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Glass dry plates of Sopoćani: Analysis of the images as the research basis and the preservation of wall paintings

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Abstract. This paper deals with the preservation and scientific application of glass dry plates as cultural properties, showing the effectiveness of image comparison as an instructive part of the research basis of heritage studies.

Wall paintings of the Sopoćani Monastery (founded in the second half of the 13th century) are recorded as glass dry plates, which have been deposited at the Institute for the Protection of Historical Monuments of Serbia. The glass plates were taken in 1954 as visual documentation, and the author has assessed the conservation state of the wall paintings by comparing them with glass plates which are under ongoing archiving. The comparative study is carried out by applying images from three different times: photographs recorded in 1926 before the first intervention of modern restoration, glass dry plate images dating 1954, and digital data taken by the author in 2017. By analyzing the differences between the multiple images of long intervals of time, the author clarified that wall paintings at Sopoćani are comprehensively in good condition. Besides image comparisons, the results of a field survey done by the author and field measurements carried out in 2017 for further discussion have been introduced. As a result, no critical damage to the mural structure or serious changes to its appearance were identified. The conservation state of the wall paintings remained satisfactory, mainly because the restoration works carried out between 1926 and 2017 had been modest enough, allowing the wall paintings to retain the stability of the original production.

Keywords: Glass dry plates, wall painting, Serbia

1 Introduction

1.1 Significance of the research and characteristics of glass plates

Photographic materials and visualizing processes have been remarkably progressing through recent centuries, while the processed images themselves were often left as older results apart from technological developments. Both microscopic and macroscopic ranges covered by these developments, so rapid as ever before, have been extending much further than the natural limits of normal human perception gained through the naked eyes or senses. Reports and papers have been published on the strength of scientific data gained from advanced analyses of material identification or even through non-contact virtual processes, somehow far from the reality of the heritage.

The point to be taken into account is that those historical works were the result of simple hands and eyes of artists, though highly trained and provided with relevant knowledge. As regards the preservation of cultural properties like wall paintings of historical value, such older visual information is of crucial importance when we open the process of conservation projects on the basis of the older but human scale of technology applied to the production of the heritage. Here lies the significance of this research. In parallel with the instrumental contribution made by advanced analyses to the conservation science, the significance of visual analog images where the situations of the heritage in the past were recorded should be reevaluated in view of the fact that they are authentic proof of the states and conditions of the recorded object at a certain time through the long history of a progressive process of deterioration. This inevitably entails that such images in the past should be conserved with due scientific care and methods in a similar way to the cultural properties themselves. This paper deals with the ‘Gelatin silver glass plate negative’, once used as photographic documentation, to propose their effective use towards better conservation in harmony with older analog techniques of painters in the past.

The ‘Gelatin silver glass plate negative’, commonly known as simply “glass plate”, had been the main photosensitive material since its industrialization in 1878 until the 1920s when it became gradually

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replaced by the film negative [1]. Glass plates, being feasible for long-term storage following the mass production, enabled the proliferation of photography both in number and popularity beyond the limit of conventional specialists. Thus, the visual information recorded on so many glass plates should be regarded as historical documents, not only for the half-century period but also for decades after the 1920s when they were still in use, besides the progressive spreading of modern, easier negative printing methods.

The glass plates kept in the Institute for the Protection of Cultural Monuments of Serbia have been examined and scanned by the author, with the aim of building up the database for the future conservation project of wall paintings of Sopoćani Monastery. The result of the analysis of the scanned images is given in this paper, with additional suggestions regarding the better way of the preservation of this collection with special regards of environmental factors.

1.2 Photography as historical archive

Photography can be broadly divided into two types: photography as art and photography as documentation. The latter can be further divided into different categories: news photos, scientific photos (taken with different light sources and films, microphotography), and photos for documentation and conservation, including visual archivist materials. The photograph became applied in research in the 19th century: it was in 1839 when François Aragaud, who had created the sensation with the daguerreotype of the outside scenery taken by Joseph Nicéphole Niepce, pointed out that the application of daguerreotypes could accurately and quickly copy archaeological material such as hieroglyphs (Aragaud, 1839)[2]. Furthermore, on 15 June in the same year of 1839, a bill submitted to the French government stated that "for archaeologists and naturalists, this device of Mr. Daguerre will become an indispensable means of their daily activities" [3]. From the very beginning of its invention, photography commanded the first position of the surest and everlasting record.

