The on site conservation of archaeological mosaics: the case of the building of the Nile in Zippori, Israel.

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1 INTRODUCTION

This article describes the on-site conservation of a group of 12 polychrome floor mosaics found in a III Cent. A.D public building in Zippori, Israel. [i] The intervention is included in a broader project directed by the National Parks Authority of Israel. The part of the project regarding the mosaics was implemented in two different moments in 1994 and 1995 and is now concluded. Construction of lixed architectural roofing and sealing the trenches left from the removal of the original masonry walls is actually almost completed. Both campaigns were carried out in 'building yard' conditions and under temporary cover. The conservation of the mosaic of the Nile was carried out allowing the public to wach the work "live": a terrace was built for this purpose. We would like to describe the conservation intervention on the mosaics and comment on various aspects. Starting with technical procedures, we will then consider the principles and the objectives behind the choice of the methods followed and we will conclude with some general reflections.

2 DESCRIPTION OF THE BUILDING

The building is situated in the national park of Zippori, in Galilee, Israel, near Nazareth. Numerous excavation campaigns, as well as development plans, have rapidly increased the number of visitors (130.000 in 1994) attracted by the quality of the mosaics on exhibit. The building is called the Building of the Nile because of the extraordinary quality of the mosaic in the main room representing Nilotic scenes. Twelve of the many rooms in the building still have mosaic floor decorations. All are polychrome: some show equestrians figures, others have geometric designs. Unique is the mosaic of the Nile, with scenes representing an extraodinary flood of the Nile, with a river-meter marking the level of the water, with the town of Alexandria with the famous light-tower, together with several scenes of wilde animals hunting each others. They all share high aesthetic and technical quality.

The mosaics' state of conservation divides them into two groups, according to whether or not original masonry is present. The masonry was stolen from part of the building in ancient times, creating severe damage to the floor foundations, considerable loss and upheaval to the mosaics themselves. Where the masonry (and the foundations) are still in place, the floors have partial hollows and surface calcareous deposits, but are in a generally good state of conservation. The damages caused by structural collapse are visible everywhere.

3 THE INTERVENTION FOR THE CONSERVATION OF THE MOSAICS

The intervention took place in two separate campaigns: April/June 1994 and May/August 1995. The first campaign was dedicated to the Nile mosaic; the second dealt with the remaining floors. The work teams comprised 8 professional conservators from abroad plus 4 local technicians. The division of the mosaics into two groups (1 in the first and 11 in the second) depended upon the working and 'strategic' requirements of the site management: the work to be done on the "Nile", a very wellknown mosaic, was meant to create the conditions needed to authorize and finance intervention on the rest of the building. The apparently disproportionate time allotment (3 months for 1 mosaic and 4 months for 11 mosaics) was due to the typology of the Nile mosaic (50 square meters of extremely fine mosaic work) and to its poor state of conservation (large hollow areas in the preparatory layers, insoluble surface deposits, areas where settling had scrambled the tesserae).

This demanded considerable time, whereas during the second campaign, the different state of conservation of the mosaics, the greater familiarity of the conservators with the situation, in general allowed a faster working pace. The working-steps, in the order of their execution, were: planning documentation; preventive measures of protection; pre-consolidation; in-depth consolidation; cleaning; surface consolidation; bordering; treatment of lacunas; final inspection; temporary protection; recommandations for final protection.

3.1 *The Plan*
The plan comprises one general section which describes the principle theories and methods of the program (on-site conservation without detachment, use of traditional materials and techniques, admittance of the public, full documentation of the work as carried out and broad distribution of information): the second section analyses each floor individually. The diagrams of the state of conservation, details of the work to be carried out, time estimates and costs are presented in this part. Using the plan, the "client" can make an economic and technical evaluation of the offer, can organize the contract documents and obtain the required authorizations from the Superintendent. From the technical point of view, the plan allows us to allocate resources, write up the work schedule, organize the purchase of materials and equipment (what was more convenient to buy locally and what had to be imported). Another, and in our opinion even more important aspect of the plan, was its presence as a parameter for what was actually accomplished in the field. The comparative analysis of plan data and effective data, and particularly the study of errors in planning, furnished precious information to add to what we already have in this sector.
To do this, we drew up tables to be filled in daily, showing the date, floor number, technical operations, conservator's name, hours of work. The data thus collected became instrumental in drawing up new plans. They can be distributed and will enrich the files needed to plan the conservation and maintenance of archaeological sites. (diagram 1)

