

**FRANCO SCIORILLI**

**LEAD CONSERVATOR**

**A History of Conservation at the Temple of the  
Winged Lions**

**JULY 9 2019**

**Lecture Hall, AL HUSSAIN BIN TALAL UNIVERSITY, Petra College for  
Tourism and Archaeology  
Wadi Musa, Jordan**

**فرانكو سكوريلى**

**خبير الترميم**

**تاريخ ترميم معبد الأسود المجنحة**

**التاسع من يوليو 2019 في قاعة محاضرات جامعة**

**الحسين بن طلال ، كلية البتراء للسياحة والآثار**

**وادي موسى ، الأردن**



**USAID**  
FROM THE AMERICAN PEOPLE



**ACOR**  
AMERICAN CENTER OF  
ORIENTAL RESEARCH  
المركز الأمريكي  
للأبحاث الشرقية



**SCHEP**  
Sustainable Cultural Heritage Through  
Engagement of Local Communities Project

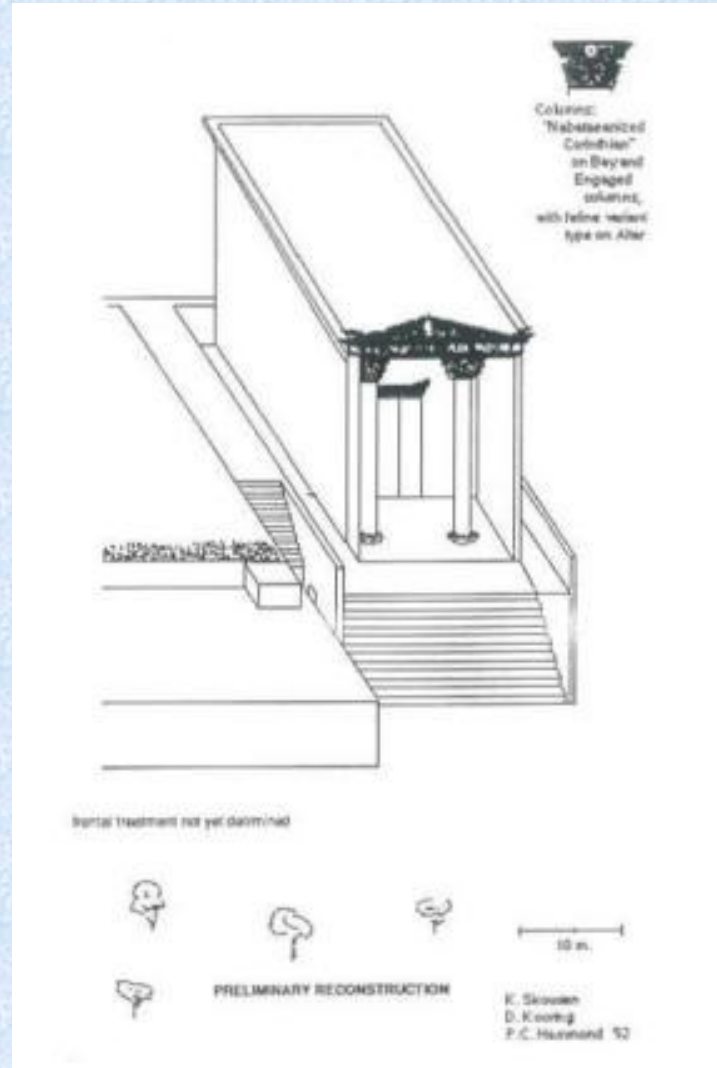
**1973-1990**  
**Dr. Philip C. Hammond**  
**‘ Temple of the Winged Lions’**  
**Survey, Excavation and**  
**Research**

**1990 – 1973**  
**الدكتور فيليب هموند**  
**" معبد الأسود المجنحة "**  
**مسح- تنقيب- بحث**



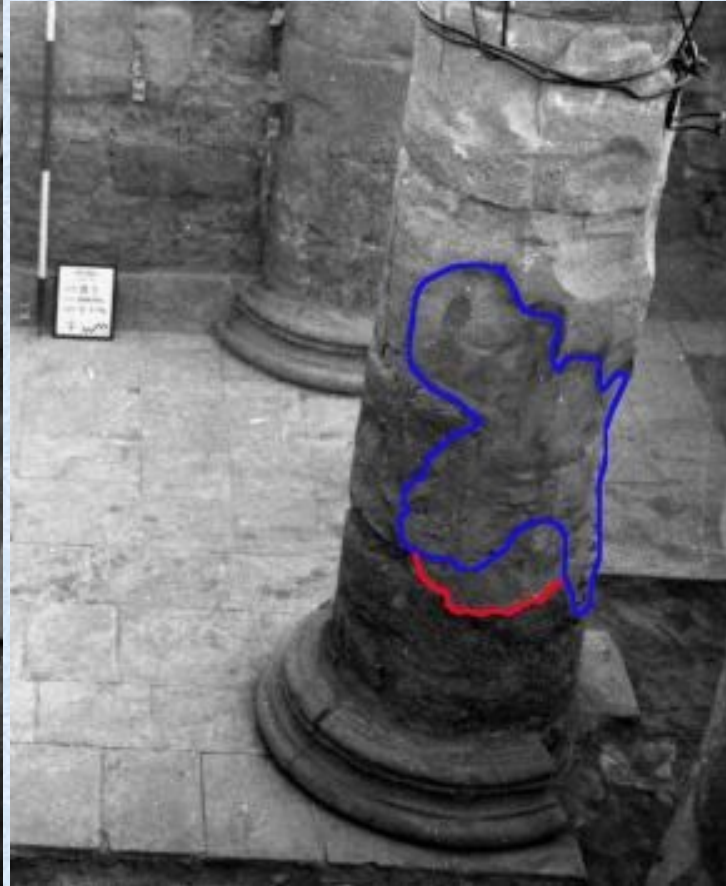
1992

# Proposal for the reconstruction of the TWL





# Stabilization and consolidation of column 34 E



**2012-2014**  
**Christina Danielli**  
**Lead Conservator**

**2014 – 2012**  
**كريستينا دانييلي**  
**خبيرة ترميم**





# Conservative Intervention

- North and East interior walls of the Cella
- Vertical walls of the Podium
- Part of the columns





