

ARCHITECTURAL CONSERVATION RED MONASTERY CHURCH SPRING 2018

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EMERGENCY TERMITE CONTROL WORKS FINAL TECHNICAL REPORT JULY 05, 2018

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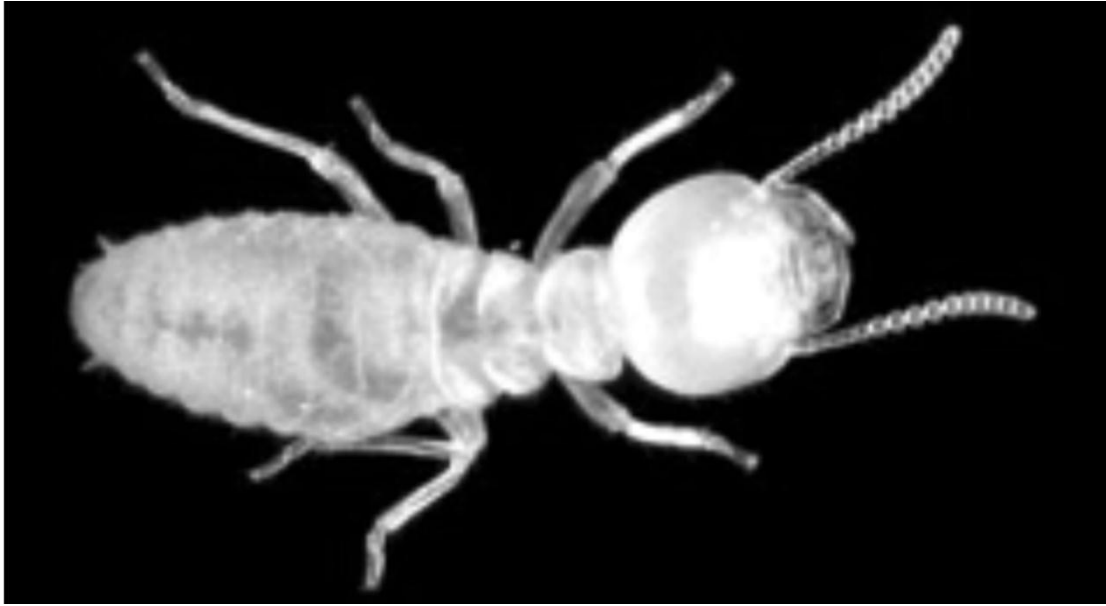
RED MONASTERY CHURCH EMERGENCY TERMITE CONTROL WORKS

FOREWORD

The spring season of the architectural conservation project at the Red Monastery commenced on 02 May 2018 and was completed on the 26 June 2018. The work was carried out in two phases, before and after Ramadan. The project was directed by Dr. Nicholas Warner and implemented by Mahmud al-Taiyyib. Inspector Mohamed ‘Abd al-Azim Ahmed and Inspectors Aouni Naguib Hakim and Mustafa Mahmud Ahmad ‘Abd al-Latif [conservation] from the Sohag Taftish of the Ministry of Antiquities supervised the work. Mr. Rashed Mohamed Badri [Chief Inspector], Mr. ‘Ali Ahmed al-Saiyyid [Director of Islamic and Coptic Antiquities, Sohag Inspectorate], Mr. Essam Rushdi [Director of Conservation, Islamic and Coptic Antiquities, Sohag Inspectorate] provided monitoring. John Shearman [Associate Director – ARCE Luxor] carried out the final inspection visit on 27 June. The work was executed in accordance with the Permanent Committee approval of April 29, 2018 and under the terms of the ARCE sub-agreement no. CHTE-01 under USAID cooperative agreement no. AID-263-A-15-00007, “Site Management at the Red Monastery”.