1.3 Sopoćani glass plates

The above-mentioned collection of glass plates is composed of approximately 1000 glass plates, among which 303 show Sopoćani monastery (hereinafter referred to as Sopoćani glass plates). The rest correspond to the other monastery buildings and their wall paintings in the territory of the ex-Socialist Federal Republic of Yugoslavia. Sopoćani glass plates were made by R. Delić and M. Lazarević in 1954 during a series of administrative documentation works ordered by the government. Since then, all plates have been left in an underground space without being examined or cataloged.

The size of plates is the so-called 'half-plate (130 x 180 mm)', commonly used in Europe at the time. Wrapped by glassine paper, each plate was put into a paper envelope, as is shown in Figure 1, and placed vertically in metal cabinets, shutting off the effect of light. Temperature and humidity, well-known factors accelerating the deterioration of the photosensitive material gelatine, seem to have been kept successfully low by chance. Air conditioning was not installed. However, they were just kept as plates made of glass, Sopoćani glass plates happened to be relatively in good condition. A few physical damages, such as cracks and scratches, are observed, which may have occurred during handling. The gelatine adherence to the surface of the glass is good enough, without any symptom of severe flaking or detachment. The manufacturing of plates was of high standard and, fortunately, the space where they were kept has long been alien from extreme changes in humidity. During the course of time, the inevitable silver mirroring has appeared along the periphery of the plates, which, however, has not invaded the images themselves. Such peripheral deterioration would be greatly softened if they were laid under a better conservation environment in the future.

2 Analytical method

Thanks to the two highly skillful photographers of Sopoćani glass plates, it is still possible to make the comparative analytical study. In addition, we have the oldest photographic records of Sopoćani taken in 1926. Comparison between photographic records of 1926, 1954 and 2017 were made by using Adobe Photoshop 2024.

The preparatory analytical comparison is made by superposing two images of the same surface to obtain the visual differences between the two. Absolute values of the superimposed images are measured on software. Fig.2 gives the result of this simple comparison of the partial images of the west wall of

Naos from 1954 to 2017. The difference is given as vacant areas. Compared with the two original images, these vacant areas exactly correspond to the additional complementary coloring done between 1957 and 2017.

Thus, the comparison of the two visual documentation may show not only certain developments of the deterioration but also traces of interventions done between the relevant periods. Visual records may offer clearer objective decisions for experts without hampering them by iconographical meanings or material characteristics. Detailed naked-eye observation may be somehow subject to the experience or knowledge on the part of the researchers, which should be effectively related with or adjusted by mechanical and purely analytical information as complementary data in the investigation of the heritage in situ.

Comparative analyses are useful if two photos were taken at relatively long distance of time. In such cases, one or both older photos happen to be short of exact correspondence due to the distortions or misalignment caused by the old mechanisms of cameras and characteristics of lenses. Distortions become wider in the periphery of images, which may occasionally be observed by the naked eye. The accuracy of image comparison can be improved by correcting such shooting distortions or adjusting the contrast of shading.

This simple method allows old photographs to be compared with new digital images, and the comparative information may well be of basic significance in the conservation projects by showing the degree and causes of deterioration or confirming the diagnosis of the suffering wall paintings. Advanced analytical equipment or large-scale field measurements are not always applicable whenever required at every site. Therefore, it can be expected that people involved in cultural heritage will make effective use of historical materials to widen and deepen their understanding of effective conservation by making use of the above-mentioned materials and software widely used worldwide.