3.2 *Documentation*
Documentation is the first operation carried out on-site: each mark on the mosaic's surface is classified and represented graphically on specific, pre-arranged bases. The process starts by entering the state of conservation (type of decay) of the mosaic, details of the original techniques of making the mosaic (sinopia, *giornate*, retouchings), of the historic life of the building (uses, restorations, collapse of the building). Documentation continues throughout the intervention, entering the operations carried out and the areas treated and will go on throughout maintenance.(diagram 2) [ii]
In order to facilitate graphic representation, computer photographs were used as base. During the first campaign, the information was entered directly at the site in order to perform fewer operations (and errors) and to obtain the finished product immediately. Nothing could have been more purely theoretical. The sunlight and the dust at the site made it difficult if not impossible to make the idea reality. Screened though it was, the sunlight made reading the monitor extremely difficult, leading to a lack of precision in entering and to consequent stress for the workers. The dust quickly damaged the portable computer even though the keyboard was covered by transparent plastic. The second campaign saw us back to traditional on-site paper and pencil, registering data to be entered later in the studio. We feel it important to insist that documentation is not simply registration of data: it is first of all an instrument for the study and understanding of the mechanisms of decay, essential to the successful corrective measures (on structures and floors) to be carried out in preventive conservation.

3.3 *Preventive measures of protection and preparation of the worksite*
The concentration of delicate floors, their high level of fragility and the hollow spaces in the preparation layer of the Nile mosaic, allerted us to take preventive measures of protection.

The worksite was organized with marked paths; systems were set to supply electricity, running water, compressed air directly to the operators. On the Nile mosaic we built a structure holding two movable bridges in metal and wood panels, spanning the width of the floor. They were held by a track based on the foundations of two opposite walls of the room. This allowed two different teams to work contemporaneously on different areas of the mosaic without trampling directly on the tesserae. These bridges were easily moved when necessary, such as when tourists wished to view particular sections of the mosaic or the conservator's schedule permitted the total view of the floor.
This construction added one week to the planned work period, but it was created to insure protection of the mosaic, the safe carrying out of the work and the correct development of subsequent activities.

3.4 *Pre-consolidation*
During this operation, those areas of the mosaic in which the tesserae have become loose or detached from their original beds are temporarily set. The borders of the floor mosaic are reinforced (exteriors and also the internal edges of lacunae) with lime-based mortar (1/2 Lafarge hydraulic lime, 1/2 slaked lime, 2 sifted stone powder) set perpendicularly to the mosaic plane in a very thin layer (1-2 mm). The areas where the tesserae were detached and out of order and which needed consolidation and cleaning, were protected by gauze, once the areas were cleaned with varying kinds of dry and damp brushes. The gauze was applied with an acrilic resin, Paraloid B72, diluted in acetone 15%. Paraloid was chosen after direct comparison with PVA (Polyvinil acetate). This, while more practical because of lower toxicity, easier acquisition on the local market and greater elasticity of the finished product (with respect to Paraloid's great rigidness) turned out to be too vulnerable to water, that we would be using in a subsequent phase. The gauze was removed after consolidation using acetone compresses and brushing. In the rare instances of decohesion of the tesserae themselves, for example of some vitreous pastes, a protective treatment was established using Ethilsilicate Waker OH, applied by brush or dropper.

3.5 *Deep Consolidation*
The main problem in dealing with deteriorated mosaic in situ is the 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. Consolidation is carried out following these steps [iii]:

3.5.1 *Location of hollows*
Done by hand, tapping the mosaic surface to hear the sound variation between "hollow" and "solid". The area identified as 'hollow" is marked using masking tape and is drawn on the relative graphic representation in the documentation.

