

BACHARACH THE RESTORATION AND CONSERVATION OF ISLAMIC MONUMENTS IN EGYPT

# The Restoration and Conservation of Islamic Monuments in Egypt

Edited by  
JERE L. BACHARACH



## The Restoration and Conservation of Islamic Monuments in Egypt

The Cairo earthquake of October 1992 was the immediate background to an international conference of art historians, engineers, and architects, held in Cairo in June 1993 to discuss general and specific problems related to the preservation and conservation of Islamic monuments in Egypt, with particular focus on Cairo. More than half the participants were Egyptian, while others came from the United States, Britain, Germany, Italy, Poland, Switzerland, and Turkey. The papers presented in this volume record the views and experiences of this diverse group of specialists.

In the first section of the book, the opening essay raises critical theoretical issues on the nature of restoration and how decisions to repair, replace, or remove particular elements in a building reflect the values of a particular time and group of individuals. A second essay addresses the question of approaching restoration in terms of an historic zone rather than particular buildings, and others demonstrate the breadth of overseas involvement in the restoration of Cairo's Islamic monuments, with specific examples of work undertaken by Germans, Italians, and Poles. The technical problems facing any restoration or

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**Jere L. Bacharach**

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# **The Italian–Egyptian Restoration Center's Work in the Mevlevi Complex in Cairo**

**Giuseppe Fanfoni**

The Italian–Egyptian Restoration Center (C.F.P.R.) was inaugurated in 1988. On this occasion, the restored sama'khana of the Mevlevi dervishes (a well-known Turkish order) was opened to the public and to visitors. The restored sama'khana is part of a large architectural complex in which the Italian–Egyptian Restoration Center is located. It is responsible for the recovery of other historic buildings in collaboration with the Egyptian Antiquities Organization. It also serves as a training center for Egyptian restorers of the EAO and students of Egyptian universities, and has been sustained since 1977 with contributions from the Italian Ministry of Foreign Affairs.

## **The Architectural Complex**

The area, which is at the foot of the Citadel, comprises buildings of different ages and purpose. The planimetric, historical, and archaeological study undertaken shows that the most ancient buildings were architecturally connected by the Mevlevi dervishes in the course of the last intervention (between the seventeenth and nineteenth centuries). The most imposing part of the complex is the so-called Yazbak Palace on the east side of the area (built and enlarged in the time of Qawsun, Yazbak, and Aqbardi between the fourteenth and fifteenth centuries). The mausoleum of Hasan Sadaqa, the minaret, and the remains of the madrasa of Sunqur Sa'di (partially reused for the building of the Mevlevi sama'khana) engage the west side of the complex, fronting Shari' al-Suyufiya (fig. 1). The whole area was given to the Mevlevi dervishes in 1607 by Prince Sinan, and they, in various phases, adapted the existing buildings to the needs of the confraternity.

They built a new wing on Shari' al-Suyufiya, which allowed access to the large Aqbardi garden and to the conventional area. Then they built the

eighteen cells of the convent around the garden, where the internal front of the sama'khana is located, and around the Aqbardi garden, largely preserving the existing structure of the Yazbak Palace (figs. 2, 3). At present, handicraft laboratories have been set up in the area of the convent for various specialized sectors devoted to restoration (woodwork, metalwork, ceramics, drawing, photography, etc.).

### **Methodology of Intervention**

A historical study of the buildings of the area has been carried out on the base of a planimetric survey of the whole architectural complex. At the same time, both a technical survey of the sama'khana and the first urgent intentions to save the collapsing dome were undertaken. The gradual acquisition of historical and technical data during the course of the first restoring operations made the complexity of the restoration project more and more evident and interesting.

The cognitive and operative aspects of the problem of this monumental restoration are interlinked. The technical study of the complex (implying surveys and inquiries) is useful for gaining information on the historical period as well as on the typological character of the buildings, but at the same time it gives us information on the techniques and materials used, which is necessary for deciding how to carry out the project with respect to the historical data. Until now, the main restoration has focused on the sama'khana, the Hasan Sadaqa mausoleum, and the Sunqur Sa'di madrasa (where the restoration is in progress).

The Mevlevi sama'khana is a cultural domed building built on a central plan, mostly of wood and reusing such ancient structures as perimetrical walls. In fact, it was built on the space of the main court of the Sunqur Sa'di madrasa and on the walls surrounding it, but at a level three meters higher than the original. The main problem we faced was to restore the sama'khana and at the same time carry out archaeological excavations under it, keeping the underlying structures (figs. 4, 5).

The urgency of the work coupled with the wide variety of technically and historically interesting aspects impelled us to start the recovery project in 1979 with the aim of rescuing the sama'khana and the underlying archaeological remains. An analytical study of the ancient techniques revealed the use of very low-level technology and poor materials, which caused static trouble to the monument as soon as it was built.

It is a problem that more or less concerns most of the Islamic monuments in Egypt. We have confronted it by studying and applying appropriate technologies, which have integrated the original and local techniques, and have maintained the functionality of the building while preserving the aesthetic and formal aspects of the monument. Advanced technology, with the use of particular machinery imported especially from Italy, is now being applied to stop the rising humidity in the Hasan Sadaqa mausoleum. This is



an operation that does not interfere with the general methodological lines, but develops them further. It is in fact the only way that has been found to solve the problem. Moreover, it may be applied to any Egyptian monument.

### **Restoration Techniques**

The restoration operations were defined as the result of the technical surveys and studies made for the restoration itself (cracks of the structure, settlement and crevices, out of plumb, etc.) on the buildings to the east of the architectural complex. The areas of restoration concerned: consolidation of the walls; consolidation of the wooden dome of the sama'khana; archaeological digs of the Sunqur Sa'di madrasa around and under the sama'khana; temporary work supporting the structures during the time necessary for the completion of the digs; new foundations of the internal structures of the sama'khana; restoration of the wooden beams and reinforcement of the floors to meet maximum safety loads; some seismic retrofits of the structures; tempera painting restoration; interruption of rising moisture in the walls of the sama'khana using resin injections and the realization of air space for ventilation; and interruption of rising moisture in the walls of the Hasan Sadaqa mausoleum by cutting the walls through the whole thickness and inserting a waterproofing layer.

### **Strengthening the Walls**

The masonry of some parts of the walls has completely deteriorated because of the constant infiltration of polluted water and the formation of salts produced by rising moisture. In other parts, settling of the foundations created cracks and empty spaces in the wall structures.

We consolidated the stone walls with injections of a mixture of lime and powdered inerts similar to the original mortar, with the addition of acrylic resins, in order to achieve reinforcement in a shorter time. In addition, the brick walls on the south side, belonging to the Sunqur Sa'di madrasa, have been strengthened by a mixture of epoxy-resins allowing better capillary penetration of the material in the numerous cracks and internal crevices that have occurred over time.

