

FINAL REPORT

2008 - 2010

ARCE Groundwater Lowering Response Project, Luxor

“Conservation at Karnak Temple”

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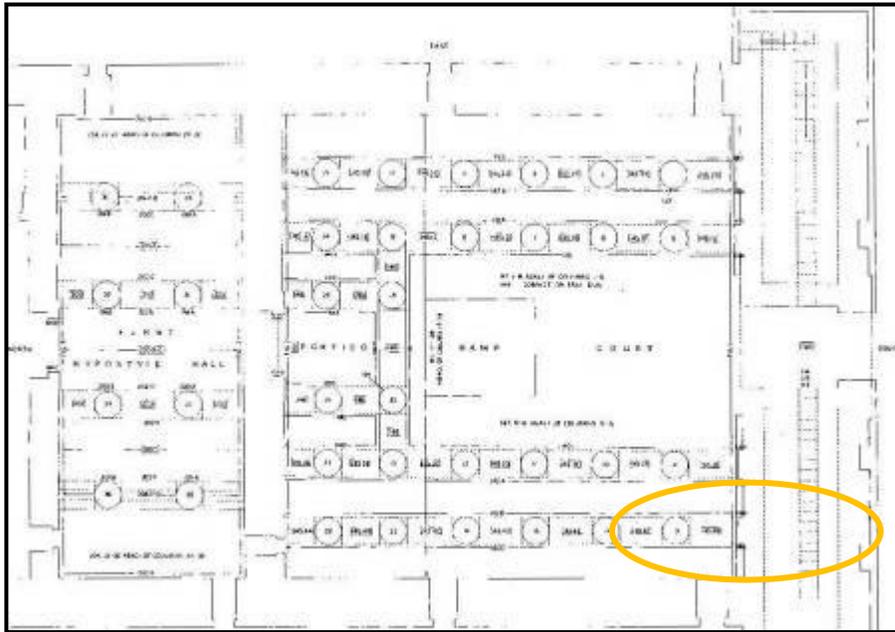
Existing Condition Survey and Overview of Additional Work Recommended for the Khonsu Temple

Introduction

This condition report is an overview of the current state of the sections of Khonsu Temple that have been treated by the ARCE staff and field school students over the past three seasons (2008-2010). The summary identifies and prioritizes the needs for additional treatment, supported by photographic examples. Some of the current issues in the temple encompass the work that was actually completed by the field school teams and other recommendations are made for additional treatment that may or may not have been part of ARCE's original work plan. It should be noted that these are general recommendations which may not be applicable or appropriate in all situations. Decisions about how to proceed with certain future treatments will need to be made on a case by case basis by ARCE conservation staff.

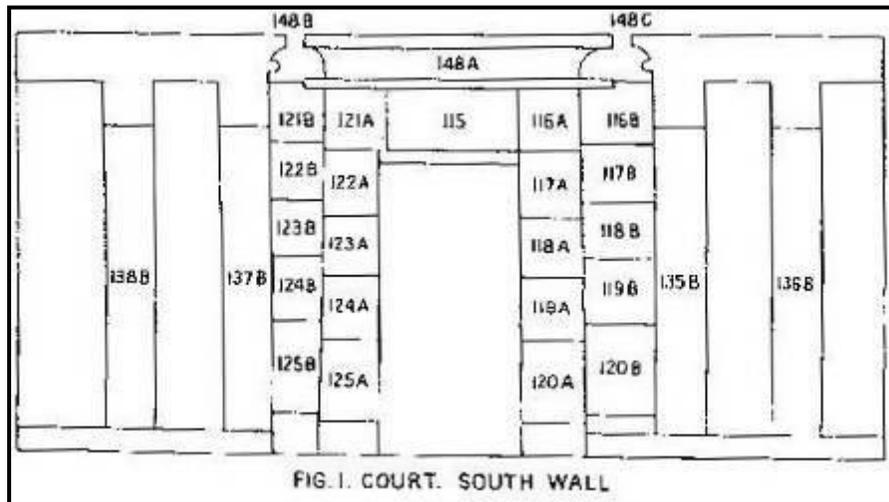
Thorough damage mapping is currently being done in the temple (June 2010), using the plates from the Oriental Institute/Chicago House Epigraphic Publications. However, there are a few sections which may not be able to be mapped this season for accessibility reasons. Once the damage mapping is complete, it will be possible to have a more thorough sense of the condition of these sections of the temple. The surface area of the previously treated sections of the temple have been calculated in square meters and the man hours required for conserving a square meter has also been estimated. These are rough approximations for the purpose of understanding the additional conservation needs. The work the Italian team completed in Khonsu chapel XII has also been included for comparison purposes.