Cover Photo: Conservator Amer Said Ramadan restoring plaster edges adjacent to replacement timber bands. Red Monastery Church Sanctuary Façade, June 2018

SUMMARY SCOPE OF WORK



Psammotermes hypostoma

The work was carried out in order to minimize, if not eradicate, the structural risk and negative impact of termites (*Psammotermes hypostoma*) on the fabric of the Red Monastery Church sanctuary. The work was divided into interior and exterior areas of intervention as follows:

1 INTERIOR OF THE SANCTUARY

- 1.1 Void mortar joints in limestone paving inside sanctuary and side rooms.
- 1.2 Inject chemical termite deterrent into voided mortar joints and leave open for one month.
- 1.3 Locate termite-damaged wooden elements inside sanctuary, on sanctuary façade and at roof level and treat with termite deterrent before and after replacement of badly affected sections with treated seasoned pitch pine.
- 1.4 Re-point all mortar joints in limestone flooring with a fine lime mortar after repeat application of chemical deterrent.

2 EXTERIOR OF THE SANCTUARY

- 2.1 Drill 50 no. 5cm diameter boreholes around the perimeter of the sanctuary (east side) at 50cm intervals to a depth of one metre and install perforated PVC pipes with subsurface screw caps.
- 2.2 Apply chemical termite deterrent to achieve sub-surface saturation of ground (executed in two phases).
- 2.3 Mark locations of pipes to be incorporated into future paving pattern.

DETAILED DESCRIPTION OF WORK

1 EXTERIOR WORKS (refer to figures 1, 2 & 3)

Termite protection work was carried outside the east wall of the church as the first part of a larger project that will be carried out in the fall of 2018 when the entire circuit of the building will be fully protected (Figure 1). This area is particularly susceptible to termite infestation owing to its proximity to a major source of water: the adjacent monastic resthouse. The method employed was sub-surface saturation of liquid chemical deterrent. At a distance of one metre from the wall, a line of vertical 5 cm diameter one-metre-long perforated PVC pipes was installed at intervals of one metre (total of 21 pipes), set within a 30 cm wide x 30 cm deep trench (Line 1). Each pipe was perforated along the lower 70 cm of its length, with a bottom cap to prevent the injected liquid from draining directly into the ground and to encourage its horizontal dispersal. Another line of 11 pipes of the same type was installed two metres away from the wall, at intervals of approximately two metres in order to avoid obstacles in the ground such as concrete (Line 2). The first line of pipes was designed to be capable of repeat applications of insecticide in the future, on a recommended cycle of five years, while the second was intended for one-time use only to spread the treatment over a wider area. The first line of pipes was divided into four separate sections, each of which was connected horizontally by a welded 5 cm diameter PVC feeder pipe with a single insertion point for the insecticide. This will also facilitate repeat applications as only one insertion point for the insecticide will be required every five metres.

Separate applications of chemical deterrent were made, with an interval of one month between them. The chemical compound used as the deterrent in the initial application in the first period of work was “Pyrifos” (diethyl trichlor pyridyl phosphorothionate) – a broad-spectrum insecticide with no health side effects on mammals. This was used in place of the specified (PERSUAP-approved) insecticide “Fibronil” because “Fibronil” as a stand-alone branded insecticide has not been imported into Egypt for the last six months. Termite specialists from the Plant Protection Research Institute Dokki, Dr. Mohamed Kamal ‘Abd-el Latif Abbas and Dr. Tarek Raies Amin, the authors of an investigative report on the termite problems at the Monastery dated April 17, 2016, were consulted as to the best available alternative insecticide. The “Pyrifos” was used in a dilute solution with diesel in the proportion 20 cl to 5 litres. It was originally proposed to dilute the insecticide in water, according to the recommendations of Dr. Mohamed and Dr. Tarek, but Mr. Essam Rushdi (Director the MoA Sohag Conservation Department) requested that diesel be used as an alternate solvent. This seems not to have had any perceptible adverse effect on the rate of saturation achieved. During the first application in May, a total of 350 litres of deterrent was inserted into the pipes manually using a funnel. This volume was

divided between Line 1 (150 litres) and Line 2 (100 litres). In addition, the excavated trench of Line 1 was treated with the same chemicals and filled with clean sand.