Care has been taken to preserve the visible traces of the functional, artistic, or formal changes in the history and reuse of the building; a graphic representation on the north and east external plaster shows us the presence and situation of more ancient structures inside. On the south, the reused brick wall of the Sunqur Sa'di madrasa, has been left without plastering in order to testify to different periods of construction (fig. 6).

### **Restoration of the Dome**

When we started restoration work in the area, the sama'khana dome was in danger of falling down as it had been flattened and distorted by a great deal of settling of the foundation. After supporting the dome from the inside with

wooden scaffolding, we applied a steel belt on the outside (composed of three elements) at its reins. By tightening the hoops gradually and checking the reduction of the cracks from inside, the dome recovered as far as possible its original shape with a rising of twelve centimeters in the top. The wood centers were strengthened by epoxy-resins and some of them were replaced. The laths forming a covering under and over them were sewn up with strips of wire netting. Glass wool was put inside the hollow spaces for thermal insulation. A lime mortar, quite similar to the old one in its composition, with the addition of acrylic resins, was applied to the outer surfaces (fig. 7). A movable panel on the extrados allows us to see the restoration work carried out inside the dome section.

### **Archaeological Excavations**

The digs under and around the sama'khana were done with the twofold aim of locating points of static settlement (all the pilasters were out of plumb [see fig. 8]) and of studying the ancient underlying structures. Stratigraphic excavations of the archaeological and architectural remains were carried out. With this information, we decided to hang up pilasters to bridges supporting the two-level floors of the sama'khana and the load of the dome in the affected areas.

After the conclusion of the archaeological excavations in the court of the Sunqur Sa'di madrasa, we laid a foundation in the area below the ground level. The ancient wood pilasters were resettled to plumb with a saddling mechanism and extended with iron pilasters discharging the load on the new foundation plinths. Then they were linked together as well as to the four perimetrical walls by an horizontal iron structure which is the definitive floor of the sama'khana and, at the same time, allows one to visit the excavated ancient remains.

Completion of the structure took a long time but the problems we faced have been largely rewarded by the historical interest of the findings and the importance of the architectural remains relating to the Tulunid and earlier periods. Their publication is in progress.

### **Structural Consolidation of the Floors**

The second floor, which consists of a circular balcony looking down on the performance area, has been strengthened according to calculations for the safety load (see fig. 9, scheme B). The roof has been made 50 percent lighter by removing heavy and useless materials and restructured by laying a glass-wool coat as thermal insulation. The corners and the floor of the structure have been strengthened in accordance with public safety standards. The original appearance of these areas has remained unaltered (fig. 10). All the wood has been treated with disinfectant and preventive substances with a base of pentachlorophenol and a final coat of Paraloid B72.

## **Seismic Retrofits of the Sama'khana Structures**

The seismic retrofit of the building structures is integrated into the restoration projects: a perimetrical concrete beam is fitted inside the thickness of the wall, linking the wooden structure of the roof and the dome with the vertical walls. The shape of the roof square has been strengthened by diagonal iron tie-bars anchored to the concrete beam (fig. 5).

Moreover, the new iron floor linking the perimetrical walls constitutes an anti-seismic connection at the ground floor level of the sama'khana. New careful connections of all the joints of the wooden structure and the strengthening of the walls with injections are an improvement of the structure that helped save the monument during the October 1992 earthquakes.

## **Restoration of the Paintings**

The dome paintings, retouched and altered many times and darkened by sediments of dirt, were reduced to scales, and, in some points, these had fallen, leaving gaps. Firstly, the scales were wetted and reattached to the walls by spraying resins (Paraloid B72, 5 percent).

A study of the original paintings and the following restorations and repairs was carried out using ultraviolet shots and analyses of microscopic sections. Based on this, we had a fairly clear picture of how the paintings originally appeared and evolved as they were retouched and repainted.

Originally the sama'khana was simply painted in white and ivory yellow, with red and blue squares. The dome was white and illuminated by eight windows (the number eight has a special mystic symbolism in the Mevlevi ideology). The most interesting phase in the dome is the period of the tempera landscape (Turkish Rococo). During that period the dome windows were closed. In order to keep the paintings and to make it possible to see the dome in the original light, we installed eight simultaneously movable window panes (fig. 3).

During the same period when the landscape paintings were done, ancient doors of the madrasa on the ground floor had been walled up and covered from inside the sama'khana by wooden panels. Oval windows were opened in order to provide a soft light. We have installed a double frame system, which has allowed us to open new doors (complying with the present safety standards for public places and corresponding to the ancient madrasa doors) and to keep the beautiful panels with the oval windows (fig. 8).

As for the paintings on the dome, the period in which the landscapes were done has been retained since this era has the most complete documentation. The sky of the landscapes was sprayed by a velatura of Paraloid B72 and natural pigments. The paint is easily reversible and does not interact with the layers underneath. The velatura neither dims the view of the tonal variations, nor the surface consistency of the dome, nor even the traces of the restored cracks reminiscent of the history and vicissitudes of the building.

## Elimination of Moisture in the Walls

It is well known that the chief factor in the decay of all Egyptian monuments is moisture. The problem is particularly prominent in the buildings fronting Shari' al-Suyufiya, both for the alluvial ground and for the great quantity of polluted water in the area.

In the sama'khana, we have carried out a series of combined works for this purpose. Two rows of holes, made in alternate position and spanning the thickness of the masonry under the level of the floor, have been filled with injections of epoxy-resins in order to reduce the suction on sections of the walls.

A one-meter-wide air space was excavated around the sama'khana beneath the level of the outside pavement; it was later covered, leaving two openings on the north and the south in order to provide continuous ventilation, which effectively solves the problem (fig. 6).

Different types of binders have been selected for the restoration of the internal paintings and for the paint used on the outside. These allow a transpiration movement on the outside surface, thus keeping the internal decorations. Five years later, no water lines have appeared on the walls. The capillary suction of water from the ground is the main factor causing the decay of the mausoleum of Hasan Sadaqa and the adjoining liwan of the madrasa, the buildings where we are presently working.

The disintegration here is caused, as in many Egyptian monuments, by the presence of various water-soluble salts, chiefly sodium chloride. The rising water dissolves and brings the salts to the surface, where they crystallize and cause external pulverization and internal swelling, ultimately leading to spot destruction or even the total collapse of structures.

The particular techniques employed in the sama'khana would not be effective in this part of the complex, where the water level is presently and constantly at a few centimeters underground. In this case, we have resorted to advanced technology to create a physical block against the water present in the foundations.

We are using special machinery made in Italy (donated by Ansaldo) to cut through the entire thickness of the walls. It is a hydraulic dry-operating piece of equipment, which avoids the use of water so dangerous in ancient and decayed structures. It works with a blade two meters long, but we are making another much longer one of special steel alloy.

