

The conservation of the mosaics in the Thermae of the Cisiarii: technical report

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The project for the conservation of the mosaics of the *thermae* of the Cisiarii represents the practical application of one of the projects conceived in the framework of ICCROM's Progetto Forum. The aim of this programme is to identify a safeguard policy which, once tested on a single archaeological monument, may then constitute a prototype applicable to the conservation of the entire site.

The conservation project in question was developed by carrying out a direct intervention on the mosaic floors of the *thermae* of the Cisiarii and by applying preventive measures of safeguard. Concurrently, major emphasis was placed on offering information to the public in such a way so as to make it an active partner in the project.

In this report we will describe all the phases of the project, its technical aspects and its methodological principles. In conclusion, we will present the results of this experience.

A safeguard policy

One of the most difficult tasks faced by anyone dealing with safeguard problems is how to preserve the archaeological heritage for as long as possible. The problem is, in essence, how to ensure the durability and integrity of cultural properties that are indissolubly linked to their surrounding context. What emerges at the end of an excavation is a sum of structures, objects, and decorative elements that constitute a single ensemble. From the 'reading' of this ensemble, and of the relations by which its constituent elements are bound together from the moment of origin to that of burial, we receive information directly from the past.

Thus conservation of archaeological heritage means conserving as far as possible an entire site; it means intervening directly on the materials and on the environment so as to limit the elements putting its long-term conservation at risk, and in order to improve the 'reading' of the monument. To fulfil this task, difficult and costly from the point of view of the human and economic resources involved, it is necessary to implement a safeguard policy which is able to achieve the maximum results with the minimum input. This means conserving the monument with recourse to such means as prevention, planning of interventions and maintenance, while at the same time ensuring that the public continues to gain access to it.

For a safeguard plan to be effective, some prerequisites are essential:

- the technical solutions adopted need to respect the ancient structures in terms of their aesthetic impact on the environment and of the materials used. The latter need to be compatible with the original materials of the monument and, at the same time, reversible;
- the intervention as a whole must be simple, practical and cost-effective. This means limiting to the minimum the direct operations on the artefacts and using for their restoration or conservation materials that are easily obtainable and do not require sophisticated instruments of application. The carrying out of periodic maintenance will ensure the long-term conservation of the site;

- the programme must aim at creating a relationship with the public through appropriate channels of information. The public is, in the last analysis, the main beneficiary of the archaeological property.

The intervention on the *thermae* of the Cisiarii, conducted on the basis of the afore-mentioned principles, represents an example of how to apply a safeguard policy which can be extended to other sites.

The conservation of the mosaics

The conservation programme begun in November 1993. The first step was the protection of nine rooms decorated with mosaic floors. This was followed by the conservation treatment proper, which is now complete. A maintenance plan for the future conservation of the mosaics has also been drawn up and is currently being evaluated by the Soprintendenza di Ostia.

The *thermae* of the Cisiarii is an open-air site, exposed to the elements. It is situated in a privileged position on the route visitors are recommended to take through the site. Although not all the mosaics are visible from the street level, the *thermae* of the Cisiarii are one of the monuments most frequented and admired by visitors to Ostia Antica.

Intervention

The direct intervention on the mosaic floors was planned in order to create the necessary conditions for their future conservation. The criteria that guided it were those of in situ treatment through the minimum possible intervention, the compatibility and reversibility of the materials used, and the possibility of repeating the operations performed on other sites. The problems presented by the mosaics included the detachment of the bedding layers and of the tessellation itself, the disintegration of the mortar between the tesserae, lacunae, and deposits of biological and chemical origin. Some floors had been treated in the past, by having sections of the mosaic lifted and re-laid on reinforced concrete beds.

The following operations were carried out: documentation, pre-consolidation, consolidation of detached portions of the bedding mortar, cleaning of the surfaces and removal of the old stucco, surface consolidation, levelling of sunken areas, and treatment of the lacunae.