- Mortar Test
- Application of Mortar
- Consolidation

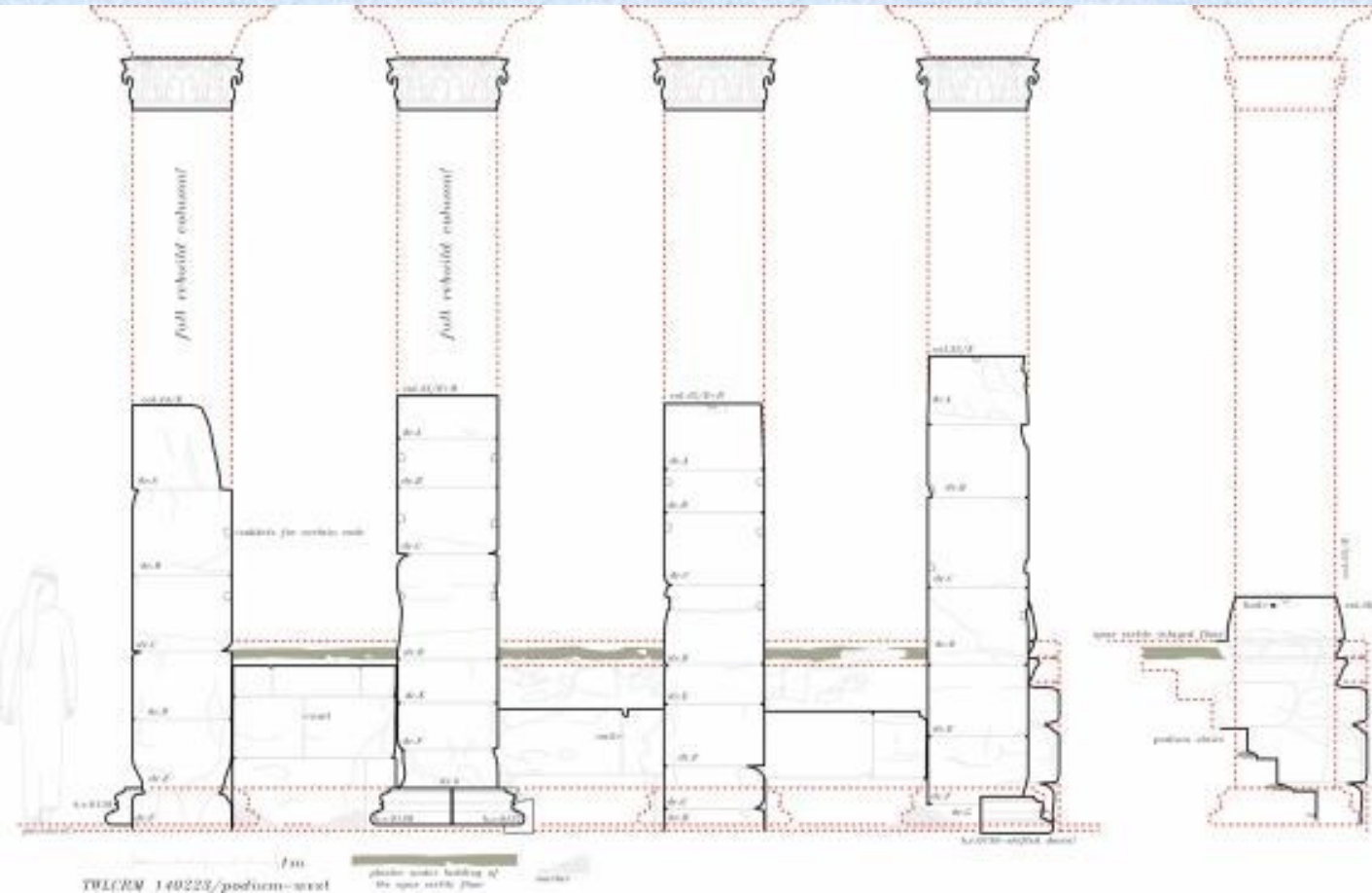








# DOCUMENTATION BY QAIS TWESSI



# 3D RECONSTRUCTION OF THE SWQ BY JASON BLANZY





# 2014-2018 Engineering Geological Investigation at TWL

**Giuseppe Delmonaco (ISPRA, ACOR consultant)**

**2014-2018**

البحث الجيولوجي الهندسي في موقع معبد الأسود المجنحة  
جوزيبي ديلموناكو (مستشار المركز الأمريكي للأبحاث الشرقية)



# Why Engineering Geology at TWL?

- ❑ The TWL is located in a highly seismic-prone area in Petra
- ❑ Sandstone-forming materials of the TWL structures (e.g. walls, columns) are highly exposed to mechanical and chemical degradation
- ❑ Slope stability problems in zones interested by recent archaeological excavation (e.g. SW quadrant)
- ❑ Diffuse erosion, also enhanced by construction of paths



- ❑ Restoration/consolidation works for the safeguard of the TWL need measures that take in due consideration the negative effects of geological/natural hazards in the long-term
- ❑ A comprehensive and inter-discipline approach between traditional different expertises dealing with CH (i.e. archaeology, architecture, conservation/restoration) and Earth Sciences experts is strongly needed for long-term and sustainable conservation of the TWL



# Mechanical and chemical degradation of sandstone materials

July 2014

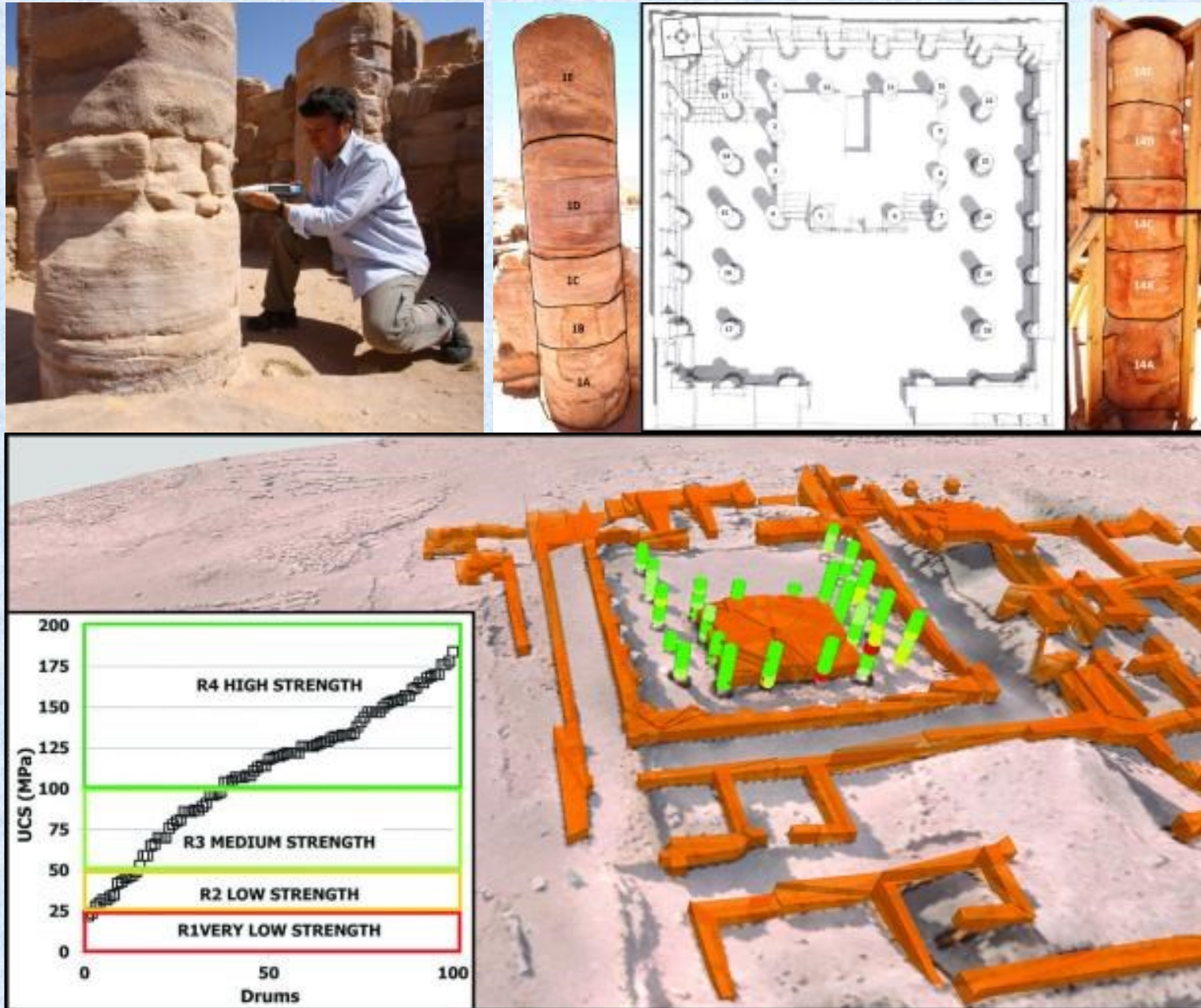
## *Issues*

Possible elevation of columns in the NW side of the cella with reconstruction of horizontal structures (beams)

- Mechanical deterioration of some elements (drums) of the columns of the temple cella;
- Presence of inclined columns in the western corridor of the structure;
- Consolidation and restoration of individual columns;
- Irregularity of foundation soils and presence of underground structures.