A repeat application of chemicals using the pipes of Line 1 was carried out after an interval of one month (in June) to improve the saturation and diffusion of the deterrent. The Plant Institute consultants recommended the use of a different insecticide for the second application as they considered it efficacious to expose any termites surviving the first treatment to a different chemical.

This repeat application was carried out using a chemical compound with the trade name “Coach 20% SC” (+/- 5 amino – 1-2,6-dichloro-trifluoro-p-tolyl-4-trifluoromethylsulfinylpyrazole-3-carbonitrile) which has as a constituent the PERSUAP approved chemical “Fibronil”. “Coach 20% SC” was used in dilute solution with diesel in the proportion 20 cl to 5 litres, with a total application of 150 litres. Following the repeat application, the feeder pipes were re-sealed and their locations protected with limestone slabs. These pipes will be incorporated into the paving around the church that is scheduled for execution in Fall 2018.

2 INTERIOR WORKS

Apart from the treatment of the ground outside the east wall of the church, insecticide was also applied inside the sanctuary area below the stone pavement and to wooden elements in the walls, in the manner described below.

2.1 Treatment of pavement (refer to figures 4 & 5)

The existing limestone floor installed inside the church in 2014 is of two thicknesses: 18 cm in the area of the triconch and projecting platform, and 7 cm in the side chambers. Mortar joints in the floor in all paved areas were selectively cleaned out, and a chemical deterrent introduced through the empty joints. Care was taken to make sure visually that the liquid chemicals, which were applied by hand using a funnel, spread along the path of the mortar joints under each block to ensure adequate dispersal of the deterrent. The insecticide used in the treatment was a mixture of “Pyrifos” (as used outside the church), “Citronelle” and “Navda Rumi” in the proportion 20 cl / 75 cl / 5 litres. It was originally proposed to dilute the “Pyrifos” in water, according to the recommendations of the termite specialists, but Mr. Essam Rushdi requested that “Navda Rumi” be used as an alternate solvent. This seems not to have had any perceptible adverse effect on the rate of saturation achieved.

The recommended rate of coverage was applied over the surface area of the paving, namely 4 litres per m². A total of 400 litres were used, with approximately 50 litres used in each of the side chambers and the remaining 300 litres used in the area of the

triconch and projecting platform. The raised section of pavement under the external trilobe portal facing the nave was also treated at the same time.

Following the first chemical treatment, the open mortar joints in all areas apart from the sanctuary and projecting platform were re-pointed using a sifted sand and lime mortar (3:1 ratio). A visual assessment provided assurance that no further treatment was required as a satisfactory dispersal rate had been achieved. The areas with thicker floor slabs were re-treated during the second campaign that took place in June. This secondary treatment utilized a different insecticide: “Coach 20% SC” (+/- 5 amino – 1-2,6-dichloro–tricfluoro-p-tolyl-4-trifluoromethylsulfinylpyrazole-3-carbonitrile) which has a constituent the PERSUAP-approved chemical “Fibronil”. “Coach 20% SC” was used in dilute solution with navda rumi and oil of citronella in the following proportion: 5 litres navda, 150 cl citronella, 60cl “Coach 20% SC”. Following the treatment, all open joints were re-pointed using a sifted sand and lime mortar mix (3:1 ratio).

2.1 Treatment of cells

On the upper floor of the church, above the side chambers of the sanctuary and flanking the north and south semidomes, the vaulted cells also showed traces of termite infestation, particularly in the chambers on the north side. The north cells had been returned to use as storerooms and contained numerous carpets and wooden elements. These were removed (with a request that such materials should never be stored here as they constitute an attractive source of food for the termites), and the rooms were sprayed during the first period of site work with the same chemical deterrent that was used in the sanctuary, with particular attention being paid to all internal corners. A second application was made during the second period of site work in June using the Fibronil-based chemical deterrent “Coach 20% SC”.

