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PRESERVATION AND USE OF THE RELIGIOUS SITES
CASE STUDY OF THE ROMAN CATACOMBS

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Abstract

The roman catacombs are the most important early Christian monuments in Rome and they are visited by thousands of pilgrims every year. Their underground nature affects their state of conservation and these specific conditions can not be changed without compromising their integrity. The only viable solution would seem to be found a form of sustainable conservation. It is for this reason that in the recent years we have undertaken many and diversified experimentation.

Keywords: Roman catacombs, environmental condition, preservation, pilgrimage

1. Introduction

The Pontifical Commission for Sacred Archaeology is responsible for the protection, surveillance, scientific excavation and exploration of the Italian Christian catacombs since 1852, in order to offer a valid and effective support to knowledge and protection of the valuable monumental and spiritual patrimony entrusted to it [1].

The monumental heritage of roman catacombs is composed of about 60 funeral complexes carved into the tufa rock. They are very different in size and topographical development. Also the diffusion of mural paintings - about four hundred painted funerary structures - is not homogeneous in distribution and chronology. They date back to the beginning of the 3rd until the 5th century, with some occasional fresco painting of the 6th-7th century, the last testimonials of the pilgrimage in these underground sites [2].

After this period the roman catacombs were abandoned and remained forgotten in the roman underground until the 1578, when Antonio Bosio began the process of their rediscovery. But only in the middle of the 19th century, with the scientific approach of Giovanni Battista de Rossi, we came back to know almost all the early Christians cemeteries of Rome [3].

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2. Case study

2.1. Enhancement and preservation of hypogean monuments

Today, only five catacombs are permanently open to the visitors and only some of the others can be visited on demand. The public of the catacombs is very diversified: some visitors come just for tourist purposes, some other for cultural interests and many others for religious reasons. Each of them has different expectations and needs, but it is extremely difficult to satisfy all the requests.

Upon specific environmental conditions of the sites there are restrictions applied for safeguarding both people and artwork. The visit is always with a tour guide and visitors can not stay for a long time in hypogean gallery. Only some groups of pilgrims get the permission to celebrate Mass in specially selected cubicles.

In the hypogean environment, the most important deterioration factor is the very high level of humidity, about 96%. Not only the simple presence of the visitors can cause sensible variations in the microclimatic conditions, but also all kind of interventions made to adapt these places to the visits. Multiple entrances, lighting installations, systems for air exchange, etc., can cause significant alteration phenomena.

The protection of cultural heritage involves the preservation of the integrity of a site and its attributes, but a "cultural heritage is a group of resources inherited from the past which people identify, independently of ownership, as a reflection and expression of their constantly evolving values, beliefs, knowledge and traditions. It includes all aspects of the environment resulting from the interaction between people and places through time." [4] The fruition of historical sites used for religious purposes is specifically or mainly enjoyed by the faithful, and is aimed at the 'public access' and above to their effective *Deputatio ad Cultum.*

Therefore the conservation activities must find the right tradeoffs between integrity and fruition, and it is always important to judge the impact before start any type of intervention.

2.2. Ancient and recent experiences

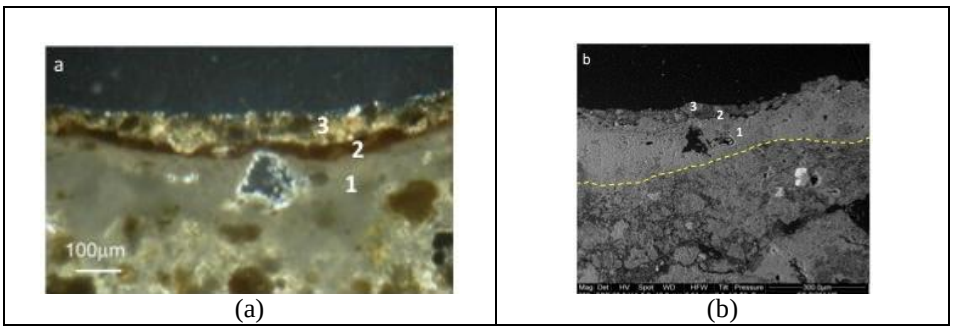
Since the moment of the catacomb's discovery the interest of archaeologist has focused on conservation of the pictorials evidence which are preserved there. The techniques available at that time were not able to stop the progressive deterioration of the paintings. Making copies and reproductions by simple watercolour was the only way to preserve those important testimonies [5].

Later there were repeated unsuccessful attempts to remove the paintings to store them in antiquarian collections. As further technical inventions were developed, reproductions were made photographically; these black and white

photos, also touched up with water colour, are a significant documentation of the appearance of the wall paintings (Figure 1), but to take the pictures, unskilfully surface cleaning were performed, thus ruining the paintings [6].