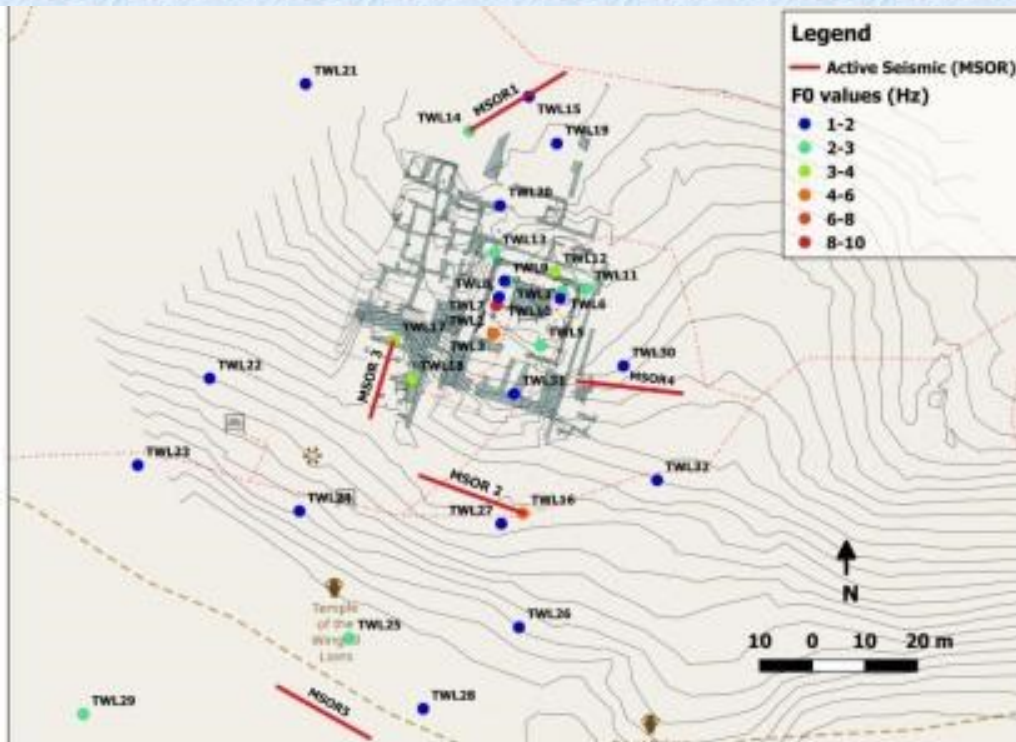
## *Activity*

- ✓ Geo-mechanical assessment of blocks forming TWL cella (22 columns, 104 drums)
- ✓ Set-up of topographic monitoring





# Seismic vulnerability (geophysical investigation)



November 2014

## Issues

- Mechanical deterioration of some elements (drums) of the columns of the temple cella;
- Presence of inclined columns in the western corridor of the structure;
- Consolidation and restoration of individual columns;
- Irregularity of foundation soils and presence of underground structures;
- Presence of salts;
- Seismic vulnerability of the TWL
- Stability of the N wall in the SWQ

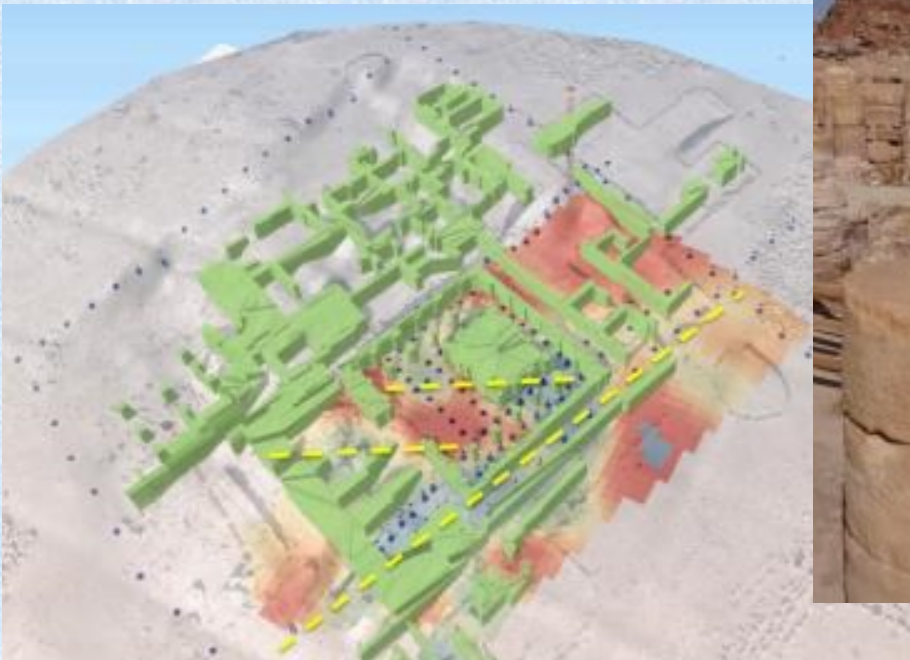
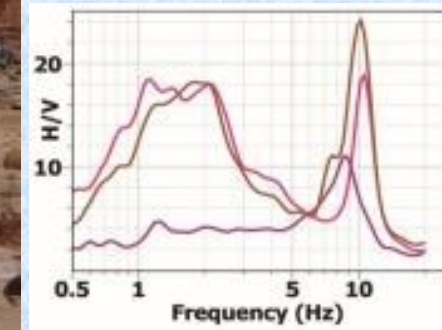
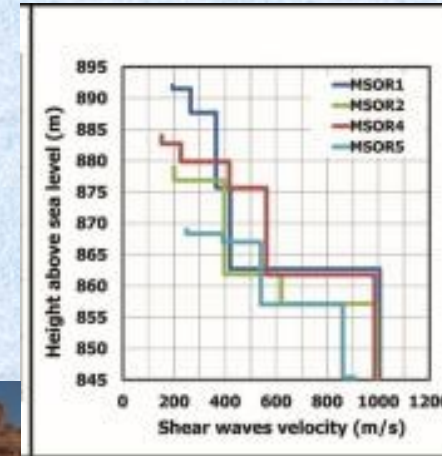
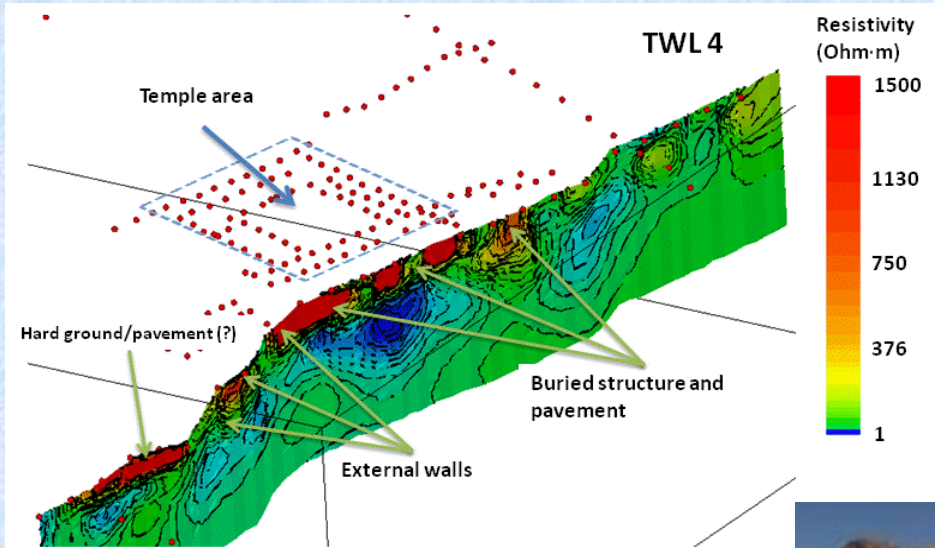
## Activity

- ✓ Geophysical investigation: 19 seismic active and passive tests; 11 geoelectrical surveys
- ✓ Geotechnical analysis
- ✓ Topographic monitoring