On the other hand, it must be taken into account that the conversion from silver halide analog information to quantized-digital discrete data involves fundamental problems that go beyond mere mechanical media conversion. Digital technology is advancing at a dizzying pace in terms of both hardware and software, and converting data each time is a major burden, and unlike analog information, it also carries the risk that a small inconvenience may make it impossible to read any images at all. Digital data, while being easily processed and edited, may connote risks of losing its reliability if the process of data acquisition and storage is not well documented.

3 Assessment of the past restorations

Comparison of the three visual sources, those of 1926, 1954, and 2017, clearly shows that there had been a series of extensive architectural interventions, including structural additions, which may have altered considerably the external appearance of the church. Contrasting irrevocable alterations and additions in architecture, a comparison of photographic records from three different periods clarifies severe deteriorations or changes caused by both environmental and restorative factors are scarcely observed in the wall paintings drawn on the inner surfaces.

In Fig.3, partial images of the wall painting in the center of the south wall of the Naos are compared on the basis of the database made by the author from photographs taken in 1926, 1954, and 2017, respectively. The major change that occurred between 1926 and 1954 was the filling in of the missing area in the upper center of the screen. Although weathering and small-scale flaking on the right side of the screen are observed in the data, it should be noted that the 1954 image was taken at a higher exposure setting, which resulted in a brighter image being acquired overall. Therefore, we may safely conclude that the degree of abrasion was less in 1954 than visualized in the images of this year. On careful comparison of two images from 1954 and 2017, differences were observed on the right side of the screen, which demonstrates a certain intervention by additional complementary coloring applied to areas missing due to weathering and abrasion.

The image comparisons between the two different times show weathering over time but no symptoms of structural deterioration, i.e., progressive increase of structural cracks, biodeterioration, or conspicuous loss of the surface. In other words, it can be assumed that no critical deterioration threatening the structure had been occurring during the 91 years from 1926 to 2017, despite the fact that the building with its depicted surface had not been placed in a stable, safer environment like an exhibition hall of a museum: before 1926, it had been exposed to the severe climatic violence like strong wind and heavy rainfall for more than 200 years without roof covering, and crumbling stones or broken bricks had accumulated in the hall, and plants had grown both inside and outside. This architectural heritage, judging from visual

documents, turned out to be exceptional in preservation and sustainable condition. One of the probable reasons for this lucky persistency of the building is ‘neglect’ in the good sense of the word; that is, the building had long been left uncared for without being suffered from harmful and disguised ‘repairing.’

Especially the comparative analysis between images from 1954 and detailed and close observations done by the author in 2017 has clearly shown that there had been no serious interventions that might have caused later negative effects upon the original. Minor interventions are: removal of older treatment, followed by modest re-treatments, and filling of gaps between the painted plaster and the wall. These interventions were done during restoration projects conducted in the last century. The author has confirmed that they are minimum treatments, clearly to be identified, and remain nothing particular to cause further side effects or deteriorations. Restorations or consolidations of cultural properties in the last century often tended to go beyond the limit of the ‘minimum intervention’. Materials and chemical products to be used in those works have frequently been tested, changed, and somehow improved. Considering this rush of restoration fever in the second half of the last century, the ‘steady calmness’ by which Sopoćani wall paintings have been preserved should be worthy of particular attention.

Sopoćani glass plates prove the persistent existence of the almost unchanging original inner surface since 1926 when the first modern repair project was started after the total abandonment of the Sopoćani monastery for more than 200 years. The fact, while emphasizing the importance of those plates as historical visual documents, may well make us suppose that the technique, as well as the material of both original painting and wall construction, were sufficiently high to secure the durability of the work against the long-term deterioration [4]. Although there remain no full records of the restoration works through the 20th century, we may safely assess, through detailed analysis, those interventions were of ‘minimum’ even from the advanced and rigorous standard of restoration we should follow today. Along with the efforts towards a complete and safer preservation of Sopoćani glass plates, we should make a more penetrating analysis of them as the basis of the in-depth evaluation of their significance and, if necessary, of their future protective restoration.

