Rome, San Paolino alla Regola and Mamshit, Israel: what cooperation or interference between archaeologist/conservator can produce.

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ABSTRACT
Archaeological sites are important for the messages that they bring from the past. Everything in archaeology must be devoted to the recovery, conservation, presentation and transmission of that message. Optimal results will be obtained when all involved professionals cooperate for this common objective. In this paper we present two cases of on site conservation: Rome, San Paolino alla Regola, frescoes and mosaics of II cent. a.d. and Mamshit, Israel, frescoes of III cent a.d. In the first intervention the collaboration between conservator and archaeologist from the beginning of the excavation made it possible to follow the principle of *minimum intervention - maximum efficiency*. The second intervention was carried out many years after the excavation and represents an example of *maximum intervention - minimum efficiency*. Both the treatments presented used local materials similar to the original. Preventive measures and maintenance programmes have been set up for future conservation.

1 Introduction

"It is not the excavation that takes precedence over restoration, but rather the excavation is simply a preliminary phase of the progressive reacquisition of the work of art by the mind from which burial had hidden it. The excavation, therefore, is the prelude of restoration and restoration cannot be considered a secondary or possibly subsequent phase." It was 1963 [1] when Cesare Brandi wrote these words. When he referred to the possibility of an excavation that was not followed by restoration, he added: "To begin an excavation in these terms, is neither historical research nor aesthetic study, but rather irresponsible activity of serious social and spiritual consequence, because there is no doubt that what is beneath the ground is better protected in its stabilized surroundings than by the violent interruption of these conditions that an excavation would cause."

More than thirty years have passed since Teoria del Restauro [1] was published and much progress has been made in the fields of teaching, conservation and safeguarding of archaeological properties. It is increasingly evident that the concept of restoration of the single artefact as an end in itself must be overcome in the light of the complexity of the conservation of archaeological sites themselves, and the totality of the interventions to maintain on site the greatest possible amount of historical information. It would seem to be widely accepted nowadays by many who are directly involved in the safeguarding of these properties, that each element is part of the communication of historical data and of the comprehension of the archaeological context. Interventions that were commonplace only a few years ago, such as removing mosaics or lifting painted plaster from original contexts, are now inacceptable since they bring about the distruction and the loss of information, and can be the cause of discontinuity in the overall understanding of the site. The lack of planning and the lack of a conservation policy in the recent past has created numerous archaeological complexes which call for urgent conservation requiring large financial expenditure. If it is true, therefore, that a conservationist culture has taken root, it is just as true that we are not always able to put efficacious and rapid safeguarding plans into effect; in the final analysis more or less important delays in the necessary operations cause more or less serious losses of historical impact .
We can well wonder what instruments available today are adequate for the next millenium while

attempting to halt and repair the deterioration of our historical heritage already, or in the process of being, excavated.
The most common techniques regard of on site conservation, drawing up unified maintenance schedules, interventions for passive protection. Parallel is the increasingly, popular concept that the best path to follow is prevention, planning conservation from the first steps of archaeological investigation.
This planning, however, calls for the presence of the conservator in the field working alongside the archaeologist; he is the person with the means to identify the problems and to suggest more suitable operative solutions to the person responsible for the administration of the site.
Planning conservative intervention from the moment of the excavation is undoubtedly a step ahead in safeguarding the properties and the least costly choice in both economic and cultural terms. The risk of starting a chain reaction of natural factors of deterioration, because the equilibrium of the environment protecting the artefact was disturbed, can be controlled and limited and consequently economic costs are much lower.
We feel it is useful to dwell on this point, presenting the results of our experience as conservators in two different and opposed situations from 1994. The first regards the restoration of frescoes dating from the first years of the III Century A.D. discovered in the city Nabatea of Mamshit in southern Israel; this was a conservation intervention performed twenty years after the excavation. The second instead dealt with hypogean frescoes and mosaics found during the excavation of various rooms of the Roman houses of San Paolino alla Regola in Rome. This second intervention is an example of the collaboration between the archaeologist who directed the excavation and the conservator: the result was that the excavation was carried out in function of the conservation operation.
Comparison of the two situations allows us to evaluate efficacy in terms described above and in relation to the different working conditions of each.
Both interventions were carried out respecting the following principles: on site conservation; least possible intervention; reversibility of the materials used; compatibility of materials and techniques with the original; treatments to be recognizable; thorough documentation of the entire intervention with photographs and graphics.
We also feel it useful to complete the text describing the intervention with a series of drawings whose purpose is to facilitate understanding of the working details.