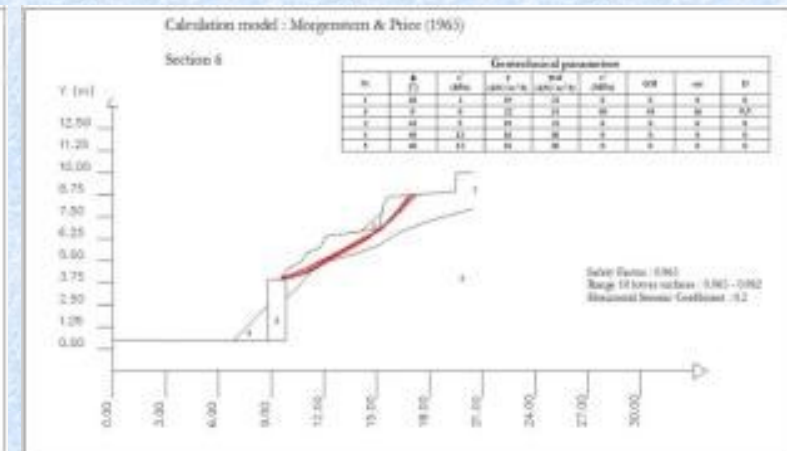
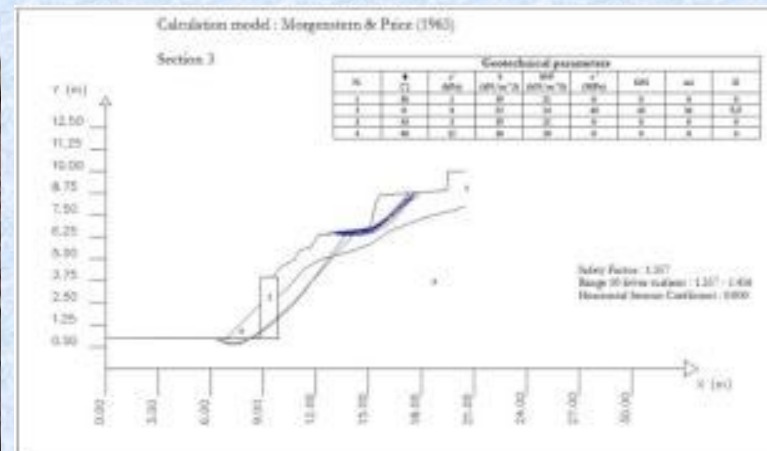
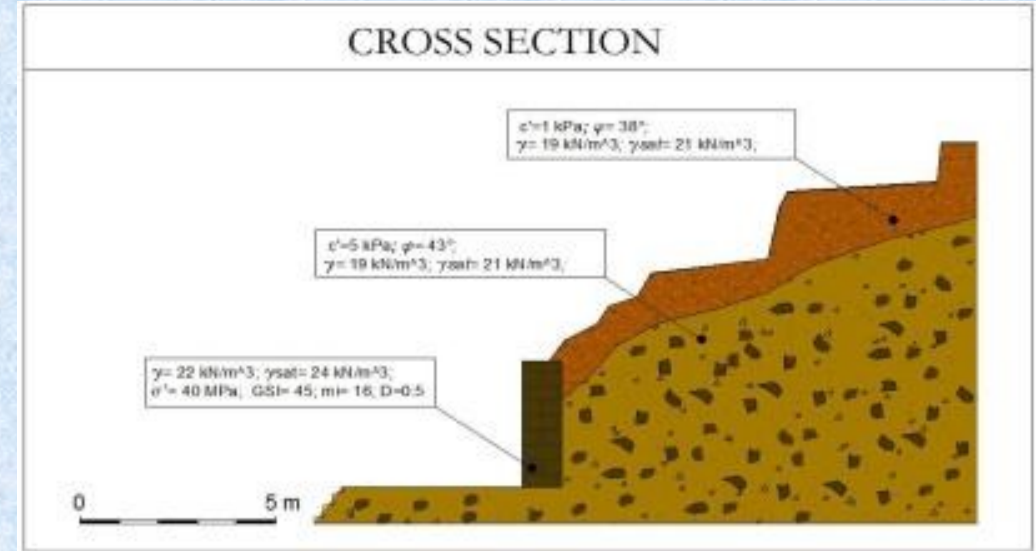


# Seismic Vulnerability



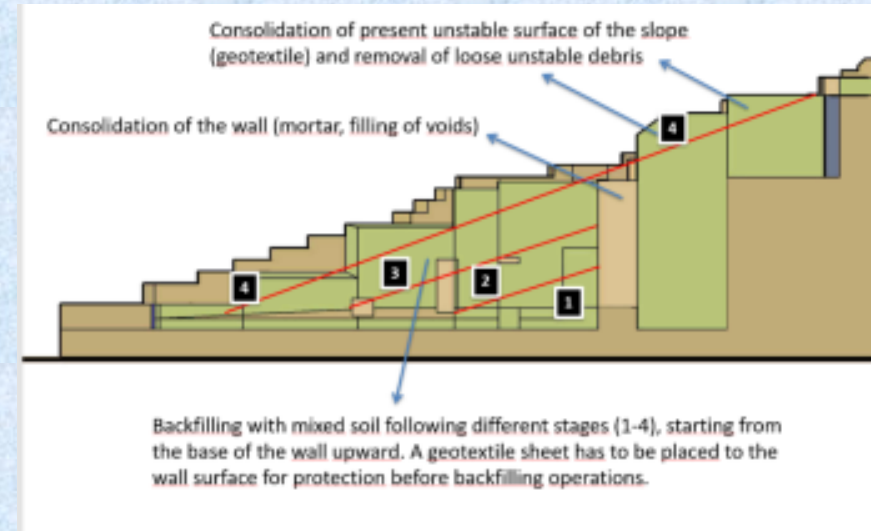


# Slope Instability





## Oct. 2016-Jan. 2017 (Backfilling SWQ)



## Oct. 2017 (Backfilling SWQ)





## **Dec. 2017 (Backfilling SWQ)**

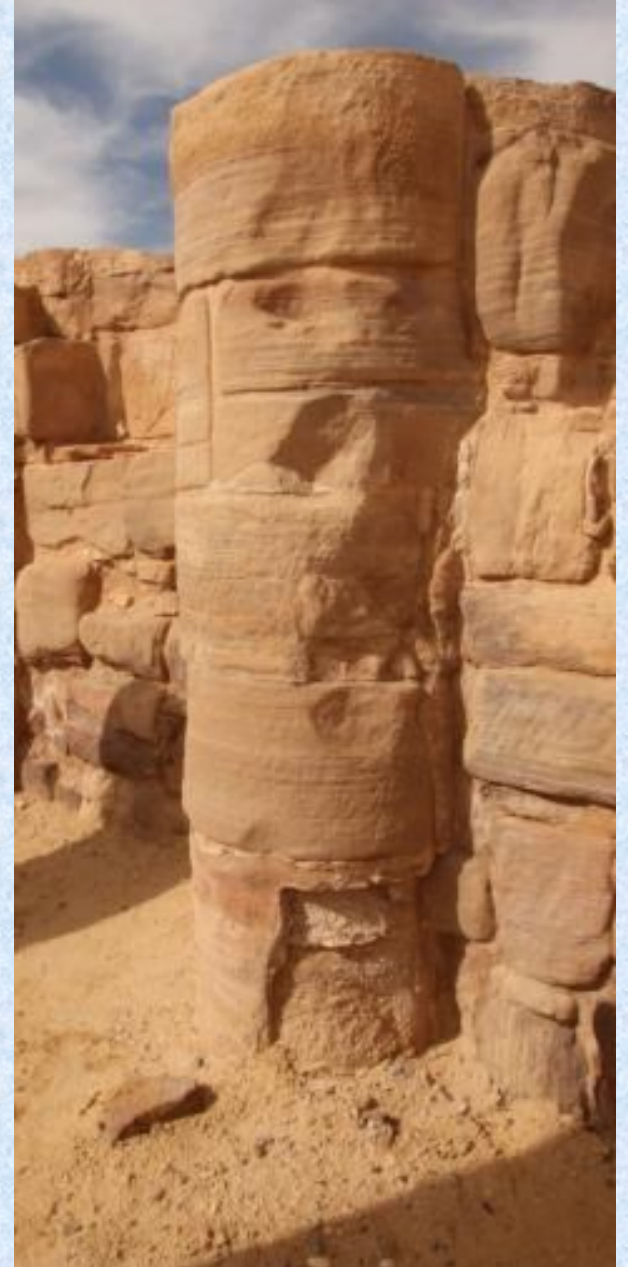


## **Survey Feb. 2018 (Backfilling SWQ)**





## Survey Feb. 2018 (Salts)





## Survey Dec. 2018 (S wall)



### ISSUES

- ✓ Inclination southward
- ✓ Overload by backfilled soil
- ✓ Salts and mechanical degradation of blocks