In Sopoćani Monastery, two services are given per day, morning and evening. Worshippers are relatively dispersed throughout one year, and congestion of visitors remains minimized even on the day of major events such as Easter. The seasonal and daily variations of the temperature and humidity in the church of Sopoćani show no serious acute curvature nor delicate peaks which may threaten the microclimate of the space (Table 1). The most difficult season is summer, when the temperature and humidity undergo severe daily variations (RH 29.3-50.6%, 19.4-23.9°C), but not to the extent of being exposed to sudden temperature and humidity changes, while winter months are stable with little daily variation (RH 54.5-57.5%, 3.5-4.0°C).

The climatic condition of the outside is a different issue. The outer surface is subject to the atmosphere with relatively larger changes in temperature and humidity. Especially the latter may cause a certain threatening effect, the highest degree being observed during winter months when there is much snowfall and rainfall. However, the outer surface displays no perilous phenomena leading to threatening progressive deterioration, such as condensation or salt damage. Microenvironmental changes, both inside and outside of the church, may certainly exert negative impacts on the wall paintings. Through detailed observation done by the author, however, the Sopoćani structure turns out to be in good and safer balance with the environment surrounding the vulnerable heritage, though additional microscopic monitoring should be continued to grasp minor invisible symptoms hidden in the structure. Fortunately, no serious natural disasters have occurred.

Wall paintings of Sopoćani had long survived more than 200 years of neglect and devastation. Our detailed examination further had brought out the fact that the well-balanced environmental condition had enabled the continuation of their long life without any serious damage into the 100 years since 1925 when the first modern survey was carried out at Sopoćani. During this period of recent 100 years, mural paintings were given marginal fillings and reinforcements that maintained the murals in the minimal state they were in at the time. Supplemental painting was manageably done to the extent of restoring their appearance. The philosophy of this maintenance work deserves full accolades compared to irreversible reinforcement procedures using concrete and synthetic resins together with excessive and peculiar coloring work, so frequently carried out in the mid-20th century. The author confirmed by detail in situ examination that Sopoćani wall paintings have been fortunately left free from complicated problems caused by the restoration materials, which is the outstanding contribution of the ‘modest’ restoration carried out from time to time through the difficult period of financial shortage.

4 Conclusion

While being out of use nowadays, glass plates may certainly contain valuable visual information of the past when they were used as indispensable photographic media. This paper reconfirms the importance of Sopoćani glass plates as components of digital archives to meet the needs of advanced studies regarding the church. As there still remain many undocumented plates, the author is trying to carry out the complete catalogued enumeration with additional analysis of their industrial-technological significance. Sopoćani glass plates are not yet stored under the proper preservation environment. The relevant research has clarified that the suggested environmental condition for the glass plates to be preserved is less than 65° Fahrenheit with minimal fluctuation (+/- 2 degrees), and ideal relative humidity is 30% RH with minimal fluctuation (+/-3 percent) [5].

As well as providing an adequate preservation environment, it is also necessary to store historical materials separately according to their deterioration symptoms and degree of deterioration in order to reduce risks during handling. Storing cracked glass dry plates in the same conditions as dry plates that are not cracked does not ensure the safety of both objects.

In parallel with the completion of the digital archive, it is of academic importance to secure as soon as possible such environmental conditions to house Sopoćani glass plates in order to promote the research of the history of restoration and to discuss the future project for the conservation of Sopoćani wall paintings.

Apart from some minor emergency or partial restoration works done as temporary measures, at least three major mural restorations have been carried out at Sopoćani in the last 100 years, the period in which the materials and philosophy of restoration have undergone significant changes in the field of conservation of cultural heritage. The conservation and restoration of the wall paintings at Sopoćani have been proved to be the least extensive and risky of similar interventions taken up worldwide. The author's survey has confirmed that the original durability and soundness of the wall painting is still effective in the sense of preservation today. The original strength of the wall painting should be appropriately taken into consideration in terms of positive functioning factor. The notable durability of Sopoćani wall paintings should be the basis of the long-term conservation of the murals in good condition. The guidelines or standards of the restoration program should be discussed extensively through the correct assessments and with respect to the high standards of the techniques used when the murals were first produced. Sopoćani glass plates certainly remind us of this modesty to be shared among the restoration experts in front of the heritage which survived from a far distance of time. Historic photographs that capture a different appearance from the present state have thus important historical value, which in their turn are comparable to that of the original object once photographed. The conservation and restoration of such visual images are nonetheless meaningful in making their utmost effective use on the part of restoration-conservation experts who should always pay due attention to the information hidden or provided by them.