For every twenty to thirty centimeters cut through the wall, strips of PVC are inserted into the void. At the same time a special mixture of expansion-controlled and sulfate-proof ferric cement without chlorides (donated by Pagel Italiana) is injected under them. The PVC strips have a special shape presenting grooves. Because of these, the mortar binds the upper and lower sides of the wall. This layer also strengthens the structure against seismic activity as confirmed on the occasion of the recent earthquakes (fig. 10). The technical precision of the operation allows the possibility of the removal of

the layer with the same machinery used for inserting it, should this become necessary later.

Beginning in 1988, study (aided by funds from the Italian Research Council) has been done on the rising moisture from ground water, in which periodic measurements on a grid of fifty centimeters were done. Satisfactory results from this work support my hope that this new restoration technique may solve a problem suffered by most of Egyptian monuments.

### *Bibliography*

- Bongrani, L.; G. Fanfoni. "For an Executive Project of the Sphinx Archaeological Conservation." *Seventh International Congress on Deterioration and Conservation of Stone*. Lisbon, Portugal, 15–18 June 1992, vol. 3, pp. 1553–63.
- Fanfoni, G. "Il restauro della Sama'Khana del Dervisci Mevlevi." Cairo, 1988.
- . "Il complesso architettonico del Dervisci Mevlevi in Cairo." *Rivista degli studi orientali* 52 (1983): 77–92.
- Giordano, G., *Costruzioni in Legno*. Milano: Hoepli, 1964.
- Lucas, A. *Disintegration and Preservation of Building Stones in Egypt*. Cairo: Government Press, 1915.
- Massari, G. I. *Risanamento del locali umidi*. Milano: Hoepli, 1974.
- Mastrodicasa, S. *Dissesti statici delle strutture edilizie*. Milano: Hoepli, 1974.