The plans below show the sections of Khonsu which have been worked on by ARCE over the past three seasons. The total surface area that has been worked on by ARCE, which may require further conservation treatment, is approximately **915** square meters.

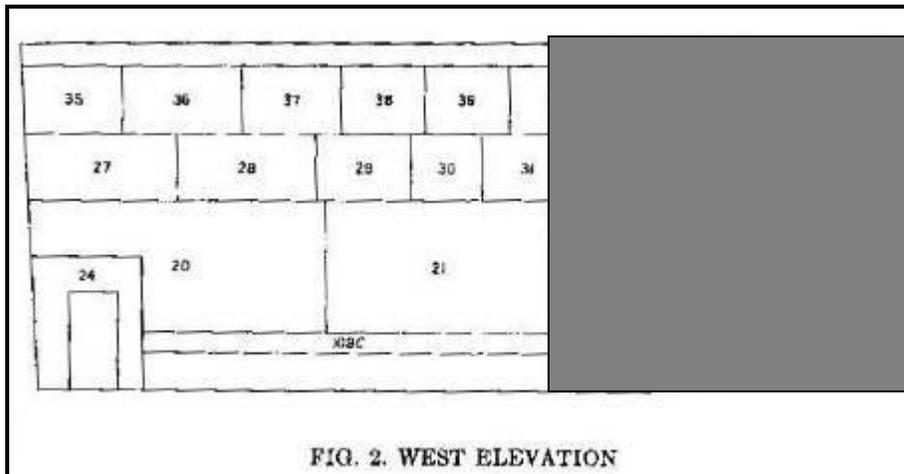


Plan of Khonsu Temple (OIP Vol. 100)

The columns circled in orange are those that have been treated by the ARCE Field School



Panels on the South Wall that were previously treated (OIP Vol. 100)



Panels on the West Wall that were previously treated - the shaded has not yet been conserved (OIP Vol. 100)



Panels on the East Wall that were previously treated - the shaded area has not yet been conserved (OIP Vol. 100)

The following pages describe the existing conservation issues within the temple. The categories of conservation needs are listed in order of priority for long-term stabilization of the walls and columns.

I. Structural/Stabilization Work Required

A. Stabilization of Smaller Voids and Detaching Stone (Spalling) and Plaster

The conservation work completed in Khonsu, thus far, has been strongly focused on cleaning of the wall and column surfaces. However, there is a significant amount of stabilization work that remains to be done and should be a high priority.

Fills tend to be completed in only the larger areas of loss, smaller voids and cracks are often not filled (Figure 1). Many areas that were gently tapped upon examination of the wall sounded hollow, indicating detachment of stone, plaster or both (Figure 2). Also, there are several cases where damaged sections of plaster jut out on an angle from the stone surface (Figure 3). The edges of many damaged areas have not been protected with a fill material to secure them in place (Figure 4).

Overall, the level of stabilization work on the East elevation, West elevation and columns 13 - 16 is inconsistent.



Figure 1.



Figure 2.



Figure 3.