3.5.2 *Creation of access points*
In order to work beneath the tesserae layer, it is necessary to create several access points depending upon the size of the area to consolidate, and the ease of linking these points. It is usually preferable to work in the lacunae or in damaged areas. Where this is impossible, several tesserae (4-6) are removed, momentarily placed on a clay support, numbered, cleaned, ready to be replaced.
3.5.3 *Gauging the areas to be lifted*
The hollows found near edges or lacunae are at times easier to reach from the edges or the lacunae themselves. This means that the mosaic must be previously 'set' with gauze in order to avoid sinking while the preparatory and consolidation work goes on. This is done as it was for "pre-consolidation."

3.5.4 *Removing all non-cohesive material (infiltrated earth, original disaggregated mortar) from the hollows*
The prepared holes provide digging access to the hollows; cleaning is first done using no water, flexible steel instruments and an aspirator. After the initial dry cleaning, a water cleaning is carried out inserting small flexible metal tubes into the empty area. An aspirator is used to avoid accumulation of water and debris inside the hollows. When all the access holes are linked and the hollow has become one, single even space, the procedure continues to consolidation.

3.5.5 *Introducing new mortar*
This operation is carried out with grouting mortar (Lafarge hydraulic lime, sifted pulverized brick dust 1:1 with water added to obtain a fluid mixture). The area to consolidate must be thoroughly wet with water. The infiltration is done with catheter syringes starting from one side of the hollow and working progressively towards the other. The process is slow and needs constant tapping up until the space is completely saturated.

3.5.6 Revision
The consolidation can be perfected only during the few moments the mortar is liquid. It is therefore very important to check by hand and 'by ear' that the area being treated is completely saturated by the new consolidant. If not, more mixture is injected.

3.5.7 *Removing the protective gauze*
at least one day after consolidation (or more, depending on the climate), when the mortar has reached a degree of solidity, the gauze is removed.

3.5.8 Closing access points
When the infiltration is completed, the tesserae that were removed are replaced and the edges of the consolidated areas are stuccoed (where they reach the borders).

3.6 *Cleaning*
This was carried out preferably by using mechanical hand tools (scalpels, plastic brushes, small chisels), and pneumatic tools (micro-vibrators and nylon brush drills). Once the mechanical cleaning was done, and in order to touch up the results, paper-pulp compresses of AB57 (without sodium bicarbonate)[iv] were applied for 4 hours. When the deposits were particularly resistent, the compress was applied more than once. Each AB57 application was followed by a distilled-water compress in order to lift away salt residues.

3.7 *Surface consolidation*
This is a 'key' operation in the general economy of the result. A relatively simple and quick operation restores the mosaic to a consistency and wholeness of great visual and material impact. The tessellate surface is carefully prepared: the spaces between the tesserae are mechanically cleaned to the depth of the original mortar. An abundant layer of very fluid Lafarge hydraulic lime and pulverized stone dust (l:l) is applied by brushing and rubbing. This is left to dry for an hour, the excess is removed using dampened synthetic sponges. This renews the original mortar network among the tesserae, recreating the homogeneity of the surface that had been lost as the mortar decayed.

3.8 *Borders*
These were defined by creating an edge at right angles to the mosaic surface 1-2 mm wide. The material used was a lime-based mortar made up of Lafarge hydraulic lime, slaked lime, sifted pulverized stone (1/2:1/2:2). The mortar was applied to a carefully wet surface and then thoroughly polished.

3.9 *Treatment of the lacunae*

A double distinction was made in choosing the method to deal with the lacunae. These were treated with a lime mortar the same shade as the lightest tesserae, with the exception of very small lacunae (up to 20 tesserae):where there was no risk or doubt of interpretation, the design was remade with tesserae; instead, if there were problems, the choice fell on using the mortar. The choice was conditioned by the need to restore form to the design, disturbed by many micro-lacunae. This facilitated the aesthetic enjoyment of the mosaic while maintaining its historic integrity in the presence of the larger lacunae and by the detail documentation.

The lacunae not reintegrated with tesserae required a double technique of foundation and final-layer mortars. The mortar for foundations, whose depth varied considerably, was used wherever a layer about 5 mm beneath the final floor level had to be created. This layer was made of slaked lime, non-sifted pulverized stone and washed residues of sifted brick dust in a ratio of 1:2:1/2. At every 1 or 2 cm of mortar, a layer of washed ceramic fragments embedded in the mortar itself was used. The ceramic and the mortar's bigger granulometry (from 1-5 mm) acted as buffers as the mortar shrank during drying. The washed residues of sifted brick dust were used to add hydraulicity and hardness to the mortar without having to add Lafarge hydraulic lime (expensive and not easily found on the local market).