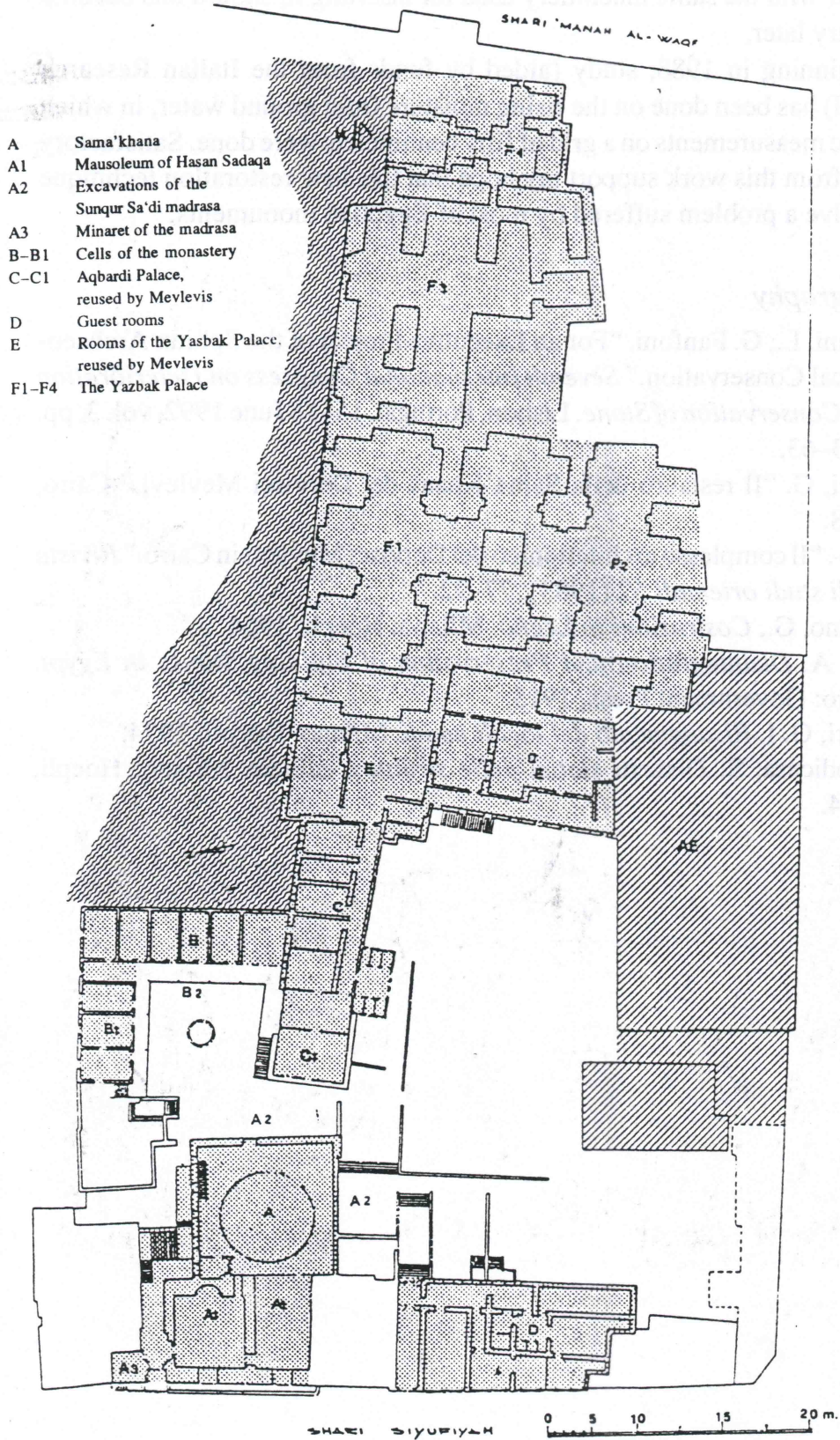
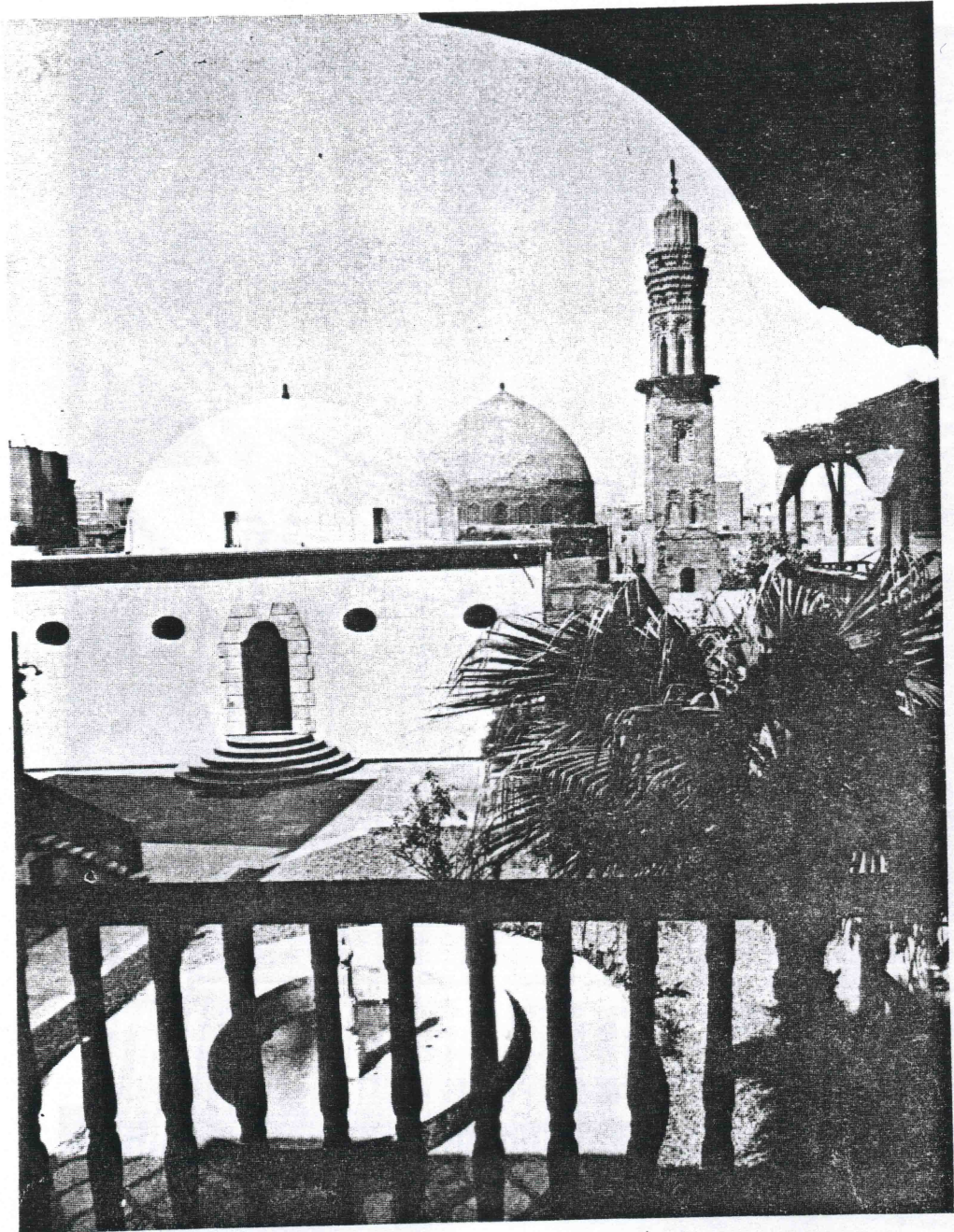
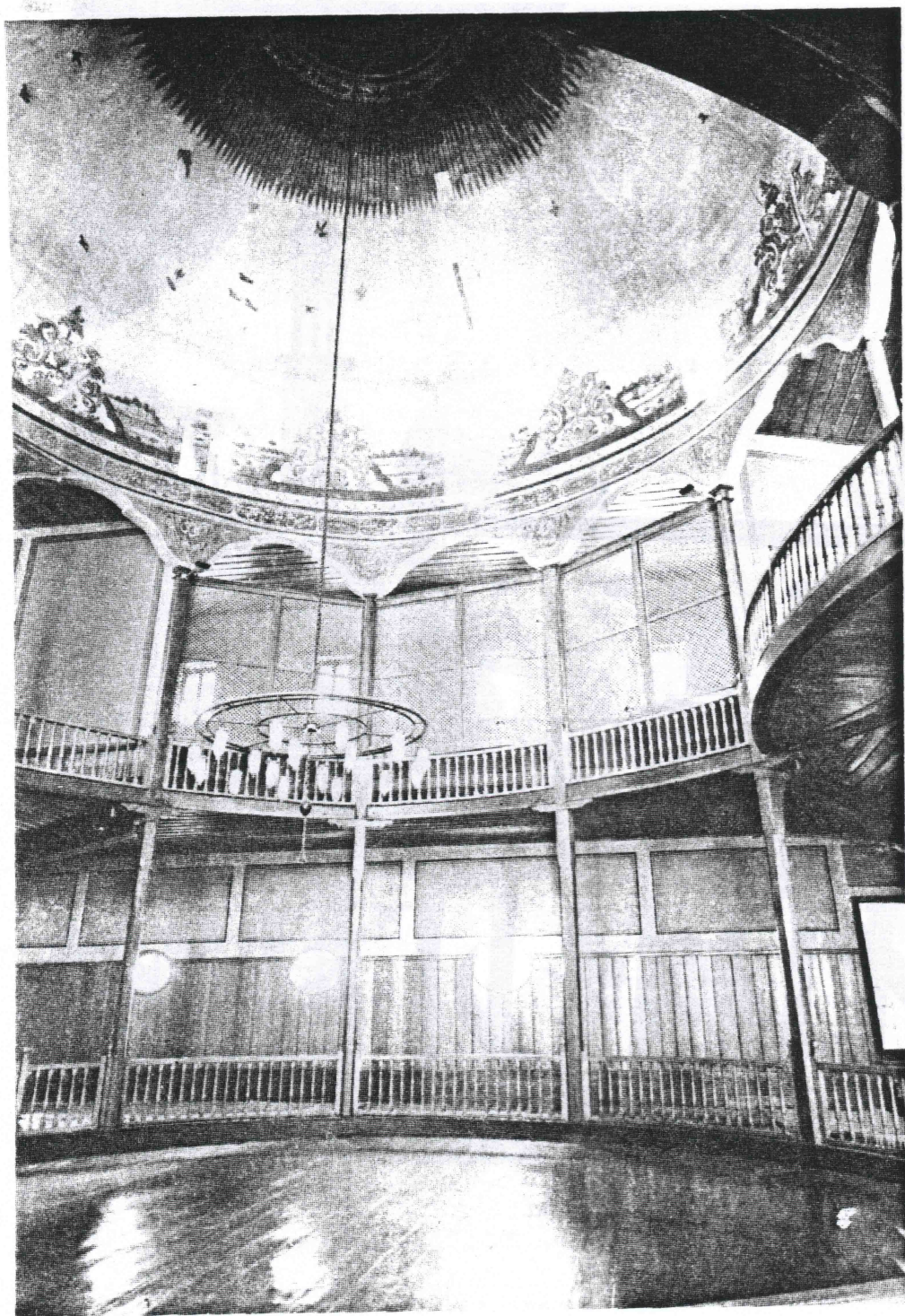


Fig. 1. General plan of the Mevlevi complex, Cairo.