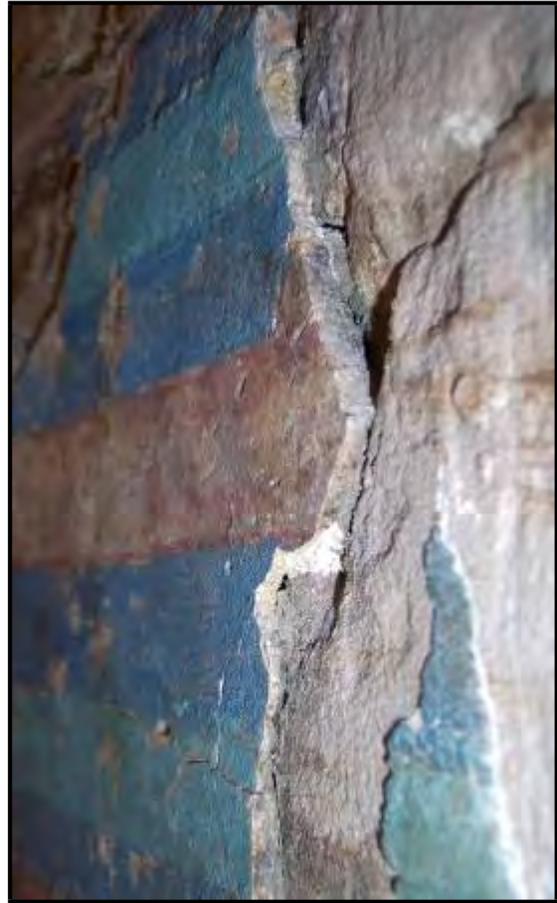


Figure 4.

B. Consolidation of Friable (unstable, flaking) Plaster and Paint Surfaces

Some consolidation work has been completed on friable areas of plaster and paint. However, there are sections where additional consolidation is needed and vulnerable areas that have not been fully stabilized (Figure 5). When touched, there are several paint flakes that move due to detachment from the surface of the plaster. Examples of this can be seen on the curved sections of the columns (Figure 6). Darkening of the surface is one risk with consolidation. Therefore, the consolidant should be tested beforehand and, regardless of the adhesive that is used, it should be a dilute solution (e.g. 3% Paraloid B72 or B44 in acetone).



Figure 5.



Figure 6.

C. Mortar and Grouting Work Required

Although the mortar work has improved since the last examination of the temple by ARCE staff in early May, additional work is recommended. There are some sections along the South Wall which have not been filled or have only been partially filled. In a few areas, the first layer of mortar is visible with scoring on the surface (Figure 7). There are also uneven and unsmooth

mortar surfaces and some areas where the old mortar has not been removed (Figure 8). There are also a few mortar patches (previously applied) that are a different color from the recent patches. The latest mortar work in Khonsu Temple was completed by SCA staff, not the ARCE field school. In general, there should be a more consistent approach to the mortar work.



Figure 7.



Figure 8.

The edges and grouting of smaller voids need further attention. In many sections the mortar work appears unfinished, particularly around the edges of the fills (Figure 9). Care also needs to be taken to apply the mortar neatly so as not to leave the first layer visible in any section or smudge the mortar outside of the fill (Figure 10). Some fills also need to be built up higher in relation to the original wall surface.



Figure 9.

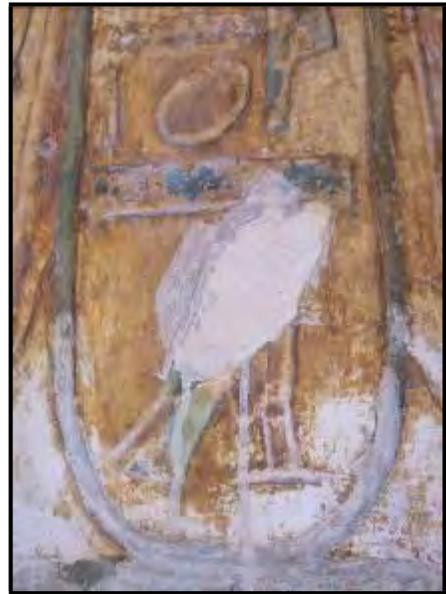


Figure 10.

II. Staining on the Walls and Columns, with Possible Cleaning

There are many areas where staining is present on the surface of the walls and columns (Figure 11). Some sections of the surface are much darker and have a yellow, oily appearance. One possibility is that the staining has resulted from iron inclusions within the original stone that have migrated to the surface with the application of any water or solvents (either during the cleaning process or during the mortar application). On some of the columns there is staining which looks as if it might have formed around the edges of something square that was applied to the surface (Figure 12). Large rolls and squares of cotton have been used for cleaning in the temple, so this possibility should be investigated further. The staining may have occurred in antiquity or some of the darker, oily areas may be a result of using too much consolidant. Whatever the cause, stains are present on several sections of the walls, columns and around the edges of many fills.



Figure 11.



Figure 12.