2.3 Treatment of wooden elements

The wooden elements of the sanctuary façade, triconch and roof structure provided the most dramatic evidence of termite activity in the church. These elements date from different periods of restoration. Major structural elements supporting the roof and the triconch date to the initial 1909-1912 project by the *Comité de conservation des monuments de l’Art Arabe*. Much of the wooden banding associated with the sanctuary façade also dates to this period. The roof cladding, some replacement beams, and some elements inside the triconch date to the ARCE restoration of 2013-2014 carried out by the author of this report (for details, see internal report dated June 2014: *Red Monastery Church in Sohag. Architectural conservation and presentation 2013-2014*). The treated timber elements installed at this date thus far remain unaffected by termites. It is also probable that many wooden elements, particularly on

the roof, were replaced piecemeal during unrecorded interventions in the intervening years between 1912 and 2014.

A preliminary physical survey of condition was carried out during May using a ladder and a steel scaffold, and the results were recorded on drawings. Live termites were found in many locations and, in some cases, wooden elements had been almost totally consumed from within with no visible signs of activity on the surface. Of particular concern was the protection of the timber lintels spanning between columns in the triconch. These provide structural support to each section of the triconch and the semidomes above them. It was the failure of these lintels in the mediaeval period (most probably for the same reasons – termite attack) that prompted the walling up of the lobes of the triconch to preserve the structure from collapse. Fortunately, major structural components such as the massive wooden supports above the columns in front of the sanctuary and the beams directly above them have not been affected thus far. A common pattern of loss seen on the timber cornices within the sanctuary was for the section of wood immediately abutting the masonry of the walls to be attacked first. On the roof, three beams in the projecting section of the roof over the central area west of the sanctuary façade were also seriously infested.

A preliminary treatment of all timber was initiated during the May campaign. Where there was no risk posed to the structure, destroyed elements were removed entirely and the voids carefully cleaned out. In the case of the south jamb of the north door between the projecting platform and the north lobe, brick masonry set in lime mortar was used to fill a very deep void. In other cases, such as in the cornices of the conches, one niche on the sanctuary façade, and on the roof, the damage was exposed for surface treatment pending replacement. All wooden elements were locally treated with insecticide, trying to maximize internal coverage of the individual elements.

The replacement of a significant number of wooden elements due to termite damage took place in the June campaign. Replacement timbers were prepared in Cairo in advance as follows:

Roof beams: 16cm x 7.5cm x 4m [4 pieces to include 1 spare]

Wooden bands: 10cm x 5cm [12 linear metres]

Wooden bands: 13cm x 7.5cm [2 linear metres]

Curved impost blocks for niche: 13cm x 15cm deep with internal diameter of 44cm

Cornices: 10cm x 20cm x 2m [12 pieces]

These timbers were sourced from seasoned pitch pine (“Azizi”) beams and machined to size prior to being soaked in linseed oil in solution with turpentine and then dried in the sun. The conservation work in the sanctuary was carried out from full height wooden scaffolding as standard metal scaffolding sections did not provide sufficient proximity to the curving faces of the lobes to allow for work to proceed in safety.

The damaged timbers were cut out using power tools such as a Fein Multimaster oscillating saw and Bosch jigsaw. During the process of replacement, it became apparent that a percentage of the damaged timbers did not date from the period of the Comité conservation work in 1909-1912, but possibly dated to a later restoration in the 1980s (the inspectorate were unable to say when exactly this took place). The evidence for this was the use of normal pine (“muski”) rather than the pitch pine (“azizi”) used by the Comité, and the presence of modern nails.

3 DETAILS OF WOOD REPLACEMENTS AND ASSOCIATED CONSERVATION WORKS

For the location of replaced elements in the sanctuary refer to the numbered key on Figure 6. Large sections of timber were left unpatinated in order to distinguish the replacement sections, but with time they will darken in tone (as replacements made in 2014 have demonstrated). Smaller sections of replaced wood were patinated to match the existing surface treatment. Localised repairs to modern plaster fills adjacent to areas where wooden elements were replaced were undertaken, with surface patination of ‘dirty water’ to match the existing treatment. All areas with visible termite activity were locally treated with insecticide before the insertion of new timber elements.

