonstrate the importance of the connection between many subjects and for the correct approach of the restoration solutions.

3 MICROBIOLOGICAL ANALYSIS

The samples coming from different structures have been obtained through sterile scratching of diverse surfaces of the wall from different areas from the hunting pavilion. The resulted material has been placed in sterile containers and then processed in the lab.

The samples were used for the determination of fungi, the total number of fungi to be more specific, (TNF) for one gram of sample (ufc/g).

Furthermore, the identification of type and/or of species of fungi from each sample has been made.

For the identification of fungi from each gram of sample, the method of decimal dilution was used, and it was processed on Petri slides, which were introduced into incubation at 25 ºC for 2-3 days.

Finally, the colonies raised on each plate were counted and the TNF (total number of fungi) / gram sample was calculated.

$TNF = \sum n \times d / N$

where:

n - the number of colonies on the plate;

d - dilution;

N number of plates s read for a sample.

The result of expressing in unit-forming colonies (ufc)/ gram sample.

The examination of colonies has been made macroscopic and microscopic, beginning with the 3rd day. Regarding the macroscopic topic, the aspect and the structure of the colony have been made, as well as the aspect of the margins of the colony, the colour of the obverse and reverse and the pigment presence diffused in the environment. For the microscopic part, the following structures were analyzed: hyphae and the gear of characteristic structures. For doing this, from each isolate colony, microscopic mixture was made between slides, using solution with aniline blue for the colouring of the samples. Each slide was examined with two magnification objects, 10x and 40x.

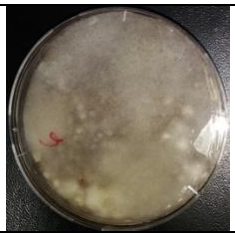
3.1Surface samples

The results of the fungi samples from coping and facing can be found in table 1.

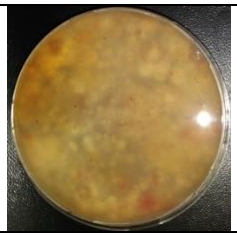
The predominant species are from type Penicillium Aspergillus, Trichphyton Dermatophit being well known for having allergen potential, which can be involved in the generation of direct patologic processes.

Table 1. Microbiological results for the investigated samples

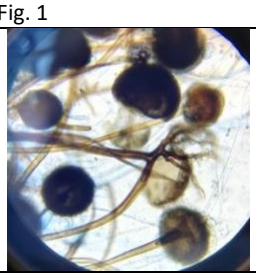
Nr. sample/location	Nr colonies on slide x 10^2	Total fungi/g (ufc/g)	Nr. colonies from each category/ description	Frequencty (%)
Samples of layers from the wall from the hunting pavilion -column Fig 1	60 colonies/slide	6000	2 downy colonies wolly with aerial mycellium blackish- *Rhizopus* Fig 1 a	3,33
			5 velvety colonies pink- orange with reverse orange– *Fusarium* Fig 1 b	8,33
			53 – velvety colonies, green and not pigmented on reverse–*Penicillium* Fig 1 c	88,33
Sample coping Sample pavilion Fig 2	150 / slide	15000	150 little colonies, white, downy, not pgmented on reverse, dermatophit Fig 2 a	100



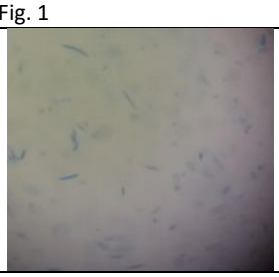
Coping sample - hunting pavilion, column
Slide with fungi colonies
Avers
Fig. 1



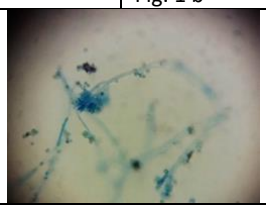
Coping sample - hunting pavilion, column
Slide with fungi colonies
Reverse
Fig. 1