The final treatment of the lacunae consisted of a thin layer (less than 5 mm) of light colored mortar similar to the white tesserae (Lafarge hydraulic lime, slaked lime, sifted pulverized stone in the ratio of 1/2:1/2:2).

The surface was finished by repeated polishing for three days after the mortar was applied; the surface was smooth (no sponging) instead of matte which is aesthetically pleasing but dust-sensitive. The final surface of the lacunae was kept only 2 mm lower than the original to keep the two different materials separate (tesserae and mortar) without weakending the edges too much.

In one case, the floor picturing the Amazons, where the lacuna was greater in size than the remaining part of the original mosaic, a different surface finish was used. The final layer of mortar was tapped with a stone to create a dappled effect typical of the layer in which the tesserae are embedded.

This was done because the smooth finish, although neutral, assumes a definite 'personality' when it covers a large area, and would have interfered, in this situation, with the final, over-all reading of the mosaic. With this solution the lacuna becomes simply one of the preparatory layers of the floor without its tesserae.

- It was, obviously, the subject of lengthy discussion. The comments, put synthetically, are: negative because of the low dust resistence and close resemblance to the original foundation layer, but greatly positive for the aesthetic result and low interference with the mosaic design.

3.10 *Final Revision*

This is the 'final touch' of the work: a careful revision of the entire mosaic surface, to replace occasional missing tesserae (1 or 2), to touch up the cleaning, patch up the stucco. This operation calls simultaneously for a detailed view and an overall impression. During this phase, the documentation is also checked and completed.

3.11 *Temporary protections*

The treatment of the mosaics has been implemented under temporary covers, to be dismantled and replaced with a stable roof after the conservation intervention.

To protect the floors during this work we left precise instructions to implement the following temporary protection:

- geotextile at direct contact of the mosaic;
- a 20 cm. strata of washed tuff grains.

The porpouse of this cover was to produce a passive protection capable to buffer eventual mechanical stresses and accidental falls of objects. At the same time this protection was planned to be inert in case of rain (no substances added to the mosaic) and unsensitive to plans growing.
Unfortunately the protection was "improved" applying playwood on top of the tuff. This instead of offering extra protection cutted the capability of the grains of absorbing mechanical stresses and produced a rigid structures (dangerous for transmitting shocks to the surface of the floors). An even more dangerous risck is the emission of chemical additives in case of rain, very common in winter time.
In the light of this experience and following the experiences carried out in the last years[v] on the temporary protection of mosaics, we present a solution finally suggested for archaeological mosaics. This is made of "pillows" in geotextile, full of expanded clay (or washed tuff), sealed and reusable, of the dimentions of: 200x150 cm. and 100x150. Those "pillows will" be layed on a strata of geotextile of the dimentions of the entire floor, directly applied on the mosaic. The pillows will be moved and stored when the mosaic need to be exposed and relayed on the floor when the pavement needs to be protected.

3.12 Recommandations for the presentation of the mosaics to the public.
The mosaics of the building of the Nile call for some preventive measures of protection before their opening to the public. The future conservation of the mosaics will be directly linked to the architectural solution adopted.

- They need to be roofed and protected from rain, wind-rain and floods;
- Visitors can be allowed to cross the corridors between the mosaics (where there is no mosaic on the floor) but protective solid measures must be taken to prevent intrusions. Paths or a bridges must be set to protect the mosaics from trapling;
- A barrier (even a textile wall) must be built to limit dust entering in the area of the polichrome mosaics;

A little more in detail.

3.12.1 Trampling.
The surface of the mosaic must be in any case protected from the mechanical stresses linked to passage of the visitors. The cured mosaic is now capable of supporting one attentive operator employed to execute the maintenance program, but not physically capable of supporting the stress created by visitors. It is suggested to create peripheral paths or bridges, or however to create a structure that permits the observation of the mosaic avoiding the direct contact between the visitors and mosaic.