3.1 Sanctuary (refer to Fig. 6 and Figs. 8-17)

South Lobe

- 1 South lobe upper register west niche
Two sections of 9cm thick cornice timbers showing severe structural damage but no current activity from termites were replaced between the surface of the wall and the outermost lintel (curved section nearest wall ex. 9 x 120 x 10cm, central section 9 x 18 x 150cm). Drill fixing with 2 no. 15cm long steel screws from external face of lintel (countersunk)

During the work, a previously repaired section of the painted limestone column on the inner face of the capital nearest the wall became detached. This had been fixed with a lime plaster prior to the ARCE conservation campaign. The plaster was cleaned off and the section was re-attached using new lime plaster – the location of the repair prevented the possibility of using pins to attach the detached section.
- 2 South lobe upper register southwest niche
Removal of small section of damaged timber adjacent to wall. This was not replaced in order to maintain an air gap next to the wall along the inner edge of the cornice (varying between 3 and 7cm). A small area of missing plaster was treated to match the adjacent modern plaster repairs dating to the ARCE conservation campaign with a dirty water surface treatment.

- 3 South lobe upper register east niche
Removal of large section of timber next to wall revealing the presence of living termites. Treatment of exposed wall and timber with insecticide prior to replacement of timber (ex. 9 x 9 x 153 cm). Drill fixing with 2 no. 15cm long steel screws from external face of lintel (countersunk and capped)
- 4 South lobe upper register southeast niche
Removal of inner timbers. Planing down and treatment of curved section prior to reinstatement and replacement of central section with new timber (ex. 9 x 20 x 150 cm). Some living termites noted, and exposed surfaces treated with insecticide. Drill fixing with 2 no. 15cm long steel screws from external face of lintel (countersunk and capped)
- 5 South lobe upper lintel, edge on northwest side.
Small timber fillet (ex. 9 x 25 cm) to external side face of lintels replaced and patinated to match existing.
- 6 South lobe west side extending to sanctuary façade
Timber band on face of wall replaced on south wall at high level adjacent to granite column (ex. 9 x 9 x 40 cm) with separate extension piece to sanctuary façade (ex. 10 x 6 x 58 cm)
- 7 South lobe lower register east niche
Damaged section of outermost lintel cut out. Removal of central section of lintel and replacement (ex. 9 x 20 x 100 cm). Drill fixing with 2 no. 15cm long steel screws from external face of lintel (countersunk and capped)
- 8 South lobe lower register above east door
Surface termite damage locally removed to a depth of 2.5 cm and 40 cm x 2.5 cm profiled timber fillet inserted on face
- 9 South lobe lower register west niche
Central section of lintel cut out and replaced with new section (ex. 9 x 8 x 105 cm). Drill fixing with 2 no. 15cm long steel screws from external face of lintel (countersunk and capped)
- 10 South lobe west side extending to sanctuary façade
Timber band on face of wall replaced on south wall at high level adjacent to granite column (ex. 9 x 9 x 40 cm) with separate extension piece to sanctuary façade (ex. 10 x 6 x 58 cm)

North Lobe

- 11 North lobe lower register above east door
Innermost curved spanning lintel (ex. 9cm x 1.8m x 22 cm) and adjacent rectangular spanning lintel (ex. 9cm x 12cm x 1.8m) replaced with insertion from side of east lobe above capital. Drill fixing with 2 no. 15cm long steel screws from external face of lintel (countersunk and capped)