Rhizopus
Fig. 1 a

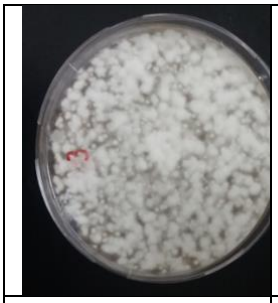


Fusarium
Fig. 1 b

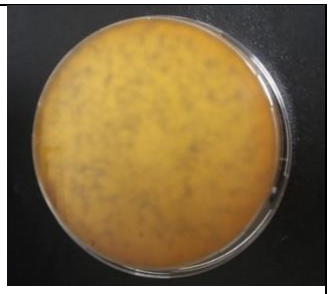


Penicillium Fig. 1 c

Fig.1 Microscopical results for sample 1

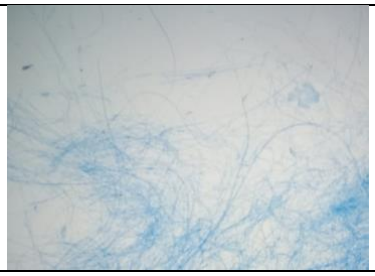


Coping sample hunting pavilion
Slide with fungi colonies
Avers
Fig. 2



Coping sample hunting pavilion
Slide with fungi colonies
Reverse
Fig. 2

In this last sample the dermatophytes draw attention, they are microscopic fungi and have a resemblance for cutaneous tissue and skin blemishes at people and animals, producing pathologic characteristic processes, called dermatophitoses.



-Dermatophit
Fig. 2 a

Fig.2 Microscopical results for sample

There are white colonies, with velvety-downy aspect, slightly pigmented in cream on reverse. From a microscopic point of view, hyaline hyphae can be observed, which have oval to round microconidia. Macronodia are missing. The microscopic aspect leads to the Tricophyton equinum species. Tricophyton equinum is a zoophile species which affects the human being and can be observed at horses, donkeys and rarely at dogs.

The sample is unique through the development of pure culture from the first insemination, which means that the presence of this fungus is predominant in the sample. Usually from a sample that contains also another species of fungi, and they are either in expressed in different colonies or grow invasive, in comparison with the dermatophyte species. The dermatophyte species (included in type Microsporum, Trichphyton and Epidermophyton) have a slower growth rate than the species from the environment (ground, air and surfaces).

The collected sample originates from an environment where the spore concentration of Trichophyton is especially big. The species represent a pathologic risk.

4 ANALYSIS OF MATERIAL COMPOSITION

4.1Equipments:

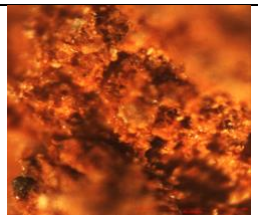
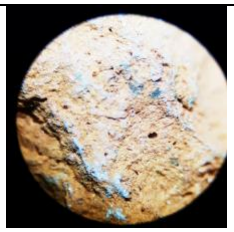
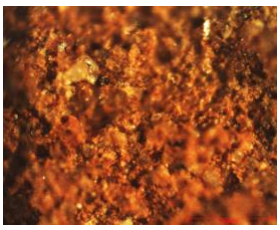
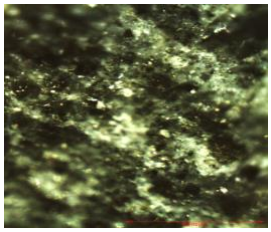
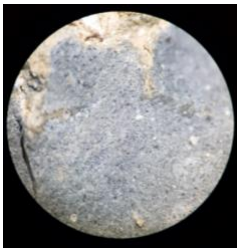
Powder X-ray diffraction (XRD) patterns of all materials were recorded on a Rigaku X-ray Ultima IV diffractometer with wavelength of Cu-Kα radiation (λ =0.15406 nm) and detector of NaI, operating at 40 kV and 30 mA. XRD patterns were recorded over the 5-80° 2θ angular range at a scanning rate of 2° min^{-1}. A PDXL 2.2. (processing)

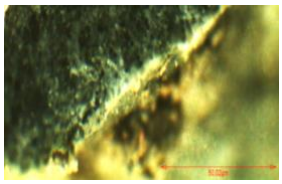
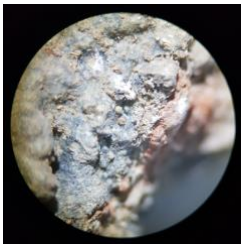
software has been used for data processing.
Wavelength dispersive X-ray fluorescence (WDXRF) spectroscopy have been recorded on a Rigaku ZSX Primus II spectrometer equipped with an X-ray tube with Rh anode, 4.0 kW power, with front Be window (30 μm thickness). The measurements were carried out on pressed pellets under vacuum atmosphere. The XRF results were analyses using EZ-scan combined with Rigaku SQX fundamental parameters software (standard less) which is capable of automatically correcting all matrix effects, including line overlaps.
For microscopic analysis, the optical microscopy (Novex, with transmitted light and magnification 4X - 100X) and Stereo zoom microscope OZL with magnification from 7.5X–36X.