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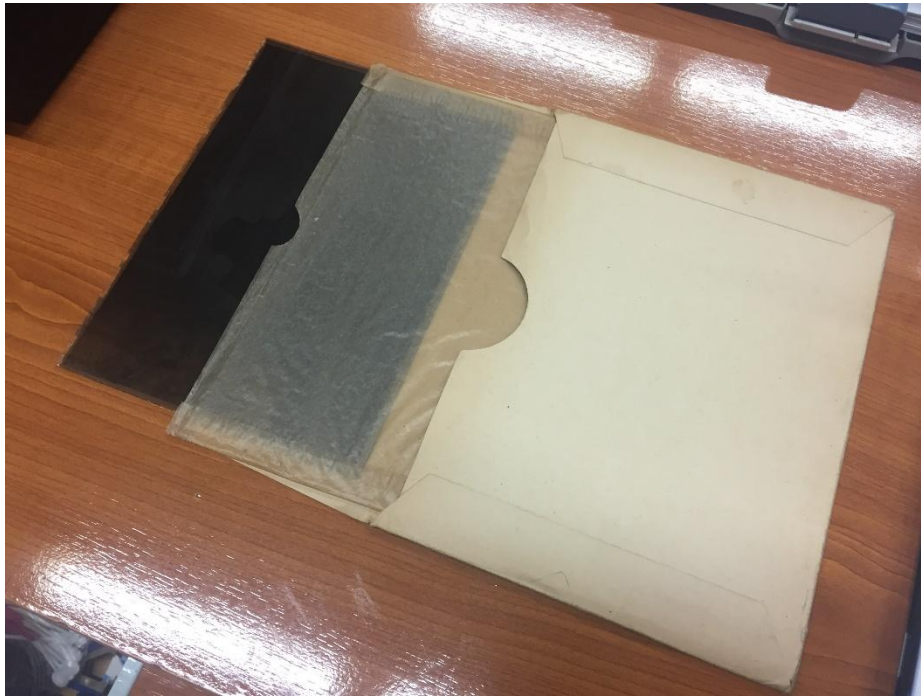