### ANALYSIS/PRELIMINARY SOLUTIONS

- ✓ Stability analysis on present conditions of the wall
- ✓ Reduction of the backfilling level
- ✓ Rehabilitation of sandbags buttress



## Survey Dec. 2018 (N corridor, unstable wall)



### ISSUES

- ✓ Inclination southward
- ✓ Overload by backfilled soil
- ✓ Salts and mechanical degradation of blocks

### ANALYSIS/PRELIMINARY SOLUTIONS

- ✓ Stability analysis on present conditions of the wall
- ✓ Reduction of the backfilling level
- ✓ Rehabilitation of sandbags buttress
- ✓ Drainage



# Survey Dec. 2018 (Drainage conditions TWL area)



## ISSUES

- ✓ Erosion of backfilled areas
- ✓ Effects of paths on water run-off

## ANALYSIS/PRELIMINARY SOLUTIONS

- ✓ Documentation of erosion forms and drainage
- ✓ Channelling
- ✓ New design and planning of paths



# Survey Dec. 2018 (Lapidarium assessment)



## ISSUES

- ✓ Erosion/weathering of the artifacts
- ✓ Water run-off in the area

## ANALYSIS/PRELIMINARY SOLUTIONS

- ✓ Analysis of weathering vs. typology of materials
- ✓ New design of the Lapidarium area
- ✓ Placement of artifacts on a platform
- ✓ Construction of dry wall (landscaping)
- ✓ Drainage



**2016-2018**  
**Franco Sciorilli**  
**Lead Conservator**

**2018-2016**  
**فرانكو سكوريلى**  
**خبير الترميم**





# Theory and Documentation



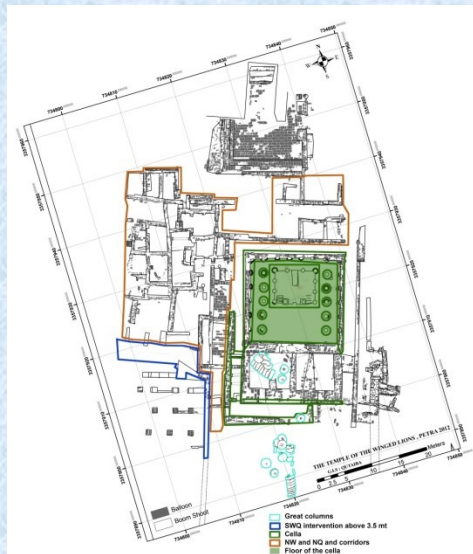
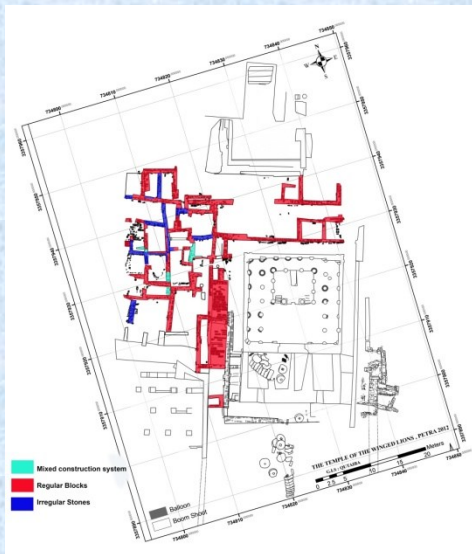
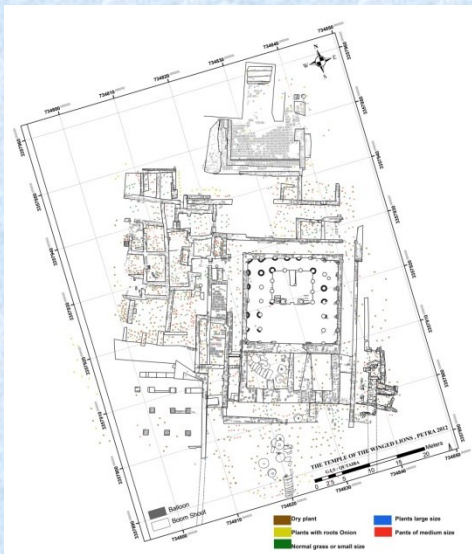