(a) (b)

Figure 1. Rome, catacomb of Commodilla, fresco painting of Turtura: (a) black and white photos, partly touched up with water colour by C. Tabanelli for J. Wilpert (1903) (Pontifical Institute for Christian Archaeology) and (b) the original (PCAS Photo Archive).



(a) (b)

Figure 2. Rome, catacomb of Domitilla, cubicle 'of the bakers': (a) PLM microphotograph (XPL) and (b) the corresponding BSE image of the sample, showing: 1) micritic lime enrichment within the mortar layer due to carbonation penetration (max. 200 µm thick; marked here with yellow dotted line); 2) red ochre paint thinner than it appears under PLM; 3) surface microsparitic crystallisations including random particles of tuff dust.

With the increase in archaeological excavations at the beginning of the last century, genuine emergency restorations were also carried out, but the materials used were inappropriate for an effective conservation of the paintings. In the past 20 years more responsible conservation actions have been undertaken; they have been aided by an intensive diagnosis of the materials used for conservation practices and were preceded by analysis of the techniques used

to execute the paintings [7]. About this, a recent very interesting study was carried out about the technology of lime-based mortars and techniques of mural painting used by the ancient *fossores* to execute the decorated surfaces. The study, still in progress, seems to have cleared up the carbonation process of the catacomb frescoes. The long time taken by the mortar to harden due to the high relative humidity in the hypogean seemed to have allowed carbonation go deeper within the microstratigraphy (Figure 2). The absence of other features attributable to an intentional lime-paint technique leads us to exclude this hypothesis [8].

Also, many diagnostic campaigns were carried out, by means of methods and techniques exclusively not invasive and not destructive, for identification of the inorganic pigments used for the paintings and have allowed to obtain a complete and unambiguous characterization of the colour palette [9] (Figure 3).

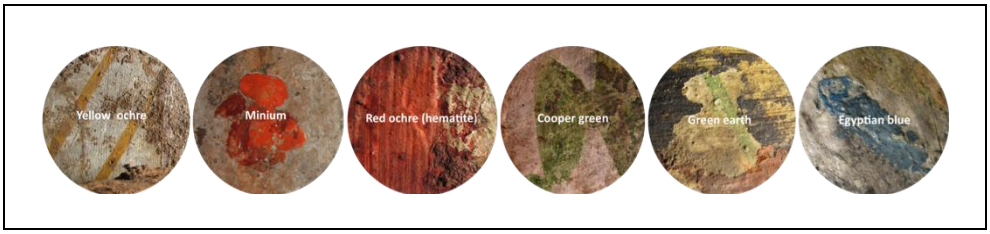


Figure 3. Rome, catacomb of Domitilla, cubicle 'of the bakers'. Characterization of the colour palette.

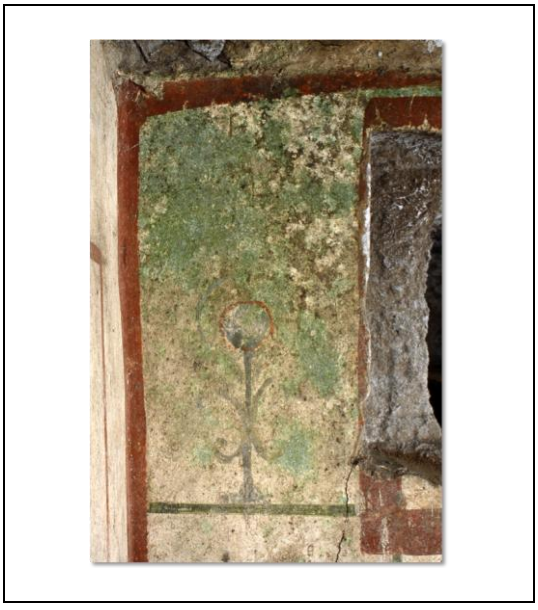


Figure 4. Rome, catacombs of Saint Callixtus. Sacraments cubicle A3. Growth of microorganisms on paintings (PCAS Photo Archive).

Likewise the mechanisms which have led to the various changes and damages on the decorated surfaces were taken into account.

One of the most influential factors on conservation catacombs is the lighting required for visits. The problem of the lighting has taken into consideration since the end of the nineteenth century. At the time, acetylene gas lamps were used, but the excessive brightness produced and the acid gases released in the atmosphere were deemed harmful. Gas lamps for galleries and open spaces, and tallow candles for cubicles with paintings was the solution found. But the burning candles developed quickly a black film on walls painting. Only in a few cases the black film was removed with a putty rubber, but in most cases remained on paintings, becoming a thick and compact layer [10].