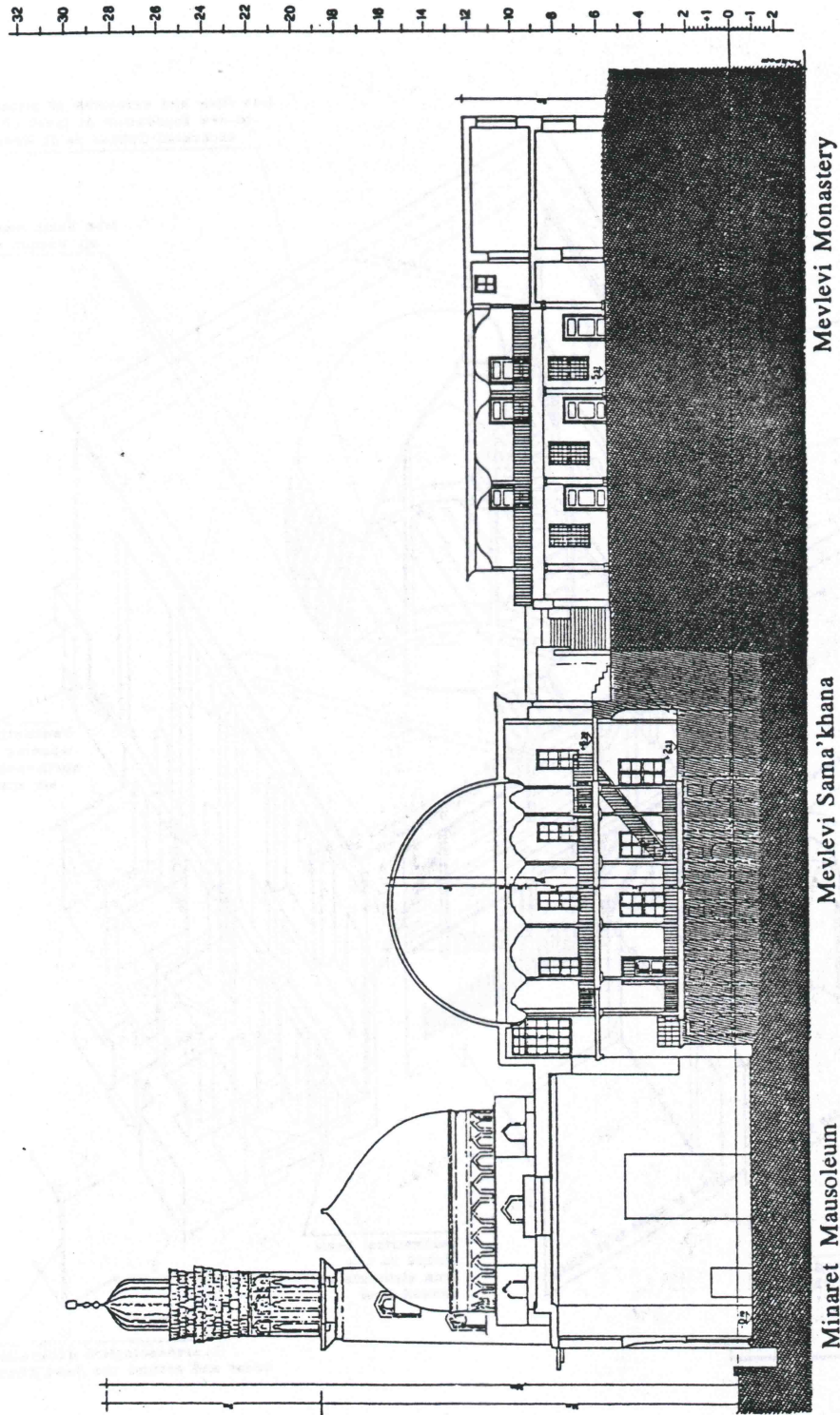


*Fig. 2. Exterior of the sama'khana.*



*Fig. 3. Interior of the sama'khana.*





(on the excavated Sungur Sa'di madrasa)

Fig. 4. Elevation and underlying structures of the sama'khana.

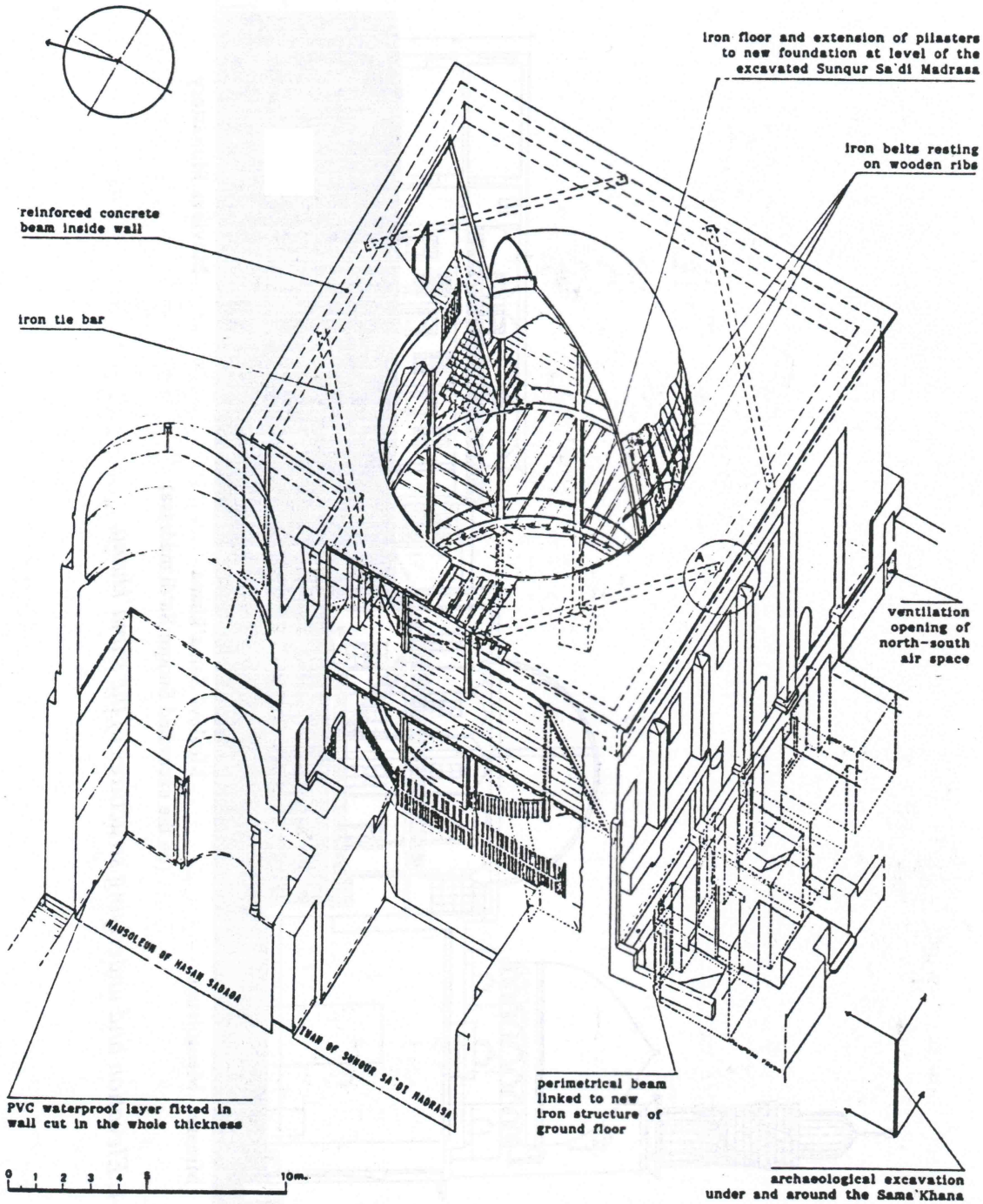
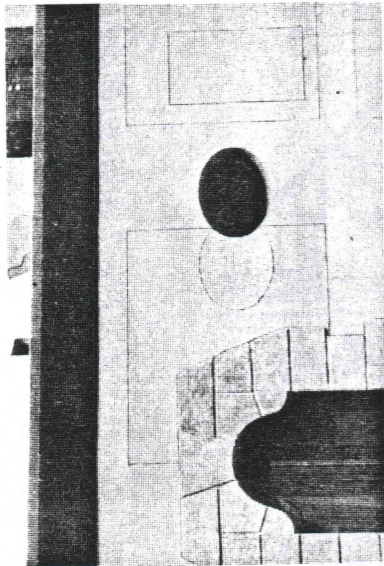
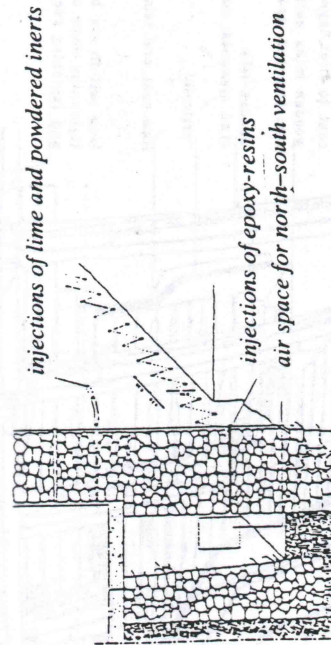