3.12.2 Direct exposure to sun
The powerful heat of the sun may cause damages in at least three catagories: thermal expansion, salts migration/cristallization, micro-organisms growing (this last point will be treated separately). To avoid the aforementioned risks it will be necessary that the covering protect the mosaic from direct insolation. The covering would be sufficient if it separates the mosaic from contact with the sun's rays.

3.12.3.Direct rainfall and wind carried rainfall
Similar to the principle of the migration/cristallization of the salts, it is important to avoid the contact between water and the mosaic. Water is specified as that which comes from direct rainfall, rainfall carried by wind, or flooding, (the latter point will be dealt with separately). To all of the damages relative to the risks of solubilizing and instigating movement of the soluble salts is added the mechanical damage caused by the impact of direct rain drops.

The architectural structure must be constructed with these elements in mind and protect the mosaic from the top (direct rainfall), from the sides (rainfall carried by wind), and flooding (gutter system)

3.12.4. Flooding
In addition to the aforementioned risks, the risk of flooding must be mentioned. Such an event would bring a large quantity of debris (mud, various clays) that would seriously compromise the cleaning of the mosaic. One must therefore foresee the presence of structures (peripheral drainage) capable of collecting and draining excess water.

3.12.5. Underground flowing water
This is defined by the passage of water in great quantity that could be linked to the presence of antiques channels no longer efficient. This would produce leakage of water and eventual erosion of the foundations and the introduction of an anomalous quantity of humidity. This risk could be avoided through an archeological analysis of the adjacent area and with a deviation and maintenance of eventual channels.

3.12.6 Biodeterioration
The growth of micro-organisms is among the factors most linked to the architectural choices. The most efficient protection will be the constant maintenance of the floors.

3.12.7. Dust
It is probably one of the most urgent and macroscopic problems of the mosaics. This is obviously related to its setting in a rural environment. To avoid that the dust deposits on the mosaic and transform into insoluble crusts, one must realize a continuous and frequent maintenance program. It is suggested to keep in mind this factor in the moment of the projection of the architectural structure and to foresee the problem realizing an enviroment semi or completely protected by the infiltration of dust. This does not necessarily signify the realization of heavy, solid structures. The dust may be screened even by light and flexible materials (textiles).

3.12.8. Unplanned artificial humidification
This signifies the risk that one, in order to revive the colors, throws water on the mosaic. It is well noted that this is a frequently used practice (internationally and locally). For this one must foresee the possibility to prevent the risck informing the tourist guides and at the same time to control the area.

4. PRINCIPLES AND OBJECTIVES GUIDING METHOD CHOICES

The plan for on-site conservation of a building with 12 mosaic floors, carried out in an archaeological area open to the public, is more complex than simply the technical enterprise might be. Without in any way diminishing its strictly conservation-specific aspect, we would like to indicate other components of the intervention: the degree to which careful administration of a conservation programme can contribute, in terms of technical, cultural and training initiatives (project cultural quality). We feel it is interesting to stress these aspects because, in spite of the importance that they normally have in the general economy of this work, there is a tendency in the professional literature to overlook this in favor of more strictly technical details, such as the choice of materials and restoration techniques. This is the result of the old viewpoint that considers restoration as the qualifying (and at times unique) moment of the conservation process, rather than as a technical phase of a broader, more complex plan. Given this, we can see which additional objectives (besides, that is, the material result of the conservation of the mosaics) were attempted at Zippori. These are: to demonstrate the validity of the principle of in <u>situ</u> conservation; to maintain all the historical values visible on the mosaic surface; to open the work site to the public; to guarantee a maintenance plan by training local staff.

4.1 *To demonstrate with practical results the validity of the principle of in situ conservation of mosaics without detaching them and using exclusively traditional materials and techniques*

Few years have passed since ICCM (International Committee for the Conservation of Mosaics)[vi] fostered discussion regarding the steps to be taken in situ consolidation of mosaics versus automatic detachment, and in favor of the use of traditional materials and techniques, opposing cement and synthetic resins. So few, in fact, that it is surprising to see how much progress has been made. We can start no earlier than 1990 in Israel to find the beginning of the process which has led, today, to use in the field and almost complete acceptance of the principle of mantaining mosaics and wall paintings in situ. The conservation of the Nile mosaic was strong propaganda in this sense: if the method was successful with such an important mosaic, then it must work.