Most of the collected samples had different voids or gaps, cracks and scratches on the surfaces, and internal degradation tracks that need to be investigated.

Microscopic analysis
The photos, optical and zoom stereo microscopy images and a short description of the studied samples are presented in Table 2. The first two samples have a red color, similar with bricks, with thin venous of impurities (blue colored), while the last one is completely different with two faces, a black-green coating and with red- ochre lines on the reverse face, as it is shown in Table 2.

Table 2. The photos, optical and zoom stereo microscopy images of the studied samples

Nr.crt.	Sample photo	Optical microscopy	Zoom stereo microscopy
1 Brick groundwork hunting Pavilion (Nordic corner)			
		OM 10x	7X
2 Brick elevation hunting Pavilion (Nordic corner)			
		OM 10x	7X
3 (frontal face) sealing mortar between groundwork and elevation hunting Pavilion (Nordic corner)			
		OM 10x	7x

3(reverse face) sealing mortar between groundwork and elevation hunting Pavilion (Nordic corner)			
		OM 10x	7x

4.2 Wavelength Dispersion X-ray Fluorescence (WDXRF)

The average mineral compositions of the sample fragments obtained from XRF analysis are presented in Table 3. The mineralogical compositions of the studied fragments are mainly representative of carbonaceous stones with a high content of calcium and consist of small particles with different compositions of Al, Na, K, Si, Ti, Fe and Ca elements.

Table 3. Mineral composition of the fragments determined by WDXRF, expressed in mass% ± S.D.%, normalized to 100%

Sample 1		**Sample 2**	**Sample 3**
oxide	**mass%**		
CO_2	2.6859 ± 1.09833	1.6727 ± 1.07521	6.4874 ± 0.84142
Na_2O	1.4439 ± 0.05482	1.3739 ± 0.04678	0.0328 ± 0.05031
MgO	1.644 ± 0.04701	1.9921 ± 0.04392	1.5941 ± 0.03971
Al_2O_3	17.8246 ± 0.04429	17.8882 ± 0.04336	5.1023 ± 0.02688
SiO_2	61.7194 ± 0.09468	63.2597 ± 0.08805	22.4891 ± 0.04985
P_2O_5	0.1641 ± 0.0116	0.2721 ± 0.00825	0.0422 ± 0.00797
SO_3	0.0506 ± 0.0099	0.0265 ± 0.0114	3.5787 ± 0.01284
K_2O	3.3206 ± 0.0198	2.9289 ± 0.01427	0.1237 ± 0.00852
CaO	1.3525 ± 0.01467	1.5841 ± 0.01157	56.0879 ± 0.04199
TiO_2	1.4847 ± 0.03795	1.2684 ± 0.03983	0.4135 ± 0.08268
MnO	0.1323 ± 0.01378	0.123 ± 0.01807	0.2115 ± 0.01562
Fe_2O_3	7.9927 ± 0.11308	7.4788 ± 0.01325	3.6953 ± 0.03141
NiO	0.0242 ± 0.00861	0.0201 ± 0.00845	
ZnO	0.0359 ± 0.00688	0.0195 ± 0.00759	0.0467 ± 0.01146
Rb_2O	0.0232 ± 0.00529	0.0153 ± 0.00457	
SrO	0.0303 ± 0.00519	0.0268 ± 0.00469	0.078 ± 0.00637
ZrO_2	0.0712 ± 0.02885	0.0498 ± 0.02548	0.0169 ± 0.00821

The proportions of these elements, together with the aggregates of clays, quartz, Ca-carbonates, and sulfates were present in the studied fragments. As can be seen from Table 2, the samples mainly consist of silicates with a dominant amount of SiO_2 phase (samples 1, 2) and CaO (sample 3). The minor phases are K_2O, MgO and P_2O_5. Besides the oxides of Si, Al, Ca, K and Na, we believe that the minor phases were added as a coloration matter or as a flux of admixed material. A high concentration of Fe is observed, too, most probably due to the ashes materials from old metallurgical factory from Resita. In any case, this sample is a magnetic one, easily observed with a simple magnet. So, we can conclude that Fe is present here as Fe_2O_3 and Fe_3O_4, the last one being responsible for the magnetic properties.