Documentation

The first operation carried out was the in situ documentation of the state of conservation of the mosaics through drawings and photographs. All the forms of alteration encountered, the traces of previous restorations and the materials extraneous to the original structure, were recorded by means of graphic documentation. The operations carried out and the areas treated were registered by the same system throughout the intervention.

Documentation represents a primary resource for studying the mechanisms and causes of deterioration. The preventive measures to be implemented and the operations to be conducted depend on a proper understanding of the causes of alteration.

Pre-consolidation

The areas that presented tesserae completely detached from their bedding were temporarily fixed in two ways. The borders and lacunae in the tessellation were stuccoed with a mortar with a low lime content (2.5 p. of grey sand, 1 p. of slaked lime), while the internal zones of the mosaics which had detached tesserae were first dry-cleaned with brushes and a vacuum cleaner and then protected with a layer of gauze applied with Paraloid B72 (solution at 20% in acetone).

Consolidation of deep areas of detachment of the foundation

The partial or total loss of adhesion between the bedding layers is one of the main phenomena of deterioration encountered in excavated mosaic floors.

The intervention of consolidation, extended to all the areas of detachment, represents one of the fundamental factors for creating the necessary conditions for the future maintenance of the floors.

Through injections of a consolidating mixture, the setting bed on which the tesserae are laid is reconstituted and the cavities between the mortar layers are filled.

This operation was conducted in the following phases: identification of the areas of detachment; opening of access holes; removal of detritus and earth from the detached area; and injection of the consolidating mixture.

Identification of the areas of detachment: the detached areas were identified through manual acoustic testing, and their position was plotted on the surface of the mosaics with scotch tape. The surface markers permitted a constant control during the subsequent operations in the area of intervention.

Opening of access holes: in order to be able to operate in the area below the tesserae, holes were made corresponding to lacunae or damaged areas in the zone to be consolidated. In some cases it proved necessary to remove a few tesserae. Conserved on a provisional clay support, and their exact position plotted in diagrams, the tesserae removed were reinstalled in situ at the end of the intervention.

Cleaning of the detached areas: accumulations of loose earth, plant roots and detritus present in the detached zone were then removed through the holes. This operation was conducted using a vacuum cleaner and flexible metal instruments.

Repeated cleaning with water was then conducted to completely clean the lacunae in the bedding layers and to soak up loose plaster in such away so as to facilitate the injection of the consolidating material and the total refilling of the detached areas.

Injection of the consolidating mixture: the mixture used was an amalgam of lime, sifted brick dust and Lafarge hydraulic lime, in proportions of 1:1, with the addition of sufficient water to render the mixture liquid and permit the setting of the consolidant. The mixture was injected with catheter syringes, proceeding from one hole to the next, until the detached portions were completely saturated.

Cleaning of the surfaces and removal of stucco

The surface of the mosaics was cleaned in order to remove loose deposits, algae, carbonic incrustations. Previous treatments of lacunae in the tessellation, either made of cement, or now altered, were manually removed using chisels and hammers.

The surface of the tesserae was first cleaned with nylon brushes and scalpels. Where necessary, pulp paper compresses and a solvent mixture (ammonium carbonate 30 gr., EDTA25 gr., NeoDesogen 10 cc. per lt. of deionised water) were used for cleaning the surface. The duration of the application of the compresses ranged between 2 and 3 hours. Each residue of the cleaning was removed with deionised water and pulp paper, which was left on the surface until it had totally dried out.

Surface consolidation

This operation was conducted in all the zones where the original mortar between the tesserae had lost cohesion or was lacking. In this way the adhesion between the tesserae was renewed and the homogeneousness of the surface was restored. The spaces between the tesserae were manually cleaned until more consistent layers of original mortar were reached. After having liberally wetted

the surface, a liquid mortar was applied with a brush (sifted grey sand 1 p., Lafarge hydraulic lime 1/2 p, water). Any excess consolidant was removed with damp sponges after the beginning of the setting phase (approx. 1hour).