As we usually do, we invited, with a multi-language questionnaire, public comment on certain aspects we felt were important or perhaps dubious. At the question: "*To conserve and to exibit to the public the mosaic of the Nile we had 2 possibilities:"* pleople answered in the following way: 89% "*to restore the mosaic in situ and to construct a cover for protection"* and 11% *"to detach the mosaic and to transfer it to a museum".*

4.2 *To maintain all the historical values visible on the mosaic surface and otherwise classified as: re-utililization, old restorations, settling, mechanical damage, lacunae, breakage*

Directly connected to the in situ conservation of the mosaic is the theme of preserving the aesthetic image of the floor as it has come to be through the centuries. Obviously we do not mean dirt deposits or other extraneous elements that interfere; we mean the preservation of all natural and anthropic traces which have characterized the mosaic as we know it. In order to understand the principle more clearly, we can use as examples a modern mosaic and an archaeological mosaic. The place we would expect to find the former is probably an interior design show; whereas the latter would be an archaeological dig. We must respect and satisfy the expectations of the public that comes to visit a site, avoiding the trap of presenting a mosaic "bright, shiny, good as new." We should, instead, encourage an historical interpretation through the marks left in time, presenting a clean work of art, free of disturbing elements but complete in its particular history and within its own context. Asking to visitors: *"The mosaic as you see it today conserves the signs of its history such as the bizantine restorations and the indentation caused by the fall of the ceiling",* 77% think that *"this is part of the history and therefore must be conserved and presented to the public"* and 23% think that: *"these elements disturb the legibility of the mosaic and must be removed in order to bring the surface to its original level state".*

4.3 *To open the work site to the public and thus transform a technical intervention into a cultural event*.

Thanks to the terrace built above the Nile mosaic, almost 10,000 visitors each month were able to see the works in progress 'live.' This initiative was completed with information posters, updating briefings for tourist guides, lectures and guided tours. All this contributed to open the technical intervention into a cultural event, creating greater sensitivity among the public towards safeguarding the cultural heritage. Opening the conservation project to visitors does not means simply to allow the public physical access to the site: the relationship with the public must be active, it must be managed rather than endured. The public must be made to feel welcome by didactic aids or guided tours: in Zippori the tourist guides were constantly brought up to date about the progress of the work, and thus they functioned as a cushion between the public and the conservators. The response of the children has been very positive, as has been shown by the large number of guided tours requested by the schools. The initiative met with great public success and achieved considerable media attention.

4.4 *To guarantee a maintenance plan by training local staff*

Conservation does not end with the intervention itself but must continue through the years with constant maintenance. We must say that a conservation programme's success is measurable in the future maintenance of today's results. It is equally clear that the best way to ensure that maintenance will continue is to make it economically viable. This means minimal present costs, maximum future saving. To achieve this the resources found in the field must be used and maintenance must be immediately linked to the conservation intervention (obviating damages and limiting future restoration needs). The conservation team from Rome was therefore reinforced by four local staff workers. They were trained to carry out maintenance operations such as documentation, cleaning and possibly revising the stucco work and consolidation.
The mosaic floors are consolidated, cleaned, filled and ready to be presented to the public. The suggestion for maintenance presented are referred to the moment the mosaics will be re-opened on display, inside an architectural structure or roof.
Maintenance will be organized in two different parallel phases: direct treatment of the mosaic and control.

direct treatment:

- dry cleaning of the mosaics with plastic soft brushes and vacuum cleaner;
- light humid cleaning with sponges;
- control of the solidity of the mortar in between the tesserae and replacing consolidant where required (see: superficial consolidation)

control (recording datas):

- of growing of micro-organisms and plants
- of cristallization of soluble salts
- of the hollow spaces in the preparation layers

These operations will be carried out by two local operators. It is suggested that the same technicians that made the conservation work (C.C.A.) will carry out a general review of the mosaics (una tantum) in the first 5 years after the treatment.