2 Conservative restoration of the Mamshit frescoes

Five years after inspecting the situation and 20 years after its excavation, in the Spring of 1994, the conservative restoration was carried out of various frescoes in a room of the biggest building (Building XII) excavated in the city of Nabatea of Mamshit, in the Negev desert of Israel.
The building, probably a dwelling, contains many rooms and was plastered and painted throughout; now, however, except for some colorless fragments, only the frescoes of this little room (Locus 411) have been saved. This is a rectangular room, 2.4 x 4.1 meters, originally completely plastered and with a high opening in the northern wall (photo 1). The decoration consisted of painted scenes on the upper parts of the walls, single figures on the conch stones of the arches and a decorative border along the walls beneath the painted scenes. The lower sections of the walls were not painted. The frescoes, which were fragmentary, are conserved on the east and west walls and on the three arches holding up the roof. The myth of Cupid and Psyche is shown on the western wall, framed by the ornamental design of a carpet. Warriors and Winged Victories are instead shown on the arches. The paintings were done on a fine layer of white plaster laid over another layer of plaster about 5 mm thick. The arriccio composed of mud, straw and stone dust was about 3 cm. thick. On the basis of archaeological and stylistic evidence, the frescoes can be dated between the end of the II Cent. and the first years of the III Cent. A:D:
The decision to undertake the restoration made by the National Park Authority of Israel was urged by the precarious state of the conservation of the paintings and followed the collapse of all the decoration that had been on the southern wall of the room. Although they already were in a poor state of

conservation, even in 1989 the frescoes were still on the walls, whereas they are irremediably lost today. As evidence of their existence we have the photographs and descriptions made by the archaeologists during the excavation (photo 2).
When the intervention was to start, large areas of the surviving paintings were about to suffer the same destiny. The arriccio, either partially or completely pulverized, no longer had its original function of sustaining the intonaco; in those spaces where the dust had accumulated between the intonaco and the wall structure, the excessive weight threatened to collapse entire sections of fresco no longer firmly attached to its support. Incorrect restoration had further accelerated the progressive deterioration of the paintings: carried out immediately after the excavation it had not taken into consideration the question of conservation and possible causes of deterioration. This restoration regarded the replacement of fragments of the arches found during the excavation, applying a coat of acrylic resin to the painted surfaces, setting fragments in broad cement borders and reconstructing the roof with reinforced concrete. No waterproof finish was used. The continuous infiltration of water from the roof during the rainy season caused more severe disintegration of the arriccio and general washing away of the colors. The impermeable layer on the colored surfaces prevented the exchange of humidity with the immediate environment and caused crystalization of soluble salts beneath the painted layer, causing this to fall in those areas near the arches and other more superficial detachments between the intonaco and the intonachino.
Closing off the room with an open grating permitted easy access to the area by birds and left the surfaces exposed to the inevitable deposits of guano.

2.1 ***The intervention***
The seriousness of the intonaco detachments required the application of a high concentrate acrylic resin gauze as the first step, in order to attach the remaining fragments to their wall support. The gauze was applied in two layers with Paraloid B72 in a 10% and 20% solution in acetone. Initial dry brushing of the surfaces removed the incohesive deposits and ensured a good adhesion for the gauze.