- 12 North lobe lower register above east door
Narrow section of outermost lintel, top edge, cut out and new curving timber fillet installed to face (ex. 4 x 4 x 90 cm). Patinated to match existing.
- 13 Deep hole in brickwork to corner of lobe filled with bricks in lime mortar.
Timber facing installed over ends of lintels replaced in 11 (ex. 4 x 4 x 90 cm). Patinated to match existing.
- 14 North lobe lower register east niche
Innermost curved spanning lintel (ex. 9cm x 1.8m x 18 cm) replaced
- 15 North lobe lower register above west door
Innermost curved spanning lintel (ex. 9cm x 1.8m x 18 cm) replaced and adjacent rectangular section (ex. 9cm x 1.8m x 12cm) replaced. Drill fixing with 2 no. 15cm long steel screws from external face of lintel (countersunk and capped)
- 16 North lobe west side extending to sanctuary façade
Timber band on face of wall replaced on north wall at high level adjacent to granite column (ex. 9 x 9 x 40 cm) with separate extension piece to sanctuary façade (ex. 10 x 6 x 58 cm)
- 17 North lobe west side extending to sanctuary façade
Timber band on face of wall replaced on north wall at mid level adjacent to granite column (ex. 9 x 9 x 40 cm) with separate extension piece to sanctuary façade (ex. 10 x 6 x 58 cm)
- 18 North lobe doorway to sanctuary façade south side
Removal of timber (lowest band) and blocking of large internal void with bricks and lime mortar. Replacement timber (ex. 12cm x 8cm x 60cm)
- 19 North lobe doorway to sanctuary façade south side
Removal of timber (central band) and insertion of replacement timber (ex. 12cm x 8cm x 60cm)
- 20 North lobe doorway, base of pilaster to north lobe
Removal of two sections of timber and insertion of replacement timbers (ex. 12cm x 8cm x 30cm)
- 21 North lobe upper register above east door
Innermost curved spanning lintel (ex. 9cm x 1.8m x 18 cm) replaced
- 22 North lobe upper register west niche
Timber replacement at base of small pilaster (ex. 9 x 30 x 12cm x two pieces mitred)

East Lobe

- 23 East lobe lower register above south marble column
Timber replacement of outer corner section of lintel immediately above capital (ex. 9 x 30 cm)

3.2 Sanctuary Façade (Refer to Fig. 7 and Figs. 18-24)

A noteworthy point for the construction history of the building is that the original structure of the church seems to have utilized much deeper sections (up to 25 cm in depth) in the location of the bands, probably used as leveling courses during masonry construction. These large timber sections were replaced in the Comité and subsequent restorations by much narrower bands, often leaving voids behind within the masonry that provided excellent termite habitats. For the location of replaced elements on the sanctuary façade refer to the numbered key on Figure 7. All replacements except in the niche to the north of the chancel arch were carried using timbers 10 cm high x 12 cm deep, and larger voids within the structure were filled using brick masonry set in lime mortar.

- 2.1 North side: below north capital of main door arch. Replacement of timber in four sections with mitred joints. Patination to match existing.
- 2.2 North side: below south capital of main door arch. Replacement of timber in five sections (three mitred below springing of arch and two extending to south). Patination to match existing. Infill of missing section of masonry with brick in lime mortar and re-attachment of previously broken limestone corner of intrados of arch.
- 2.3 North side: between main door arch and intermediate level niche including pilaster shaft. Replacement of timber in two sections. Patination to match existing.
- 2.4 North side: curved impost blocks below hood of intermediate level niche replaced with two curved sections of timber (ex. 13cm x 15cm deep with internal diameter of 44cm). Patination to match existing.
- 2.5 North side: base of pilaster on north side of doorway connecting to sanctuary.
- 2.6 North side: lower band removed entirely with void cleaned out and replacement timbers inserted to suit existing revetment. Patination to match existing.
- 2.7 South side: band below painted figure at high level, adjoining replacement 10 from sanctuary. Patination to match existing.

3.3 Roof Overhang (Figs. 25 and 26)

Three roof beams on the overhanging sections of the roof above the central axis of the church were replaced due to termite damage (two on the north side and one on the south side – see Figure 7). The beams measured 16cm x 7.5cm x 4m, and were soaked with linseed oil and turpentine and painted on site with red oxide primer to match the appearance of all the other timbers on the roof. Termite activity was most pronounced on the north side, along the line of the inner beam that was replaced. Here it was noted that the damage had extended to the underside of the treated cladding that had been installed on the roof in 2014.

4 OUTSTANDING ACTIONS

At the request of the local inspectorate and conservation department, the large timber replacements (lintels) in the sanctuary will be treated with wood stain to match the existing adjacent timbers. This is a cosmetic treatment that is not strictly necessary since the replacement timbers will themselves darken with age. This work will be carried out in October when the remainder of the external termite protection and landscaping work will be carried out.