Levelling of sunken areas

In view of the limited size of the areas of mosaic that had subsided, it was possible to remove the tesserae one by one and then relay them on a new support. For this purpose a lime-based mortar was used (sifted sand 2 p., Lafarge hydraulic lime 1/2 p., slaked lime 1/2 p.). Care was taken to maintain the original orientation and position of the tesserae unaltered, by inserting them in a provisional support of damp sand.

Treatment of lacunae

With the exception of small lacunae, filled with loose original tesserae recovered during excavation, the lacunae in the tessellation and in the bedding layers were treated with lime-based mortar.

In the foundation strata, down to approx. 1 cm. below the tesserae, a mortar with an inert-binding proportion of 3:1 (non-sifted powdered brick 2 p., non-sifted pozzolana 1 p., slaked lime 1 p.) was used. This was then covered by a final thin layer of mortar, to which colours were added so as to match those of the mosaic surface (inert-binding proportion 1:2.5, slaked lime 0.5 p., Lafarge hydraulic lime 0.5 p., yellow sand 1.5 p., grey sand 0.5 p., powdered stone 0.5 p. passed through a fine sieve).

Larger lacunae in the mosaic were treated in such a way so as to create a run-off channel for rain-water, reaching beyond the mosaic surface.

Preventive measures of safeguard

Since the mosaics in question are situated in the open air, and are characterized by a largo influx of visitors, a long-term protection system was studied which could combine the needs of conservation with those of public access to the monument. It was decided to opt for a temporary cover, which would permit periodic opening to the public of all the mosaics while at the same time maintaining the running costs low.

After having classified the floors on the basis of their state of preservation, their visibility from the visitors' route, and their intrinsic importance for the understanding of the monument, a selection was made of those mosaics that needed to be covered permanently or seasonally, and those that could be maintained visible to the public throughout the year. By drawing up an annual schedule of which mosaics needed to be covered, and when, it was possible to reduce the total surface of mosaic exposed to the risks of environmental deterioration, and limit their exposure to the period of minor climatic risk. A periodic maintenance plan was prepared (it is currently being assessed by the Soprintendenza di Ostia) for the mosaics left permanently open.

Two types of protective covering for the mosaic floors, were tested on an experimental basis. We will call them M and T. The materials used in both systems respond to the needs of the conservation programme: they can be fully reused without further cost other than the initial investment; they are completely inert (the materials do not introduce any harmful elements to the bedding and they are resistant to mechanical, chemical and biological stresses); they inhibit the growth of roots and permit the exchange of humidity with the environment.

M: 'mattress'. This consists of a large piece of geotextile folded over and sewn together on three sides to form a sack measuring 3 x 3 m. Laid on the surface, it was then filled with a mixture of expanded clay (Leka) in granules and powder in proportion of 1:1. The visible surface was then camouflaged with a thin stratum of Leka sand to reduce its aesthetic impact on the environment.

T: 'textile'. This consists of a multistrata geotextile, water permeable but resistant to ultra-violet rays, with an anti-root barrier and a drainage stratum. This is available in widths of 2 or 3 m., and can be cut to the length required. Applied on surface areas of smaller dimensions in single pieces, it was covered by a mixture of Leka sand and Leka granules for an overall depth of 5-10 cm.

A comparison between the two types of cover over a period of time, has permitted the evaluation of their effectiveness, both from the point of view of conservation and from that of the facility with which they can be installed.

As regards the mosaics protected by cover type T, it was found that, after a year's trial in situ, it provided ineffective protection against biological growths. This is presumably attributable to a discontinuity of the contact surface between cover and mosaic, which left cavities in which roots could grow.

Fungal colonization and the efflorescence of mineral salts were also recorded. From these phenomena it must be concluded that the cover did not provide watertight conditions, and that, under it, damp was allowed to stagnate and water to evaporate.