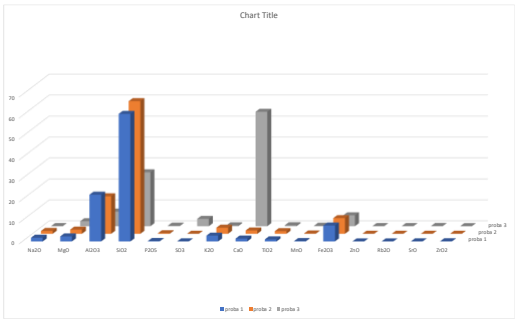


Fig.3. Wavelength Dispersion X-ray Fluorescence (WDXRF) of samples 1, 2 and 3

4.3 The X-ray diffraction

The results obtained from the investigated fragments gives specific diffraction patterns. The occurrence of some amorphous phases as well as crystalline minerals was observed. In the first two samples, the dominant phases are quartz (46-48%) and calcite derivatives (28%). Also, clays like iron-contained aluminosilicates and

minor concentration of Zn, Ni or Mn compounds are identified. The sample 3 is quite different by comparison with the others, being very rich in calcite and with many amourphous phases. Similar results have been reported in the literature for similar artefacts located in the different region - south-west region [5,6] and south-estern [7]. The iron oxides like hematite, magnetite and clays like iron-contained aluminosilicates were also detected.