Fig. 1 - Sopoćani glass plate

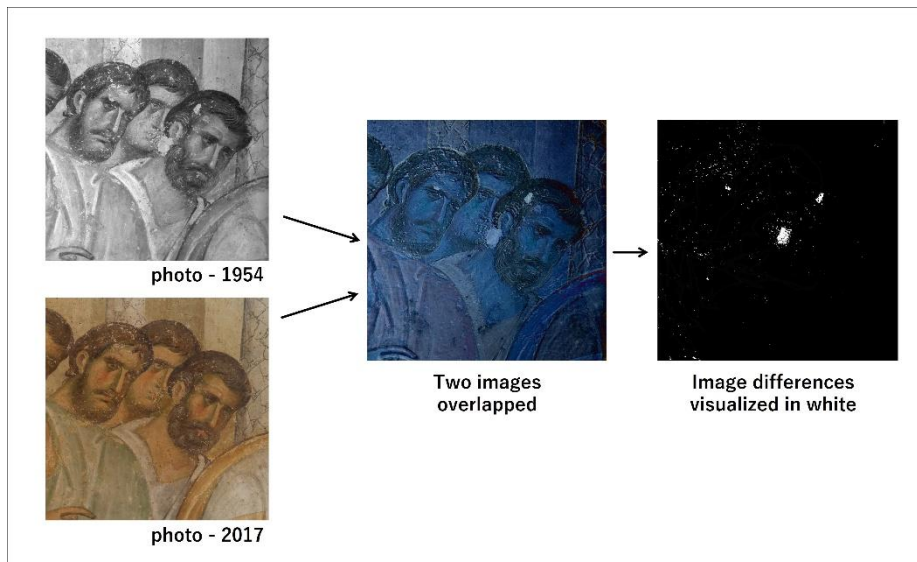


Fig. 2 - Example of the procedure of image comparison

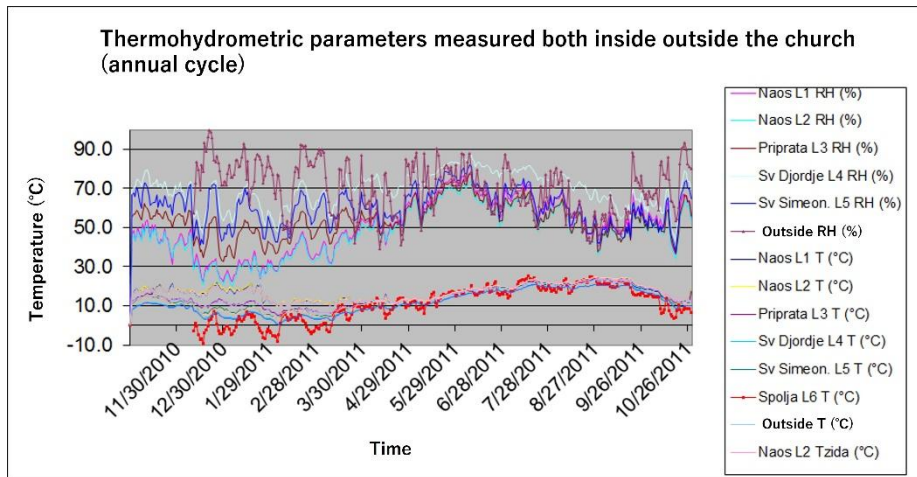


Table 1 - The seasonal and daily variations of the temperature and humidity in the church of Sopoćani

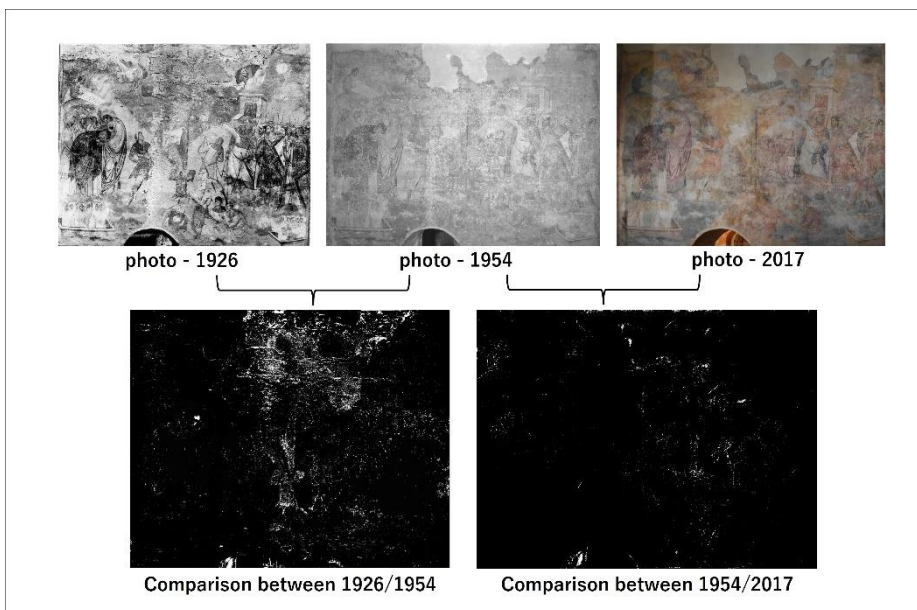


Fig. 3 - Comparison of the database made from photographs taken in 1926, 1954 and 2017