The areas to be consolidated were emptied mechanically using flexible wooden instruments inserted through existing holes and little openings along the cement borders. Repeated washing with water and alcohol was carried out by injections in lacunae and gaps to eliminate all residual dust and to prepare the wall support and the back of the intonaco for the consolidant.
Consolidation was carried out slowly to avoid sudden weight on the intonaco which, in some places, was held only by the gauze. Starting from the lowest areas of the detachments the empty areas were filled layer by layer at 24 hour intervals . The density of the consolidant mixture was also changed as the operation proceeded: initally more fluid in order to facilitate penetration, it gradually became as dense as plastic in the most external layers so that it could be spread and flattened with spatulas through the side openings along the borders.
Where necessary, props were built and kept in contact with the fragments for the entire consolidation process until the consolidant had set. The consolidant used is a mixture with hydraulic qualities based on lime and brick dust in ratio of 1/2 Lafarge hydraulic lime, 1/2 slaked lime, 1 part sifted brickdust, water [5].
More superficial detachments between the intonaco and the tonachino were consolidated with infiltrations of solution of acrylic resin Primal AC33 5% in water .
The subsequent phase of the intervention involved the mechanical removal of the cement along the borders of the fragments and between the conch stones replaced in position after the excavation, removing the gauze and cleaning the surfaces.
Where removing the cement could have weakened the structure, it was left in place. Long, patient hours with hammers and chisels in hand removed all the cement along the borders without causing any new detachments.

The thick layer of "fixative" painted over the preceding restoration was taken off using compresses of

a mixture of organic solvents, Nitro thinner applied with cotton compresses.
The coherent earth and guano deposits were cleaned with brief applications of a slightly alkaline solvent mixture, Ammonium carbonate solution in water 30 gr/l and EDTA 25 gr/l. and water [2].
The extremely fragmentary quality of the paint layer on one hand, and the broad lacunae of the intonaco on the other, made comprehension of the painted surfaces very difficult. In order to restore a degree of unity to the decorations, and with the agreement of the site administration, the decision was made to integrate the fallen sections of the paint layer, and lessen therefore the tone of the lacunae, with a watercolor gauze without in any way proposing summary and unlikely pictorial representations of the missing parts of the paintings (photo 3). The broad areas where the color surface had fallen were integrated with slightly lower plastering, using a mortar based on lime and stone dust in ratio of: 2 parts local limestone dust, 1 part slaked lime, that resembled in the overall color tones of the surfaces. The architectural detail between the conch stones was represented on the walls that were totally without plaster using a material similar to the original, made of mud, river sand, vegetable fibres and grit. In order to obtain a mixture with excellent elasticity and mechanical resistence, a greater quantity of vegetable fibre than inorganic inert materials was mixed with the mud .
At the end of the intervention, in order to create the conditions for the future conservation of the frescoes and the structures, various provisions were made to remove the direct causes of alterations and to protect the surfaces from possible deterioration.
The first operation was to see to the impermeabilization of the roof with tarred products and a coating of mortar cement. The roof slope to carry off rainwater and the various gutters were repaired. Inside the room, the roof was covered with a double coat of mortar. Water infiltration was thus eliminated as well as percolation on the surfaces. Bird damage was prevented by protective wire fencing stretched over the opening reinforced as well against vandalism. Periodic checks and maintenance of the protective structures ought to remove risks of further damage.
The intervention was carrid out by 4 restorers and lasted a total of 16 working days. An average of 73 hours per square meter of fresco was needed to complete the entire program. This time expenditure is directly proportional to the work necessary to ensure the minimum conditions of conservation and proportional therefore to the damage found on the structure.
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3 The conservation of the hypogean plasterwork and mosaics in the roman houses at San Paolino alla Regola

In 1993, the City of Rome undertook new archaeological investigation of the Roman Houses of San Paolino alla Regola. This is a group of dwellings and storage constructions dating from the first century A.D., discovered beneath a building in the historic center of Rome, in the neighborhood located between the Tiber River and Corso Vittorio Emanuele.
It is a hypogean group at about 10 meters beneath the present street level. One enters through a small doorway situated in the entrance of the building. Trapdoors and other small openings are found at street level. Upon finding four more rooms with floor decorations of black and white stone tesserae mosaic in a geometric design and painted plasterwork, the head of the worksite (the archaeologist who was in charge of the excavation) requested the immediate collaboration of conservators to set up a plan for on site conservation.