Operations:	***Schedule:***	***Time***	***Time x month***	***Time x year:***
dry cleaning	once a week	1 day	4 days	52 days
humid cleaning	once every two weeks	1 days	2 days	26 days
control of the mortar	once a month	1 day	1 day	12 days
general control	once every three month	2 days		8 days
dry and humid cleaning	special climatic or social events			5 days
		TOTAL	**x year**	**103 days**

5. CONTINGENCIES

This item always appears in the balance of payments, but never in reports. The reason is that probably the conservator is afraid of being accused of something going wrong. We would instead like to comment upon an un-planned aspect of the programme since analyzing contingencies is the best way to avoid similar errors in the future.

A series of organizational problems led to undertaking the second campaign while the cover and new wall foundations were being built. This created a series of obstacles that need no comment:

- the floors were not filled into the outside edges;
- people not connected to the conservation project were continually moving around consequently damaging the mosaics;
- the conservators were constantly distracted by so much extra activity;
- the newly restored floors had to be covered again with geo-textile and washed tuff grains for their protection;
- organizing an official opening ceremony for public and media at the end of the job was impossible.

6. CONCLUSIONS

It has again become evident that during a conservation process the mosaic is the weakest element in the building and must be given absolute priority in terms of protection. This means that excellent working conditions must always be created, limiting interference and the number of operations to be carried out. Every contact with the mosaic (documentation, photos, visits, interviews, studies) is a source of potential damage in spite of whom may be responsible. Ironically, the more the person in charge feels part of the process and expert in it, the more careless he becomes, and possibly dangerous. And even if these damages, should they occur, be minor, their very number creates a problem. The protective measures (temporary earth covering, covers of other kinds) are in any case stress sources for the floor, straining one tessera against another. We could define a new threat - **Excess Care.**

The obvious conclusion: efforts must be concentrated on planning, even putting off the starting date to ensure excellent working conditions.

At the end of this experience, we raffirm the validity of the principles and techniques such as: in situ conservation without detachment, preservation of historic 'traces', techniques based on the use of traditional materials; and especially we would emphasize the success we met in opening the work-site to the public. Visitors (and the media) responded enthusiastically, confirming the concept that investments in information have high yielding results.

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Diagram 1
Datas in this diagram are referred to 12 floors, for a total of 250 square meters of mosaic. Time is intended per square meter and is presented in minutes (m) and hours (h).
The state of conservation of the floors was very variable: from good to very poor, therefore the above datas are interesting if used as averages.

Diagram 2
The list of the items observed during the documentation.

	1	2	3	4	5	6	7	8	9	10	11	12*	Average square m
tion	30m	5m	5m	5m	5m	20m	5m	10m	20m	40m	10m	45m	**15 min.**
m. ı w.	90m	5m	5m	5m	30m	1h.	30m	30m	1 h.	40m	20m	1 h.	**30 min.**
ion	12h	10m	30m	10m	9h.	12h	6 h.	3 h.	11h	2,5h	20m	2 h.	**5 hours**
g	7 h.	1 h.	20m	20m	2h.	4 h.	3 h.	2 h.	3 h.	1,5h	1,5h	7 h.	**2,5 hours**
ısol.	1h.	10m	10m	5m	15m	1 h.	15m	40m	20m	10m	30m	1 h.	**30 min**
g	2 h.	10m	5m	5m	2h	2 h.	2 h.	40m	20m	1 h.	20m	15m	**50 min**
eat.	2 h.	10m	10m	30m	20m	3 h.	3 h.	40m	1 h.	1,5h	20m	4 h.	**1,5 hours**
ct.	12h	10m	5m	10m	50m	40m	10m	20m	1 h.	1,5h	2 h.	4 h.	**2 hours**
	38h	**2h**	**1,5h**	**1,5h**	**15h**	**24h**	**15h**	**6,5h**	**18h**	**9,5h**	**5,5h**	**20h**	**13 hours**

Carbonate deposits	Old walls
Decohesion of tesserae	Old restoration with tesserae
Deformations	Tesserae of glass paste
Detachments in depth	Bordering and fillings 1990
Detachment of tesserae	
Erosion of mortar between tesserae	Chemical cleaning
Exfoliation	Consolidation in depth
Fractures	Consolidation of glass paste
Lacunae	Extraction of soluble salts
Mechanical trauma	Filling and bordering
Pulverization of tesserae	Final revision
Scratches	Infiltration points
Subsidences	Lifting and relaying
	Mechanical cleaning
Engravure	Superficial consolidation
Sinopia	Velatura

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