With the advent of electricity new problems arose. The lighting system, operating almost continuously, created the conditions for a massive and uncontrolled growth of photosynthetic organisms (like green sickness). Growth of microorganisms on paintings cause aesthetic and structural damage. As aesthetic damage we can consider pigment discoloration, stains, and formation of a biofilm on the painted surface, whereas as structural damage we can consider cracking and disintegration of paint layers, formation of paint blisters and degradation of support paintings, and binders resulting in detachment of the paint layer from the support [11] (Figure 4).

At the present day biodeterioration has been studied within an European project called ‘Cyanobacteria attacks rocks’: high humidity, stable temperature and artificial light sources allows the growth of phototrophic bacteria like cyanobacteria, green algae, diatoms and lichens [12]. A monochromatic lamp has been experimented like method to reduce biofilm development. The lamp with a blue light was the most effective solution, but the impact for the visitors is too strong [13].

A compromise solution has taken changing traditional incandescent lamps with Light Emitting Diodes. LEDs do not emit UV or IR radiation and the light does not generate heat. Also, lights are turned off when spaces are not occupied, especially after hours.

Other non-invasive solutions, based on a minimum microclimate control, resulted from an ongoing study carried out in a catacomb near Saint Callixtus presented in the previous edition of ESRARC 2013 Symposium [14].

Always linked to the specific underground environment are the different types of incrustations of calcium carbonate; the most common damage in the roman catacombs. Crystal growth affects the readability of the pictorial details, and can alter the former mortar composition and structure. In the past this kind of damage was imputed to the air circulations. To stop the evolution process it was thought to use a kind of revolving doors at the entrance to the catacombs and shield the access to the single chambers with curtains. Unfortunately this simple but effective solution wasn’t ever applied [PCAS Archive, ASD/12, 234-237].

Several attempts have been made to retrieve the readability of the fresco paintings, before using all kind of acid solvent, after testing with mechanical removal. But the results have been very poor when they not have worsened the state of preservation of the paintings. In the recent past the restorers have understood their limits and in many case they decided not to act rather than cause damage [15] (Figure 5).

(a)

(b)

Figure 5. Rome, catacombs of Pretextatus, cubicle of the *coronatio* (Crowning with Thorns): (a) before and (b) after the mechanical cleaning (PCAS Photo Archive).

Nowadays a pilot project, in collaboration with the ICVBC - National Research Council - began studying the processes of calcium carbonate crystallisation [16].

Microclimate monitoring of the Cubicle of the Twelve Apostles in the catacombs of Saints Mark, Marcellian and Damasus by means of a sensor network is coupled with periodic surface pattern change detection. The latter is carried out by combining non-invasive techniques (e.g. colorimetric measurements and digital micro-photogrammetry) and laboratory investigations (e.g. thin and cross-section, FT-IR, XRD and ESEM analyses) on samples taken from both ancient surfaces and newly applied frescoes. The first outcomes are providing interesting insights into the operational issues involved in the monitoring of such unusual environments, including for instance the choice of the parameters to take into account, as well as the materials to use for in-situ experimentations (e.g. pigments and methods and time of application). Monitoring is assumed here as a mean towards a long-term preservation plan, with the perspective of a feasible balance between the aspects of conservation and those of promotion of this hypogeum painted heritage.

In addition to the natural deterioration caused by environmental conditions, the worst alterations of the state of conservation are due to unsuitable restorations made in the past.

It was already seen the damage inflicted by acid washes but other serious damages have been made from a practice that was intended to protect the supports of the painting. To prevent the collapse of the frescoes have been made a large numbers of cement plasters. Often this cement plaster overlay the painting and they are very hard to remove without harm for the underlying original plaster.

Moreover, attempts to consolidation of the painted layer have been made with vinyl glue. The layer of glue has become yellow and vitrified and now is impossible to remove it because the pigments have been absorbed [17]. Many other products, normally used in outdoor restoration work, have different reaction in the hypogean environment or they are not efficient due to the high level of humidity.

This is why it is necessary to be very careful about the methodology to be used. In many case the most successful methodological choices are those that are closest to the original practices, this is true specially for the materials to use in the restoration work. Often we preferred not to intervene rather than risk making mistakes.

3. Results

This approach recently has been very positive, thanks new technologies we were able to solve old problems remained unsolved in previous restoration works.

Indeed, the last frontier of conservation activity in the roman catacombs is the laser cleaning methodology. The results of this methodology were unexpectedly good.