III. Additional Cleaning of the Surface of the Walls and Columns

Overall, the cleaning that has been completed in the temple is inconsistent. Some of the plastered and painted areas do not appear clean enough (Figures 13 and 14). There are several instances where mortar and other chemical drips have been left on the surface of the wall (Figures 15 and 16). Cleaning is not as crucial as the issues that have been previously discussed in this survey and can be a lower priority for next season's work.

However, in the long-term, it seems in the best interest of the temple to alter the cleaning methods. The current technique involves placing large sheets of cotton on the surface (Figure 17) and then saturating the cotton with the following solution: ammonium carbonate, ethylenediaminetetraacetic acid (EDTA) and distilled water. Alternate methods of cleaning which allow for more control and do not saturate the surface as much should be trialed.



Figure 13.



Figure 14.



Figure 15.



Figure 16.



Figure 17.

Recommendations for Further Conservation Treatment:

- **Additional fill materials are required for areas where detached stone and/or plaster are at risk for further damage, where there are large cracks or where additional edging protection is needed.** Some sections may require additional stabilization and the smaller areas will require a fill material other than mortar (e.g. a mix of glass microballoons, Paraloid B44, acetone and sand). The fill material can often be injected into the area requiring stabilization and can be tinted to an appropriate color using earth pigments. In some cases it may be possible to apply gentle pressure to the detached section using a metal spatula so it re-adheres to the surface. The methods and materials used for these treatments should be left to the discretion of the ARCE conservation staff. The higher sections of the temple (including the corners and sections of the ceiling) are in poor condition. Re-attachment and stabilization of thick plaster sections may be necessary in these areas (Figures 18 and 19).



Figure 18.



Figure 19.

- **Consolidation is necessary for several sections of the walls and columns; some areas that have been previously consolidated should be evaluated as they may require additional treatment.** Care needs to be taken when applying the consolidant. When too much or too concentrated of a solution is applied, the area can become significantly darker. Excess consolidant has been noticed in some areas and should be removed with an appropriate solvent (e.g. acetone) and small cotton swabs.
- **Additional mortar work should include:**
 - 1) Completion of unfinished areas and voids
 - 2) Removal of any old cement fills and replacing this material with lime mortar
 - 3) Smoothing of any uneven mortar surfaces and building up of sections that need additional mortar for stabilization purposes.
 - 4) Do additional grouting around the existing mortar fills, making sure the first layer of mortar is not visible.
 - 5) Clean off any excess mortar or smears around the edges of the fills.
- **Investigate the dark, stained areas to determine if this occurred in antiquity or if it could be the result of recent cleaning, consolidation or water used during the mortar application.** Some cleaning tests should be completed, using different solvents or poultices, to see if it is possible to remove or reduce some of the staining. The tests

and any treatment that follows should be left to the discretion of the ARCE conservation staff.

- **Dry and alternate wet cleaning methods should be trialed as these could allow for more control and result in a more thoroughly cleaned surface.** Smaller areas should be cleaned at a time, avoiding the use of large squares of cotton saturated with solution. Once again, decisions about an alternate cleaning method should be discussed, tested and decided upon by ARCE conservation staff.

Surface Area Requiring Treatment and Man Hour Estimates

In order to evaluate the extent of time and people needed to complete the recommended work, rough estimates have been made of the surface area to be treated and the man hours necessary to do the work. Estimates of the surface area conserved and working hours of the Italian team who worked in Khonsu on Chapel XII have been included below for comparison purposes.

Khonsu Temple

Note: These are very ROUGH guesimates.

Time required for the full conservation of Chapel XII by the Italian team

Work hours per day	6
Work days per week	6
Work hours per week per person	36
Weeks of work	20
Number of conservators	5
Total man hours	3600
Total surface area conserved (m2)	61.1

MAN HOURS PER SQUARE METER	58.9
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Around 60 hours is needed to fully conserve 1 square meter of wall for an experienced, western-trained conservator

Time required for the complete conservation of area partially cleaned by the Field School in the last three seasons

Work hours per day	5
Work days per week	5
Work hours per week	25
Work weeks per season	32
Work hours per season per person	800

Estimated man-hours per square meter

Total surface area to be conserved (m2)	35
	915.0

Total man hours

32023.7

Number of persons required to complete the work in one season	40
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One of the main assumptions is that the work is done by fully trained conservators, NOT students in training

Time for organization, materials' preparation, documentation, and report writing is not included in this set of estimates.