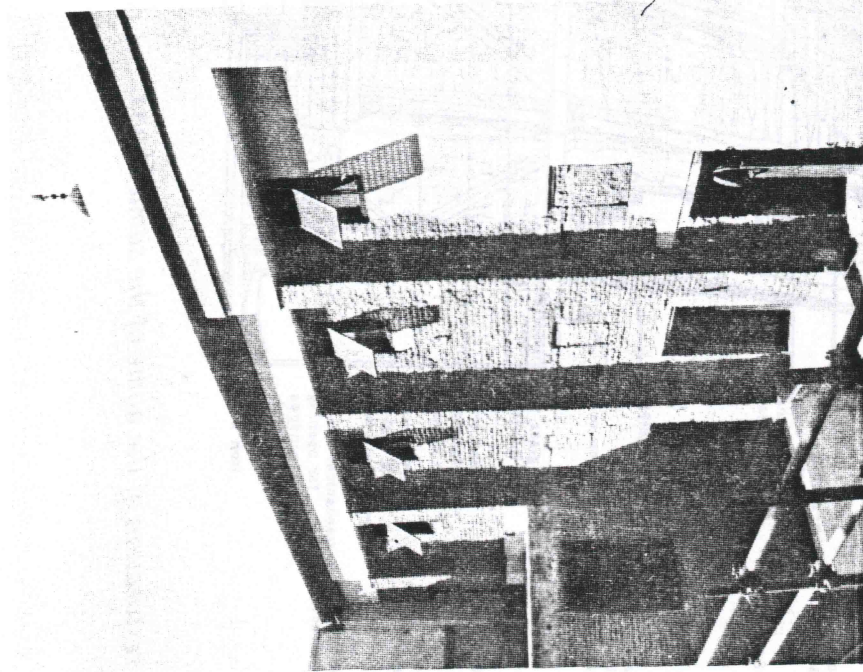
Fig. 5. General scheme of the restoration work done at the sama'khana.



Graphic Representation of Previous Uses of Wall



Elimination of Rising Damp from sama 'khana



Reused brick walls showing architectural elements of the Sunqur Sa'di madrasa (windows, doors)

Fig. 6. Masonry restoration and ventilation at the Sunqur Sa'di madrasa.