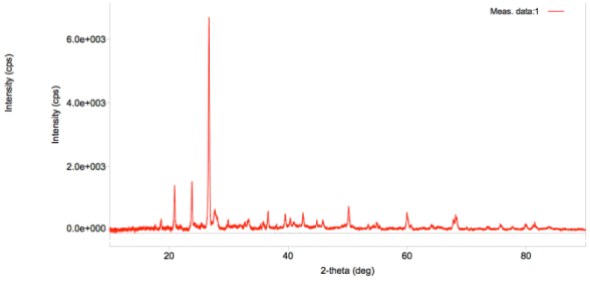


Fig.4.The X-ray diffraction for samples 1

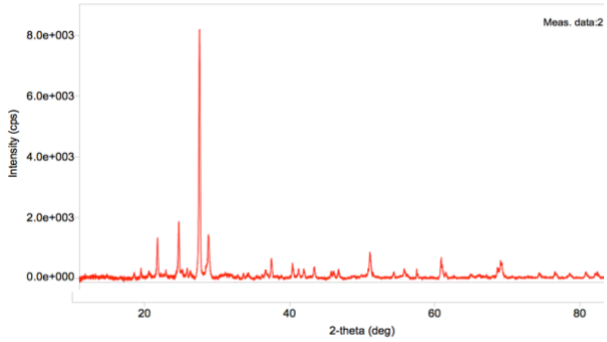


Fig.5.The X-ray diffraction for samples 2

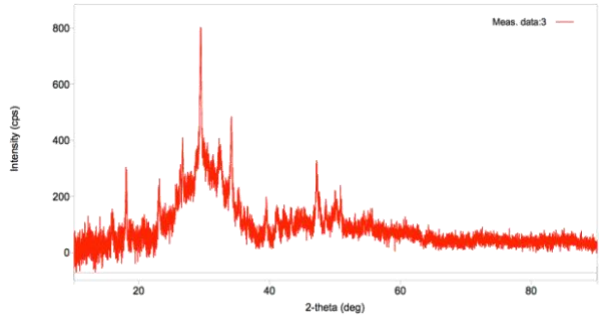


Fig.6.The X-ray diffraction for samples 3

From the X-ray diffractograms, could be identified the most important pollutants Banat region. Recent studies occasionally revealed significant heavy metals levels in air, soil, water, and vegetation in Timisoara and the neighboring areas [8]. Copper (Cu), zinc (Zn), cadmium (Cd), and lead (Pb) were chosen because they are among the most common heavy metals which can pollute the environment, especially in areas with high anthropogenic pressure. Also, in area where the extraction and processing of ferous and non-ferous ore took place, different concentration of amonia, copper, Pb, S, Cu, As, Zn, Mn, F, Cl, feldspat, and Si, or radioactive ore, H2S, Cr(III), Cr(VI), cianide, or metallic powder, could be identified [9]. The X-ray diffraction data presented in this paper supported these data. Most probably, the Sample 1 contains sludge collected from Resita factory, where the heavy metals and other pollutants (as was above-mentioned) have been released. Sample 2 is the purest sample, contain only four minerals, while Sample 3 is completely different by comparison with the others, and very different: rich in heavy metals, magnetic minerals, radioactive waste (most probably from Resita sludge area, also used as building raw materials).

Sample 1

Phase name	Content (%)	Formula
Quartz	46(3)	SiO_2
berlinite HP, syn, berlinite, syn	0(4)	$Al(PO_4)$
Galuskinite	4.8(4)	$Ca_7(SiO_4)_3\ CO_3\ (H_2O)_{0.11}$
Magnesium Hydride	18.2(14)	MgH_2
lithium silicide	13.3(9)	$Li_{2.24}Si$
Lithium Phosphorus Sulfide	10.4(19)	$Li_7P_3S_{11}$
Zangboite	3(5)	$TiFeSi_2$
Silicon Sulfide	2.1(3)	SiS_2
Aluminum Calcium Zinc	1.66(18)	$CaZn_{0.5}Al_{3.5}$

Sample 2

Phase name	Content (%)	Formula
Quartz, syn	48.7(9)	SiO_2
Albite, calcian	28.7(10)	$Na_{0.499}Ca_{0.491}(Al_{1.488}Si_{2.506}O_8)$
Anorthite, sodian	3.0(13)	$(Ca_{0.68}Na_{0.32})\ (Al_{1.68}Si_{0.32})Si_2O_8$
Sodalite	19.6(5)	$(Na_{7.7}(MnO_4)_{1.7}\ (H_2O)_{0.8})\ (AlSiO_4)_6$

Sample 3

Phase name	Content (%)	Formula
calcite	13.4(15)	$Ca(CO_3)$
dilithium manganese chloride	0.3(4)	Li_2MnCl_4
Magnesium Strontium	26(2)	Sr_2Mg_{17}
Silicon Sulfide	5.8(7)	SiS_2
Zinc Sulfide	6.1(19)	ZnS
magnesium iron tetrathiosilicate	22(3)	$Mg_{1.86}Fe_{0.14}SiS_4$
Aluminum Silicon Strontium	1.9(5)	$Sr_8Al_{10.32}Si_{35.62}$
Ferrosilicide	1(3)	$Fe_{3.921}Si_{1.079}$
Murashkoite	1.1(14)	FeP
Wurtzite-15R	15.7(14)	ZnS
Hematite	3.7	Fe_2O_3
Magnetite	3	Fe_3O_4

5 CONCLUSIONS

The project of intervention means historic research, the achievement of all topographic mapping and the analysis of its conservation stage, and degradation respectively.

In conclusion, the two types of brick (from the base and from the elevation sample 1 and 2) are not identical, having different composition and the mortar used as a binding agent between these has strong ferromagnetic properties, which give the composition very good hydrophilic properties

From the microbiological and composition studies and analyses of materials from the hunting pavilion, data has been found, that is very important for the direction that the restoration of the studied object will follow. The treatment of the surfaces (from coping to finish surfaces) will include strong antifungic solutions (or the existent ones will be entirely eliminated), and they will be hydraulic chalk based. The study results the important interconnection of many disciplines in the restoration process. Restoration does not only mean architecture projection; it includes the understanding of the built space, with everything around it, through historic study, multiple analysis, from archaeology to chemistry and biology, from the degradation studies with correct diagnosis, to the emission of a critical hypothesis leading in the end to the correct delineation of the restoration.

The importance of the microbiological study and of chemical composition are highlighted in the paper, which can change the direction of the restoration to the correct solution.

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