Since this was an underground room where the balance of the interior microclimate was extremely delicate, the suggestion was made not to finish the actual excavation phase, to leave the mosaics and plasterwork half buried in order to allow for their gradual adjustment to the new situation, and to put off the study and documentation of the structures to the time of the conservation intervention. Until then, the openings were closed and no lighting allowed so as not to alter the state of the interior climate. In other sections, the excavation is open to the public only for previously reserved guided tours.

The intervention began during the winter of 1994 in collaboration with the worksite management. During the initial phase systems were studied that would permit the work to go on while significantly lessening the risk of compromising the stability established between the temperature and the relative humidity of the air that could trigger off deterioration phenomena due to the crystallisation of salts. Non-incandescent bulbs were used for lighting only when it was really necessary; the number of workers and the time each was present in each of the rooms during the working day was constantly checked in order to control biological growths. The intervention on the mosaics and on the plasterwork aimed at restoring uniformity to the surfaces by consolidating and filling all the visible gaps using lime based materials, similar to the original materials in both composition and granulometry.

3.1 *The mosaics*

The floors that were discovered were made of regular shaped black and white limestone and basalt tesserae placed in repetitive geometric designs.
The first operation consisted in removing layers of earth. The gradualness of the change from burial to the air exposure avoided the violent evaporation of the humidity in the structures and the deterioration due to the consequent cristalization of soluble salts. [3]]
The present state of the mosaics, the result of natural aging of the materials used and the ups and downs of use and abandon that have followed the building through history, can be described in the following points:
-- partial or total decohesion of the layer in which the tesserae were embedded and frequent detachment of this from the preparatory layer with earth infiltrations;
-- large lacunae in the tessera layer and the base layer;
-- micro-fractures in the limestone tesserae;
-- insoluble surface deposits.
While removing the residual surface earth and the earth still in the interstices, the attempt was made to use dry mechanical cleaning methods as much as possible, with very small brushes and instruments and an aspirator in order to limit the humidity being added to the underlying structures. By using only water and a disinfectant that was a light biocide, NeoDesogen solution of 2% in water, for cleaning, the surface deposits were totally removed. In only one case, where there were repeated infiltrations of liquid from the street sewage system, was it necessary to resort to mechanical cleaning using water and nylon rotary brushes and scalpels.
The consolidation was carried out with infiltration of hydraulic lime based mortar [4] in ratio of 1 part sifted grey sand, 1 part Lafarge hydraulic lime in the tesserae interstices (Diagram 1,2,3,4). In this way the original embedding mortar was revived with a material similar to it in every way and strength and solidity was added to the tessera layer. In small detached areas, the tesserae were removed and reapplied on a new embedding layer.
As for the lacunae, it was decided that where the tessellated surface showed large gaps, these would be left visible and the damaged parts would be filled with mortar. The other, infrequent, lacunae in this layer were stuccoed with a mixture of Lafarge hydraulic mortar, slaked lime and marble dust in ratio of 1/2 part Lafarge hydraulic lime, 1/2 part slaked lime, 2 parts marble dust. Small lacunae and gaps along the edges were integrated with original tesserae found during the excavation. Borders were made in order to prevent the tesserae from getting loose.

3.2 *The frescoes*

There were frescoes in only two of the four rooms excavated. In one case there was a single small fragment, without color and completely covered by carbonate concretions. Instead, the other room has much of its original ornament, with traces of polychrome decoration.
The most frequent problems were alterations in the adhesion between preparatory layers, fractures, lacunae in the intonaco, decohesion in the pigments, the surface presence of biological attack and the signs left from ancient fires.
In one wall, the detachment between the intonaco and the wall surface was so great that at the time of