R E S T O R A T I O N   W O R K S

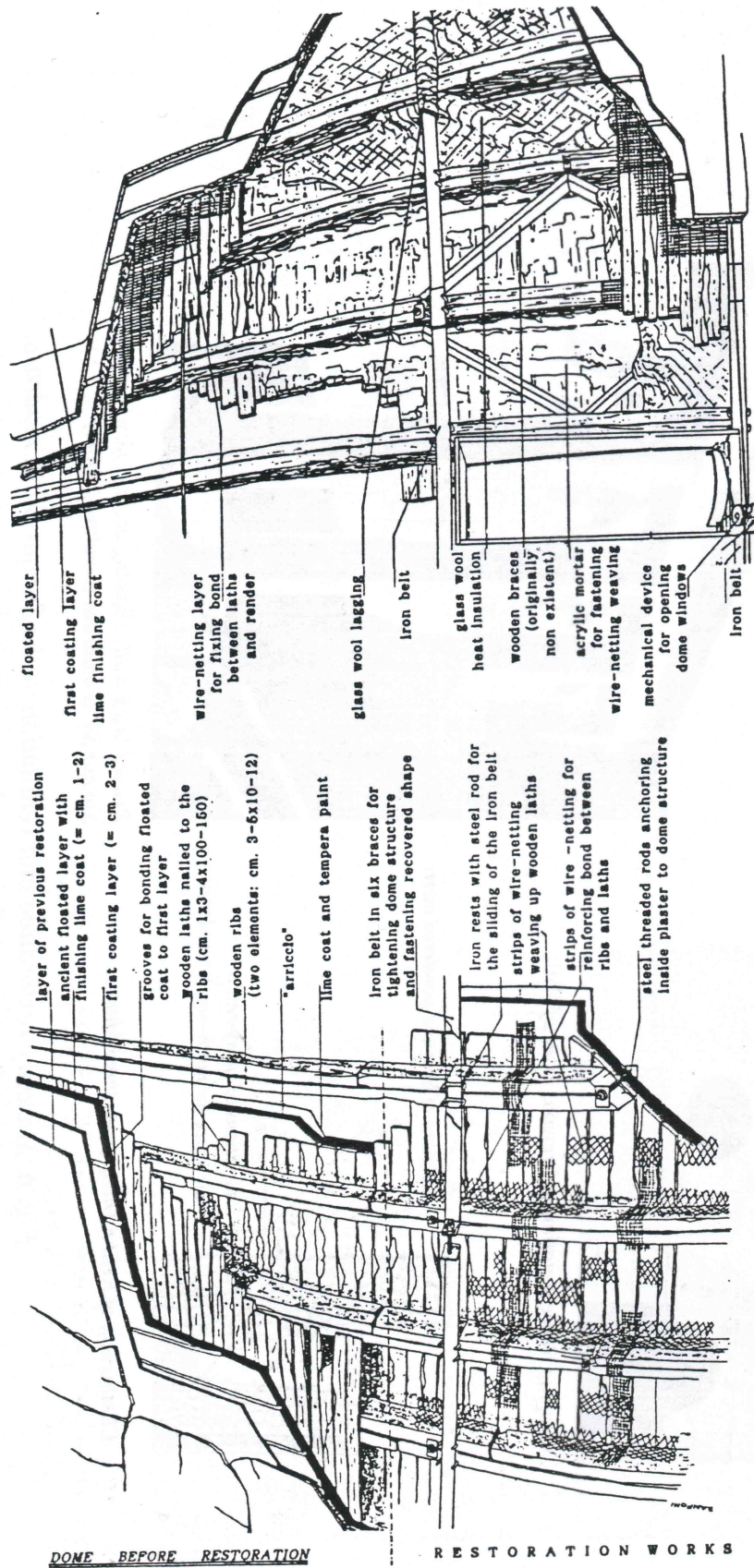
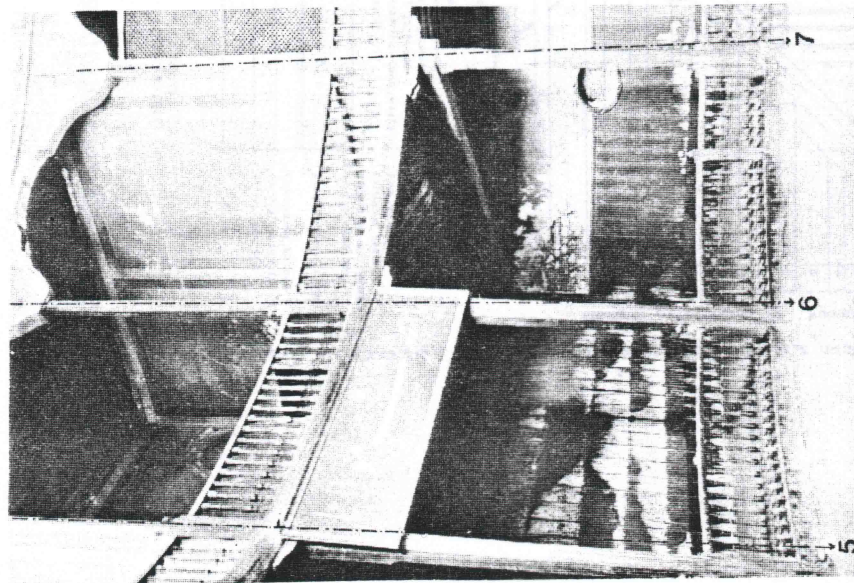
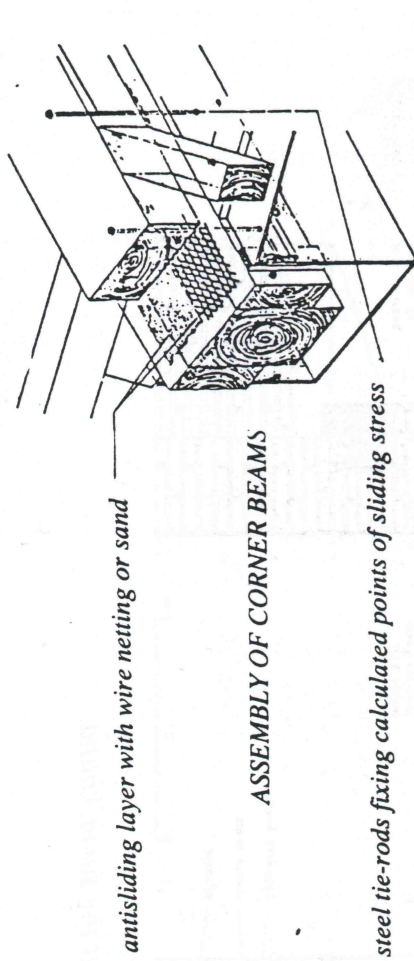


Fig. 7. Structural analysis of the restoration of the dome of the sama' khana.



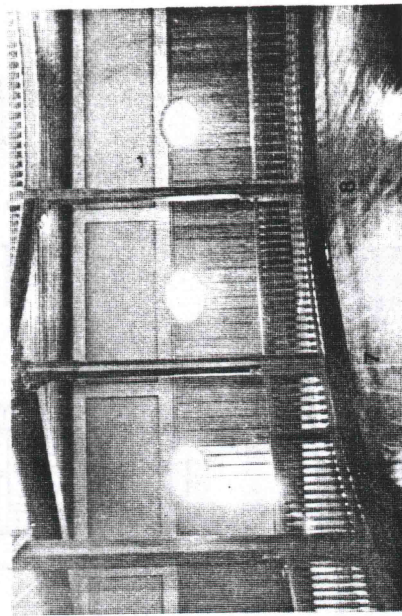
BEFORE RESTORATION: Pilasters out of plumb (nos. 5, 6, 7); the wood panels, damaged by dampness, have been structurally reinforced and reused.



antisliding layer with wire netting or sand

ASSEMBLY OF CORNER BEAMS

steel tie-rods fixing calculated points of sliding stress



AFTER RESTORATION: The auxiliary doors system keeping the old wooden panels and including the oval windows.

Fig. 8. Restoration of wood at the sama 'khana.