# **Documentation of Architectural Structures: Eman Abdessalam and Halemah Alnawafleh**





# Documentation Maps





# Herbicide and removal of plants





# Salts Removal





# Cleaning and removal of unstable soil





# Selection of Aggregates





# Base-Lime Mortar Test with different Lime (Hydrated and Hydraulic) and different aggregates





# **Consolidation with mortar: demonstration and active participation of older trainees**





# Applying Mortar



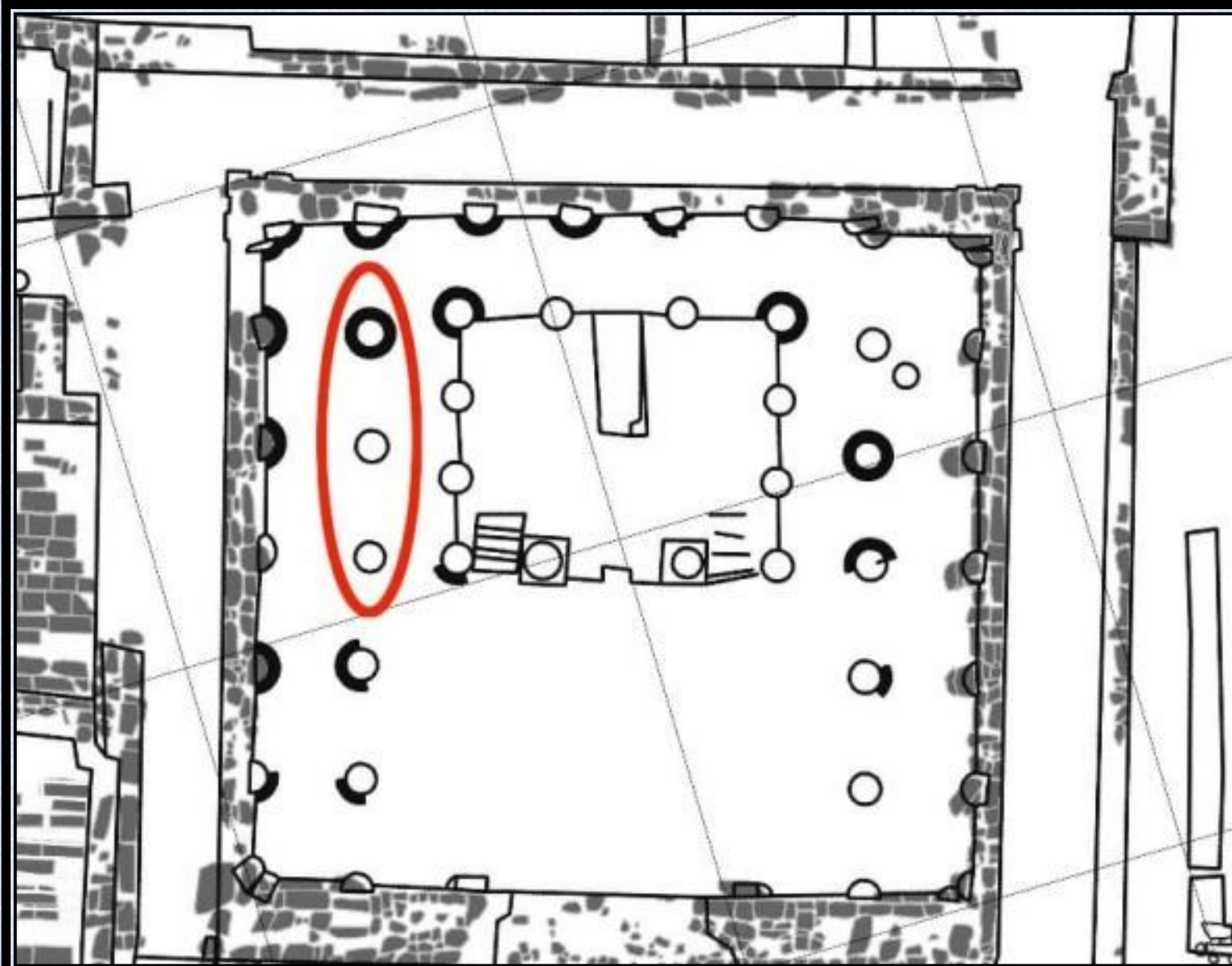


# Grouting joints with inclination for evacuating rainwater





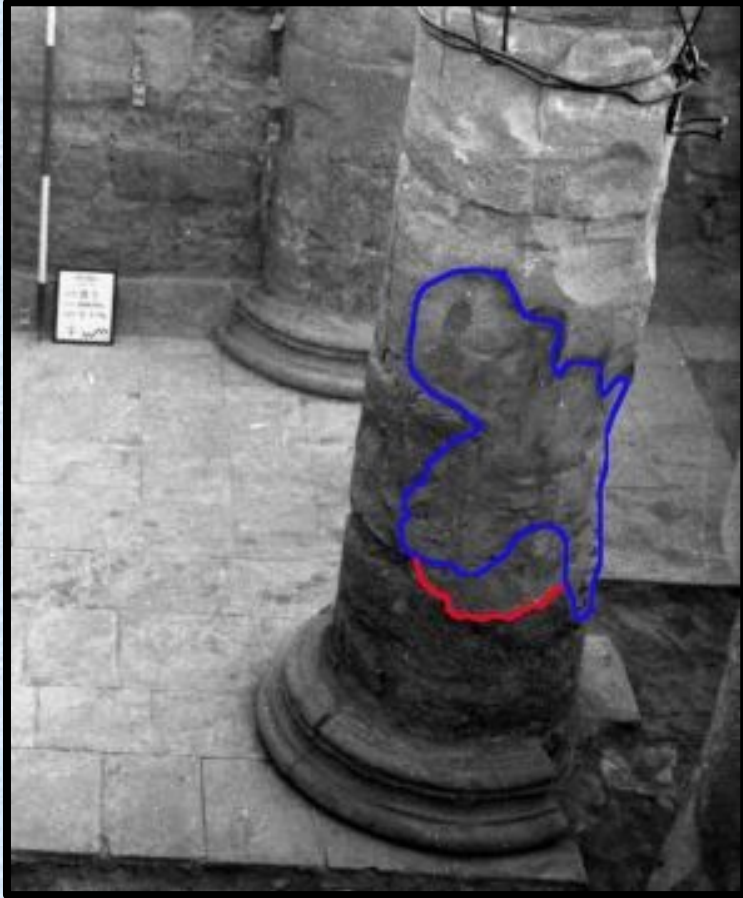
# Intervention in the Podium of the Cella and Columns 32E - 33E - 34E





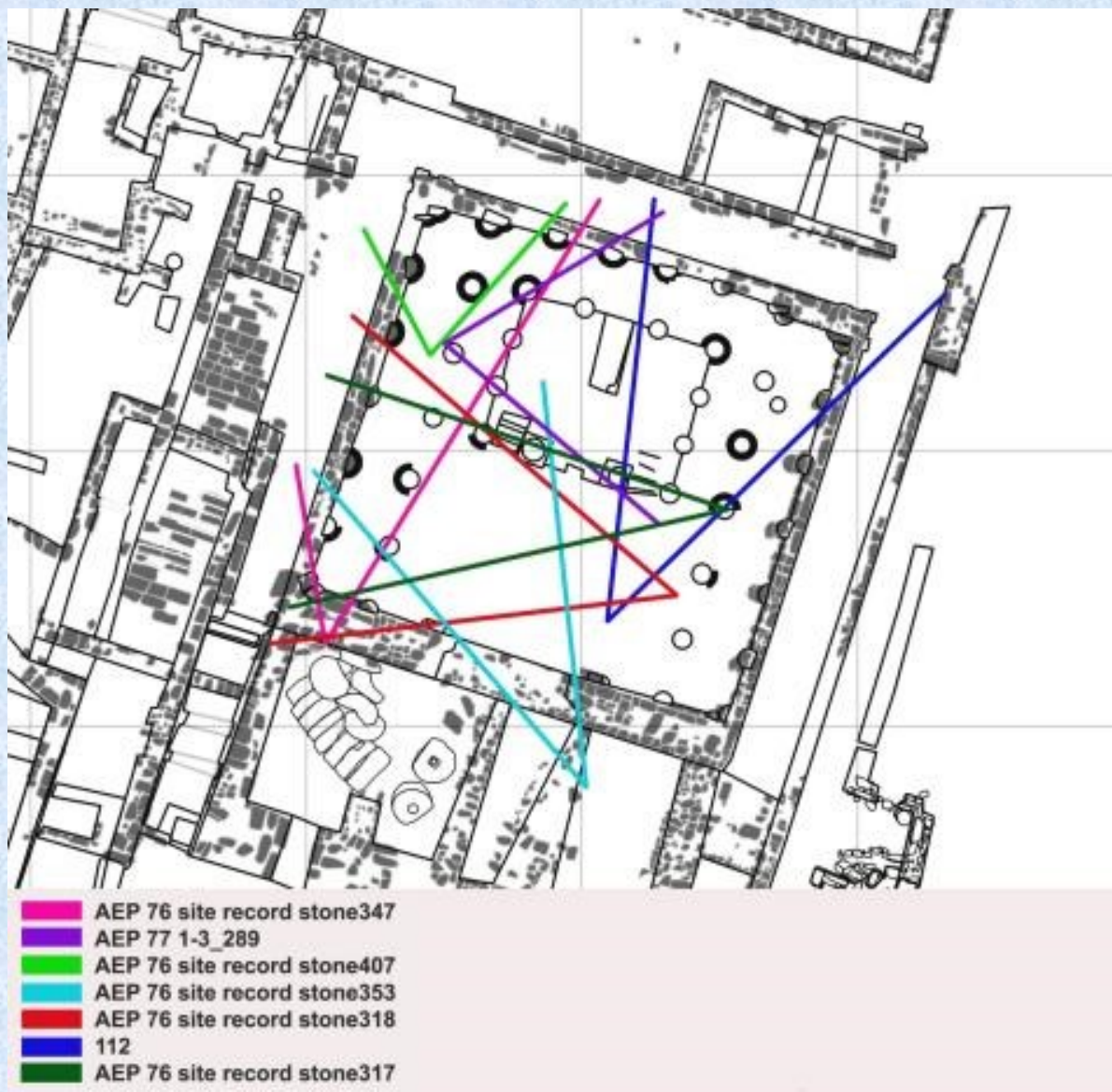
# Photo of the excavation with obvious problems of deterioration