The case of cover type M was different. Thanks to good adhesion between the cover and the mosaic, due to greater flexibility and greater weight, the results from the conservation point of view were more than satisfactory: no biological growth was recorded; and no phenomena of crystallization of soluble salts were encountered. The mosaics were conserved in a stable microclimate, protected from every kind of conservation threat. At the time of the removal of the cover, however, one unforeseen problem emerged: it proved difficult to empty the sacks of their content. They had to be emptied manually with shovels, and this took hours. In sum, the method proved to be effective from the conservation point of view, but impractical in terms of installation/removal.

Having excluded method T, very practical but ineffective, it was decided to improve method M, by simply reducing the size of the sacks. In future, cushions will be produced measuring 100 x 150 cm. These will be filled with just granules of Leka up to a thickness of approx. 10 cm. The cushions will be placed one next to the other over an underlying layer of geotextile of a size equivalent to that of the whole mosaic, placed in direct contact with it. The cushions will be filled and then sealed, and they will not be emptied when they are removed. When the covering is removed from the mosaic, the cushions will be simply lifted and stacked one on top of the other. This system will permit a simple covering and uncovering of the mosaics with the complete recuperation of the materials and a minimum effort in installation and removal. The estimated costs of this method are: supply of the geotextile and professional sewing: approx. US\$ 60; material for filling the cushions (Leka): approx. US\$ 10. Total cost per sq.m. approx. US\$ 50.

This expenditure should be considered one-off, at the beginning of the maintenance programme, though renewal costs (to obviate accidental damages) equivalent to 20% of the initial expenditure are envisaged for every 5 years.

Maintenance plan

Together with the covering programme, a plan for the maintenance of the mosaics exposed to the open air was studied. Without a maintenance programme, the interventions carried out and the costs incurred would risk being frustrated by the emergence of new phenomena of degradation.

This programme is based on the presupposition that some floors will be temporarily covered in the cold seasons, and that all the rooms of the complex will be subjected to direct maintenance interventions twice a year. These interventions will be conducted in tandem with the phases of the covering and uncovering of the mosaics.

Maintenance in this case means the periodic elimination of the plants and their roots that have infested the mosaics; biocide treatment to prevent the development of algae and micro-organisms; the regular removal of natural deposits (leaves and earth); the checking of the resistance of the materials used in the intervention; the repair of any damage to the mortars used in the consolidation between the tesserae and in the filling in of the lacunae, and the control of the run-off of rainwater. These simple operations, if performed with some regularity, will ensure the future survival of the mosaics without recourse to massive, and economically prohibitive, interventions. The times (and hence the costs) estimated for the implementation of the maintenance plan are: a total of 360 hours (two campaigns per year, 180 hours each); 10% of the manpower cost for the purchase of materials; 10% of the manpower cost for the documentation.

Information for the public

Ensuring the conservation of a monument also means maintaining alive its relationship with visitors of every age, from the youngest to the oldest, who come to archaeological sites every day, to inspect, learn about, or simply admire the heritage of the past. It is not infrequent, however, for the implementation of conservation programmes on ancient monuments to be accompanied by the closing of the monuments to the public, thus contradicting the very purpose for which the operations are being carried out.

By considering the visitors as privileged interlocutors of the programme, it was possible to transform the conservation process into a cultural event that heightens the awareness of the public about problems of safeguard, and at the same time keep the monument open for public inspection.

Five bilingual panels were placed on the road that skirts the thermae. These provided basic information on the monument and on the safeguard measures taken, together with photographs. From this raised position, the visitors were able to observe the various phases of the intervention from the roadside and at the same time converse with the personnel.

Conclusions

In conclusion, we would like to make a few remarks of a more general character. A minimum programme of renovation of the mosaics with the use of traditional materials has restored legibility to the monument. A rotating system of covers for the mosaics and a single maintenance programme has created the conditions for the monument's safeguard.

At the same time, the public has not been deprived of the opportunity to gain access to the monument and understand its significance.

Last but not least, the operations carried out were simple and involved the use of materials that are easily obtainable and low in cost.

We believe, therefore, that we have achieved our objective: that of providing a model of intervention that can be easily repeated on other archaeological sites.