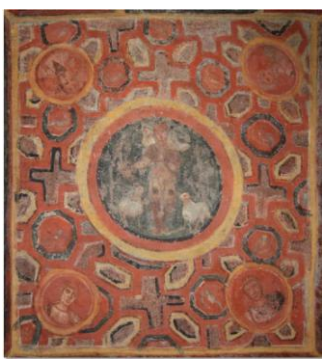
The first application of laser cleaning has performed in the Saint Tecla catacomb - a double room with unknown paintings totally hidden from a thick, black or white, calcareous incrustation. Early cleaning operations were carried out using traditional methods like scalpel and other mechanical means, which allowed only a partial removal of the mentioned crusts since deeper cleaning appeared to be very invasive. But, the historical and artistic relevance was evident since these early examinations of some partially visible figures and scenes. This led the Pontifical Commission for Sacred Archaeology to promote an investigation campaign in order to assess the state of conservation and define suitable conservation treatments [18].

Thus, a systematic experimentation of the laser ablation techniques was carried out, which allowed defining a safe uncovering methodology and performing the overall laser restoration of the painted walls of the cubicle. The laser treatments made possible to discover the early icons of the Apostles and other pictorial elements having very important historical and cultural values [19] (Figure 6).

In the wake of this successful application of the laser ablation techniques, the Pontifical Commission for Sacred Archaeology, decided to approach in a similar way the conservation problem of the wall painting of the cubicle '*dei fornai*' ('of the bakers') in the catacombs of Domitilla. This involved a presence of carbon deposits cemented within relative thin but tenacious calcareous precipitations, which represents a very common problem of many painted cubicles [20].

Also in this second case-study the restoration works were supported by appropriate scientific expertise to determine the suitable laser parameters and to verify the operational quality. The results of diagnostic tests and restoration work have made it possible to clarify the chronology of the paintings. Topographical elements indicate a dating close to the middle of the 4th century, while the special features of the decorations, especially the apses with Christ enthroned between two groups of apostles on the sides and with the principles of the Apostles, Peter and Paul, sitting in the foreground, addressing in the last decades of the century. The discovery of a double layer of plaster and a detailed study on the technique of execution has clarified any doubt [B. Mazzei, *Il cubicolo "dei fornai" nelle catacombe di Domitilla a Roma alla luce dei recenti restauri*, in 16th International Congress of Christian Archaeology, Rome 22-28 September 2013, in press; 21] (Figure 7).

(a)



(b)

Figure 6. Rome, catacomb of Saint Tecla, cubicle of the Apostles: (a) before and (b) after the laser ablation cleaning (PCAS Photo Archive).

Figure 7. Rome, catacomb of Domitilla, cubicle 'of the bakers' (PCAS Photo Archive).

Moreover, the laser cleaning has uncovered one of the most controversial scene of the art of the catacombs. In the Aurelian's hypogeum a restoration work made fifteen years ago could not remove the thick concretions that hindered the understanding of the iconographic subjects. The laser ablation allowed us to recognize with certitude the story of Odysseus and the witch-goddess Circe and excluding the alternative hypothesis of an episode in the life of the Prophet Job, demonstrating that the no-intervention policy adopted in the recent past was the correct choice [22].

The significant results of the restoration enhance also the archaeological and iconographic studies with positive effects in valorisation of this kind of cultural heritage.

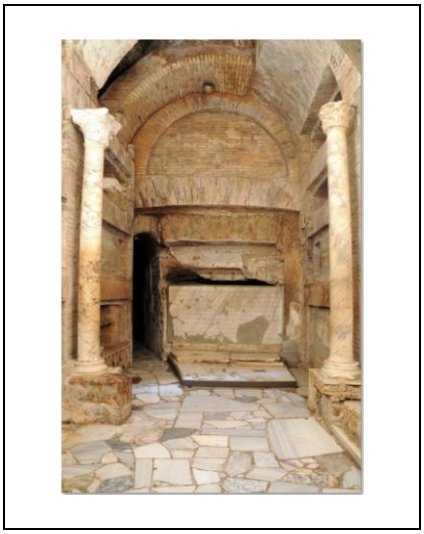


Figure 8. Rome, catacombs of Saint Callixtus, crypt of the Popes (3rd century) (PCAS Photo Archive).

4. Conclusions

The roman catacombs are the most important early Christian monuments in Rome and they are visited by thousands of pilgrims every year (Figure 8). Their underground nature affects their state of conservation and these specific conditions can not be changed without compromising their integrity.

The only viable solution would seem to define feasible and sustainable strategies of conservation and the holistic approach in this field seem to be not a choice but rather an imperative need.

Acknowledgment

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who have contributed to increasing knowledge about the roman catacombs and their conservation.

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