صورة من الحفريّة تبين مشاكل التلف الواضحة





# Reconstruction of the points of the photographic shots





# Tilt of the 3 columns for land subsidence



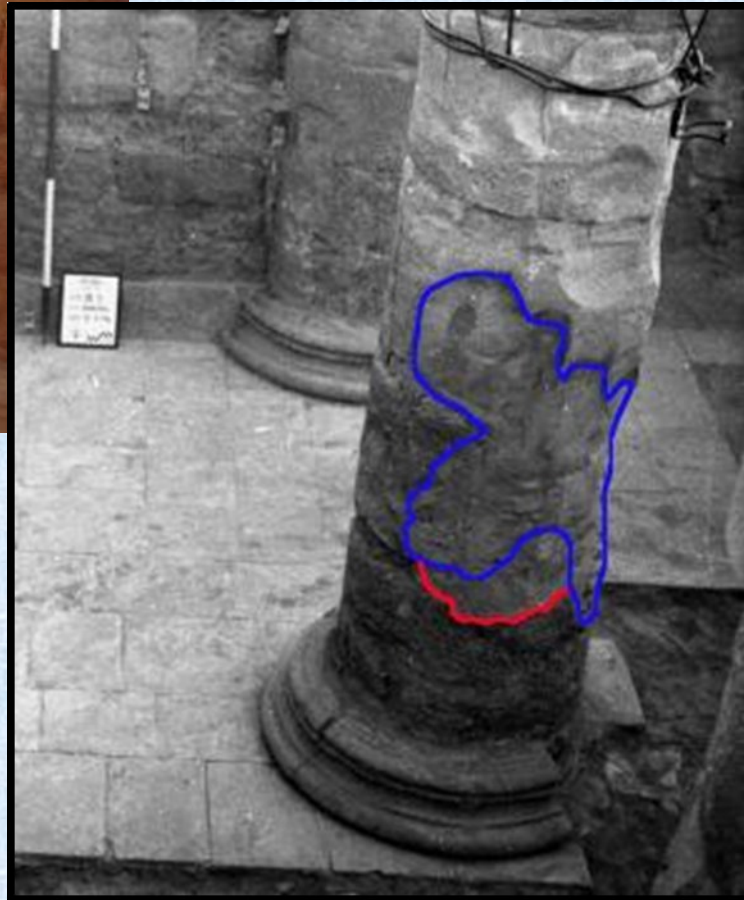


# Harness with wooden posts of columns 32E and 33E





# Replacement of the second drum





# Re-adhesion with Basf epoxy resin





# Repositioning of the column drums



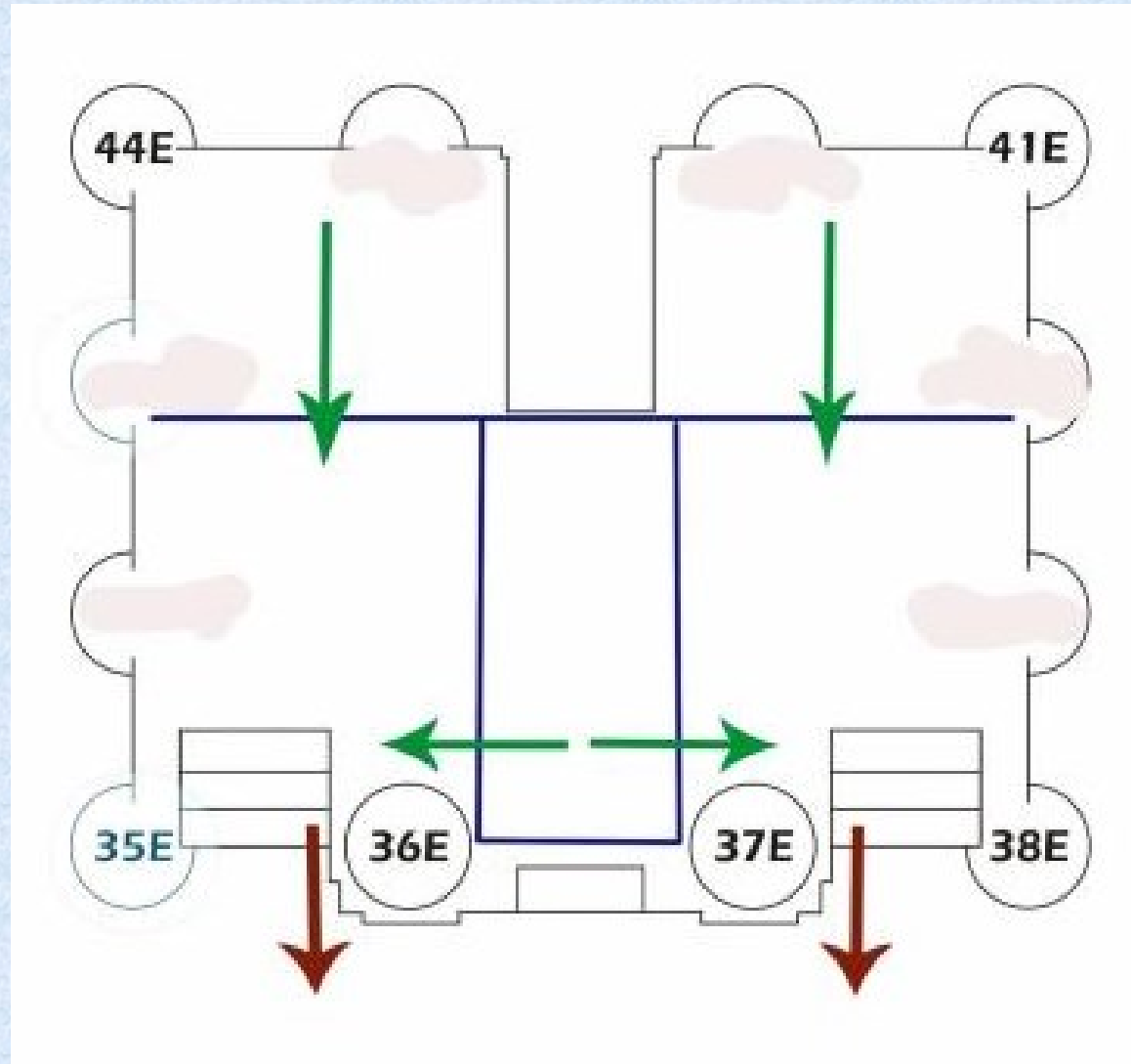


# Podium of the Cella





# Evacuation of water from the Podium





# SWQ

## Intervention of stabilization 2017-2018



تدخل لتثبيت الربع الجنوبي الغربي  
2018-2017



# Cleaning from dust and debris



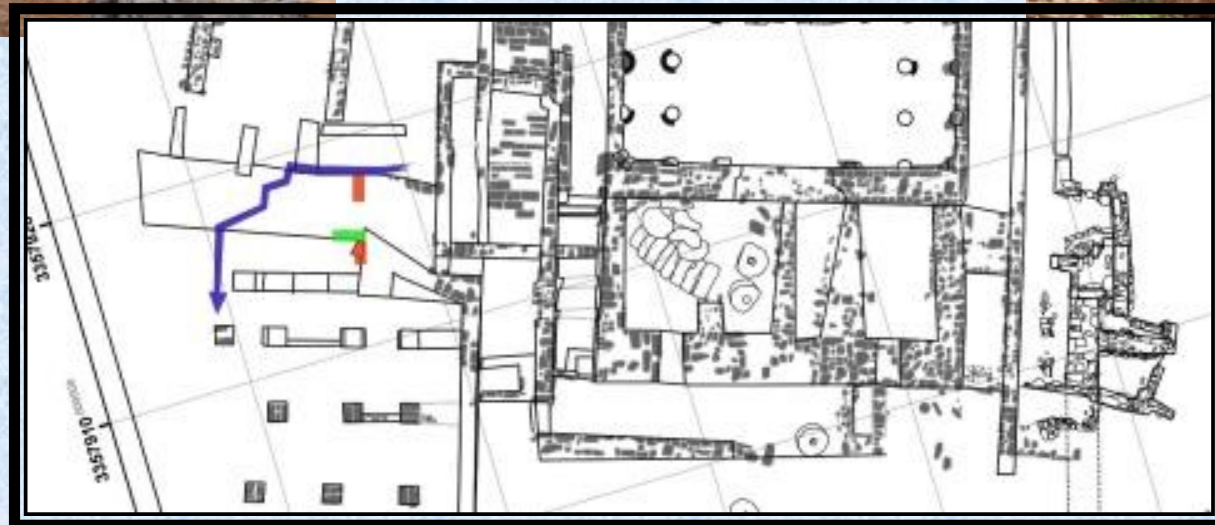


# Depth and Final Lime Base Mortar





# Details of the problems

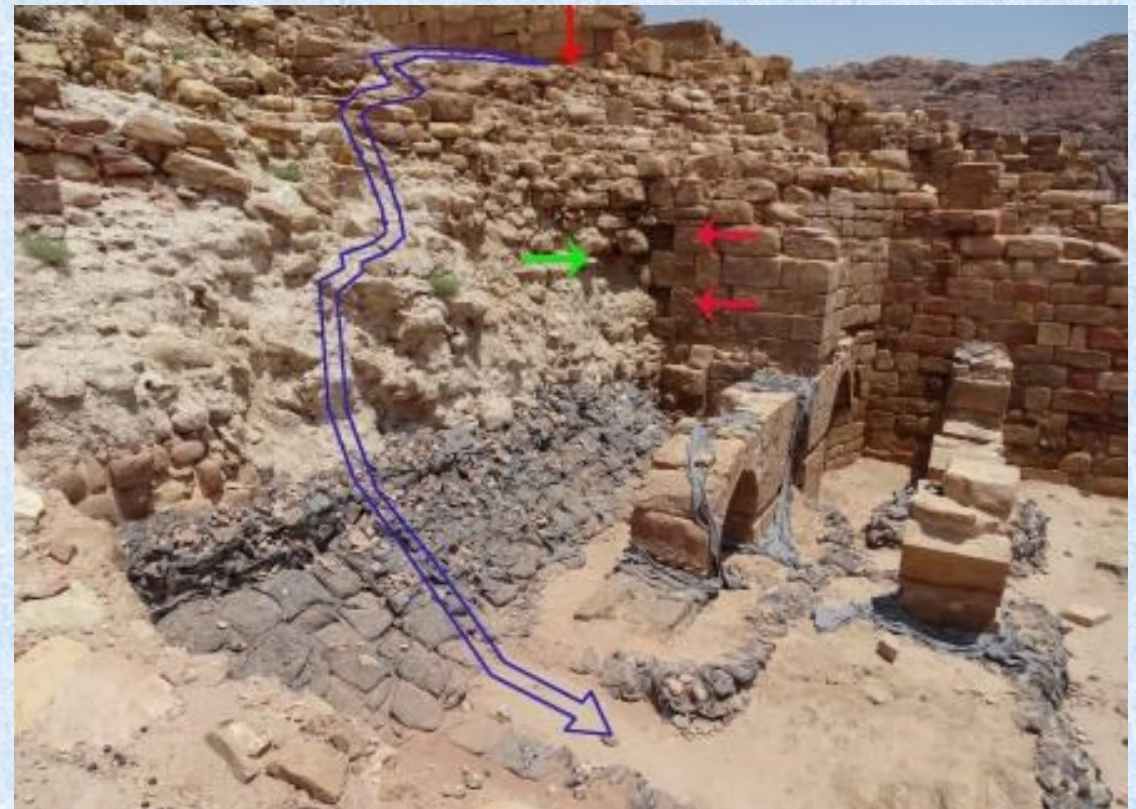




 1-Drainage channel

 2- Support wall

 3- Put two stones back





# Drainage channel





# SWQ Intervention Nov-Dec 2018

تدخل في الربع الجنوبي الغربي خلال الفترة من نوفمبر – ديسمبر 2018





# Channels created by rainwater





# New channel for rainwater



THE BOTTOM OF THE CHANNEL FOR THE FLOW OF THE RAINWATER







# Documentation for priority interventions

التوثيق للتدخلات ذات الأولوية

**North-West corner**





# North-East rooms





# South Wall



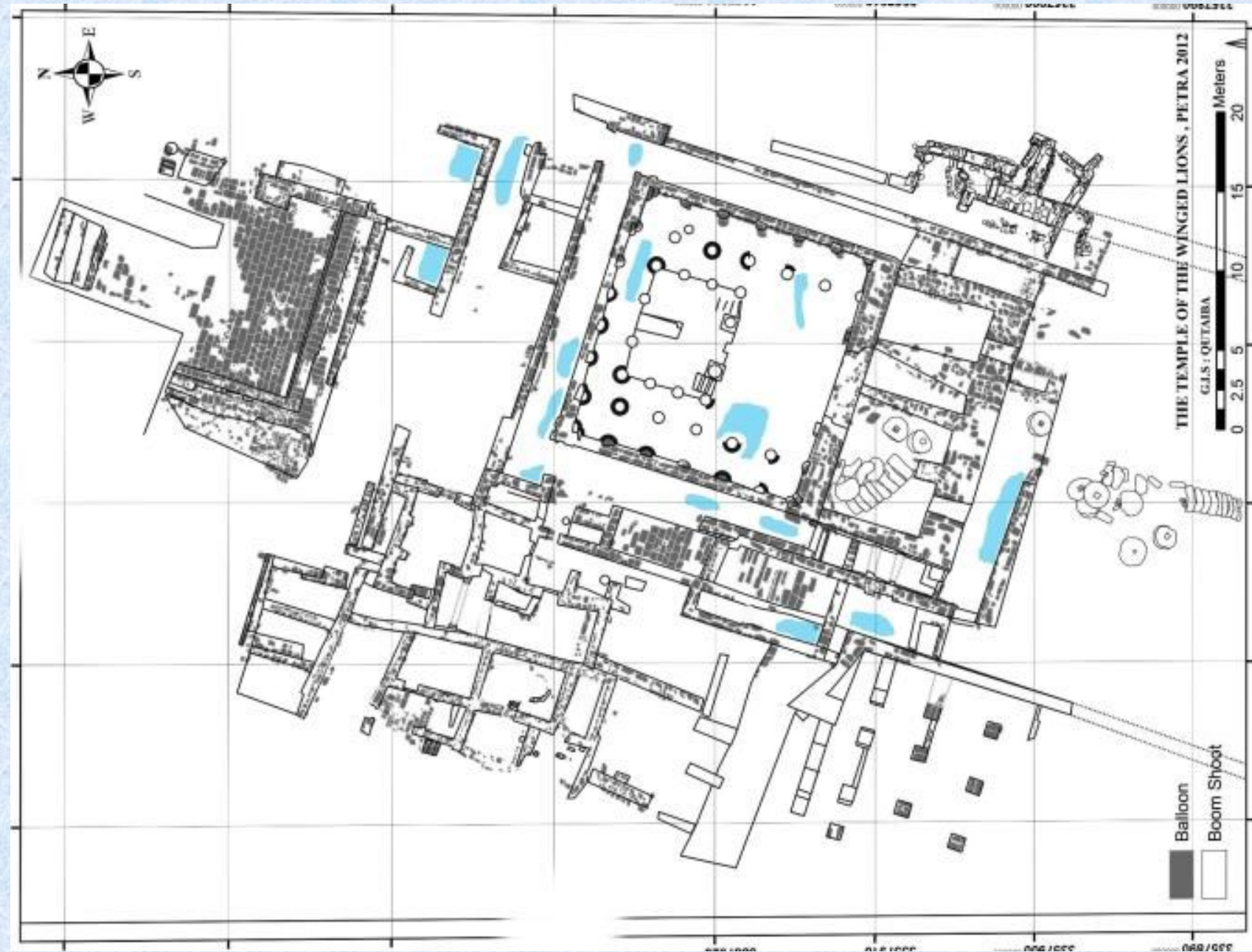