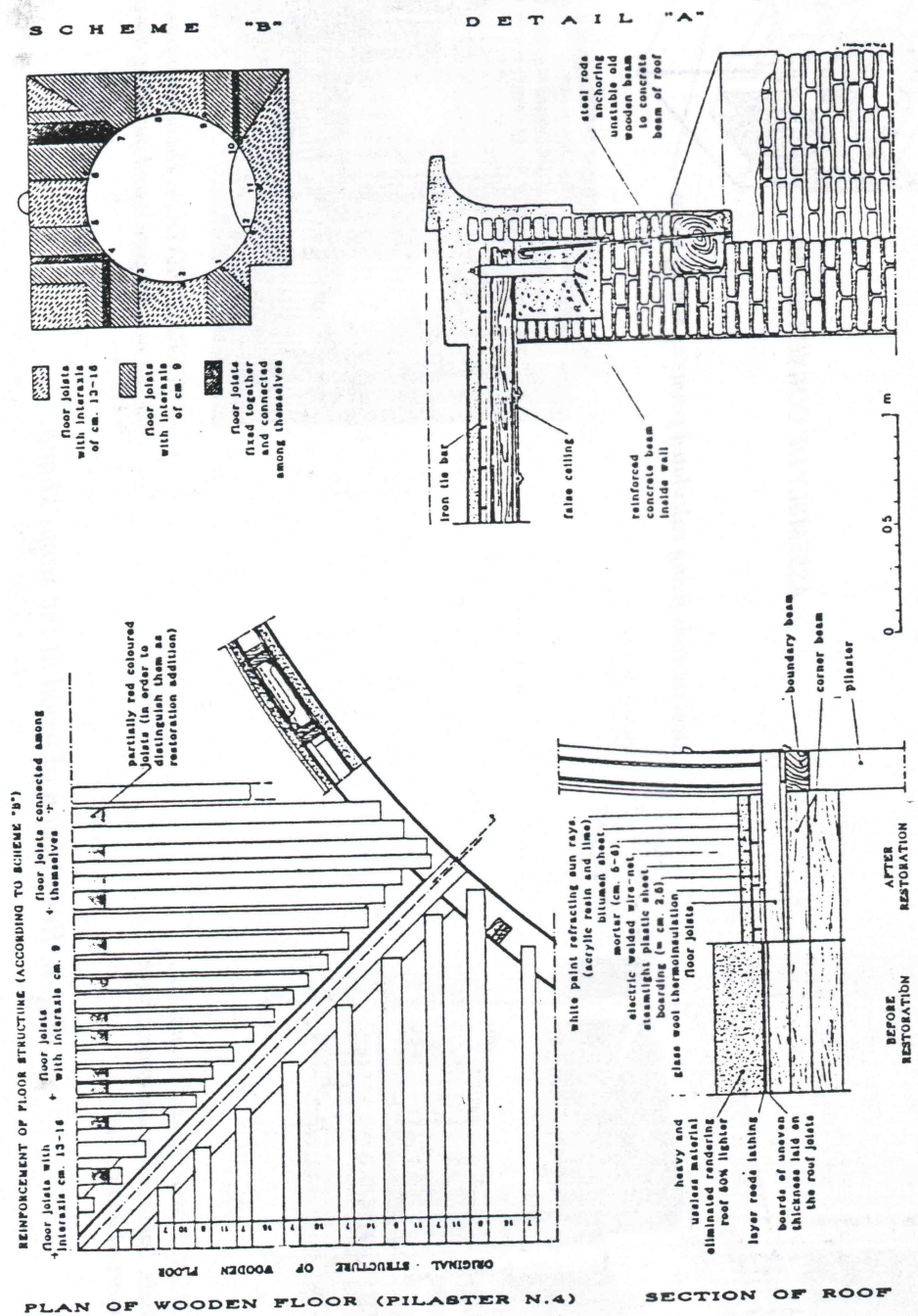
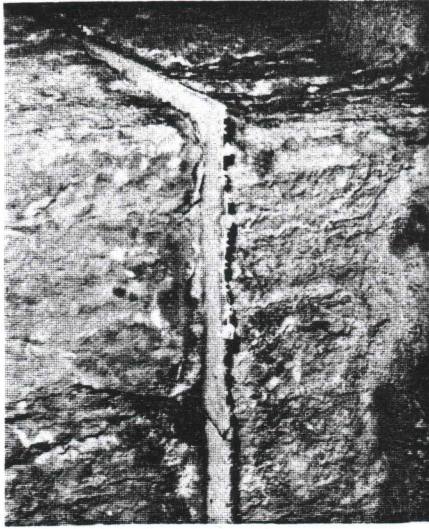
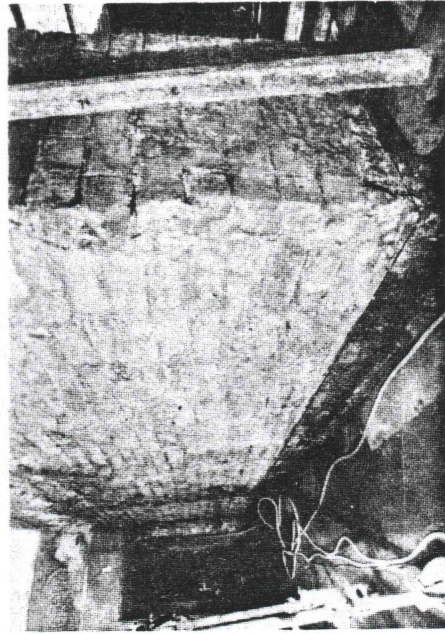


Fig. 9. Structural consolidation of floors at the sama'khana.



detail of cutting showing PVC layer and filling mortar



south wall, six months after cutting

line of rising damp (up to 5 m. with 90-95 percent humidity)

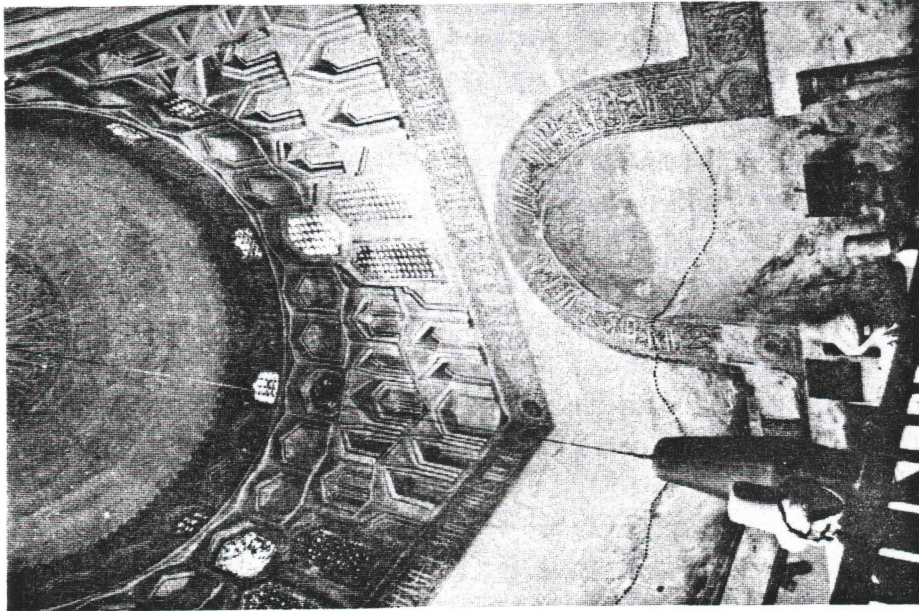


Fig. 10. Elimination of rising damp at the mausoleum of Hasan Sadaqa.

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conservation project in Egypt are the focus of the second part of the book: topics range from the problems of retrofitting monuments to prevent further damage from earthquakes to concerns with the ground water and pollutants. The book reveals how much has been achieved since the last such conference over a decade ago, in particular the growing participation of Egyptians in the conservation and preservation of their heritage.

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