the excavation it was threatening to collapse and had to be contained.
Initially, the earth deposits were cleaned from the fragment surfaces both with dry brushes and light tamping with water . The water used of all phases of the intervention had NeoDesogen added to make a 2% solution.
Consolidating the detached layers was given priority. In particular, the fragment that seemed to be completely detached from its support needed propping for the entire consolidation phase, since the application of a gauze made with acrylic resins was not advisable where biological contamination was a high risk. The operation was carried out in various phases: bands of intonaco up to 20 cm. wide were cleaned on the reverse side using water and alcohol injections and then consolidated with hydraulic mortar infiltrations, mixture of 1 part Lafarge hydraulic lime and 1 part finely sifted brickdust.. Proceeding from the bottom towards the top of the detached section, consolidation took a week's time, leaving the time needed for hardening between one infiltration of consolidant and the next.
Once adhesion between the layers was again established, the process moved on to cleaning the surfaces. This was done using water alone except for those areas were there was biological activity and hydrogen peroxide was brushed on.
All the lacunae, the borders and fractures were stuccoed with mortar based on lime and marble dust in ratio of 1 part Lafarge hydraulic lime, 2 parts yellow marble dust.
A biocide solution of benzalkonium chloride Preventol R80 at 2% in deionized water was sprayed and brushed on the surface when the intervention was concluded.
Overall, the intervention required 14 hours per square meter for the mosaics and 16 hours per square meter for the frescoes. We feel that we have for this once been able to put into practice the principle calling for the least possible interference. The proof lies not just in the time needed to complete the project, but the limited use made of materials extraneous to the structure itself and the minimal operations carried out. The area's conservation now depends upon the constant conditions of the microclimate. The equilibrium of the microclimate, essential in the conditions of conservation, and generally convulsed during an archaeological excavation, guaranteed the success of the intervention with minimum costs.

4 Conclusions

The conclusions ending this comparison of two interventions that began from completely different conditions and premises could be drawn in numerical terms. This is possible with regard to the financial aspects of the costs of the operations and is in any case a significant and useful indication. But besides this we must remember the main aspect, not quantifiable in figures, that would have been the irremediable loss of the structure's completeness. There is no term of comparison for this except that of a cultural property that is or is not damaged.
Although we are aware of the suitable responses to questions of safeguarding these structures, and although we are constantly paying for the errors of the past, in spite of this it is not unusual that archaeological investigations are carried out today without preparing a conservation plan. Even more unusual is the presence of a conservator at an excavation, that is, the person whose profession it is to choose the most appropriate methods of conservation. This is all to the disadvantage of the monument which is often irreparably damaged or damaged to a degree that calls for serious interventions which, in turn, are the cause of other damage. Now, to come back to the words of Brandi, who will assume the social and spiritual responsibility of these losses?

SUPPLIERS

Hydraulic Lime: Cement Lafarge, chaoux blance naturelle, 157 Avenue Charles De Gaulle, 92521 Nevilly, Saine Cedex, France
Paraloid (Acriloid), Room and Haas, Angler Filital, Via della Filanda, Milan, Italy
Neo Desogen, Ciba Geigy, Linea Ospedaliera, CP88, Saronno, Varese, Italy
Primal AC33, Room and Haas, Angler Filital, Via della Filanda, Milan, Italy

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CAPTIONS

Photo 1 Mamshit. General view of the room

Photo 2 Mamshit. The frescoes on the southern wall before the collapse

Photo 3 Mamshit. Cupid and Psyche after the work

Diagram 1 Detachments in depth: most of the deteriorated mosaics in situ present loss of consistency and adhesion of one or more of the preparatory layers. This can happen at various levels -- from the deepest foundation layers to the very surface layers where the tesserae are set.

Diagrams 2 and 3

In order to work beneath the tesserae layer, it is necessary to create several access points. The prepared holes provide digging access to the hollows; the dirt is first removed with an initial dry cleaning with an aspirator, followed by a water cleaning inserting small flexible metal tubes into the empty area. This operation is carried out along with aspiration of the water to avoid accumulation of water and debris inside the hollows.

Diagram 4.

When all the access holes are linked and the hollow is clean, the procedures continues to consolidation. This operation is carried out with grouting mortar (Lafarge hydraulic lime, sifted pulverized brick dust 1:1 with sufficient water added to obtain a fluid mixture). The infiltration is done with catheter syringes.

Place	***Material***	***Surface in square meters***	***Time per square meters.***	***Total time***
Mamshit Israel	Mural painting	**7 sq.mt.**	**73 hours**	**511 hours**
Rome,San Paolino	Mural painting	**5 sq.mt.**	**16 hours**	**80 hours**
Rome,San Paolino	Mosaics	**25 sq.mt.**	**14 hours**	**350 hours**