# West stairway





# Rainwater Accumulation





# *Thank you all for your attention*

## *شكرا لكم جميعا على اهتمامكم*

### **Team Project:**

*Christipher A. Tuttle, PhD. Project Director*  
*Glenn J. Corbett, Ph.D. Project Director*  
*Jack Green, Ph.D. Project Director*  
*Arch. MariaElena Ronza, Co-Director*  
*Dr Ibrahim Farajat Director of CRM of PDTRA*  
*Dr Hasan Lawama*  
*Giuseppe Delmonaco, Engineering Geologist*  
*Qutaiba Dasouqi, Archaeology Surveyor Senior*  
*Franco Sciorilli, Lead Conservator*  
*Eman Hussien Abdessalam Site Steward*  
*Baha' Jankhot, Senior Conservation Assistant*  
*Khaled Wekhyan, Senior Conservation Assistant*  
*Hamza Wekhyan, Senior Conservation Assistant*  
*Khaled Wekhyan, Senior Conservation Assistant*  
*Halemah al Nawafleh,*  
*Wajd al Nawafleh, Conservator*  
*Hala al Farajat*  
*Taher al Falahat*  
*Dina al Mashaleh*  
*Haroun Amarat*  
*Ahmad Mowasa, Site Steward*

*Shaker Alfaqeer*  
*Bassam Alfaqeer*  
*and All the Team of TWL*

*Christina Danielli, Lead Conservator*  
*Carlo Usai, Lead Conservator*  
*Francesca di Giandomenico, Conservator*  
*Francesca Procaccina, Conservator*  
*Rosaria Damiano, Conservator*  
*Mohammad Fraj, Assistant Conservator*  
*Milena Zafirova, Assistant Conservator*

*Qais Twessi, Archaeology documentation senior*