

# Qalaat Ja'bar Report 2022

## Historical and Archaeological Study, Damage Assessment, Current Situation, Stabilization, and Proposed Restoration

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### Introduction and Historical Background

Qalaat Ja'bar, or Jabbar Castle, is one of the most important medieval castles in Syria, particularly in the north. This sprawling anti-Crusader fortress of the eleventh century dominates an escarpment overlooking the east or left bank of the Euphrates River in Raqqa Province, 17 km northwest of the city of Al-Thawra. The castle is 55 km from Raqqa city and 45 km east of the City of Meskana, at an elevation of 347 km above sea level. Today the site lies on the edge of the impound lake behind the Tabqa hydroelectric dam, which was completed in the 1970s.

It has an oval form, over a high rocky base on the east side of the Euphrates Valley. At one of the river crossings opposite the semi-desert of Al-Rasafa in Shamia, the Castle is a ring in the chain of castles and fortified sites scattered along the valley in Syria, this is besides the river, which is a natural obstacle, especially for those coming from the north and east.



3D prototype of Ja'bar Castle/ Click on the Picture to Visit and Navigate the full 3D Model

The identity of the original builder of a fortification on the site is unknown. It has been mentioned in history as Dosser Castle. It was captured by the Qasher tribe and inhabited by one of its elders, Ja'bar ibn Aqili, and named after his name, which was taken from it by the Seljuk Sultan Malkshah in 1086, and then passed to Salem bin Malik al-Aqili, where he founded an emirate that played its role in the events of the Crusades. The castle was besieged by Zinki in 541 Ah / 1146 AD; he was assassinated in front of its walls. It was occupied by the Crusaders from Odessa in 1168, and then liberated by Muslims.

In 658 Ah /1260 A.D., it was renewed by Sultan Qalawun al-Alfi. At its foot, the Ottoman tribe buried its grandfather Suleiman Shah, who died crossing the river to Asia Minor.

Entry to the castle, which is surrounded by two walls supported by towers, is through a tunnel dug into the heart of the rock. In addition to the defense centers, it includes a number of complexes with public facilities, particularly the Grand Mosque with its round minaret decorated with epigraphic decorations. Bricks have been widely used for construction and restoration, and there is a museum established in one of the towers that contain artifacts from the citadel excavations. After the construction of the Euphrates Dam, the castle was transformed into a peninsula surrounded by lake waters except for a passage way connecting it to the land to the north.

The Directorate General of Antiquities surrounded it with a concrete wall that protects it from water, repaired some of its dilapidated parts, and carried out an excavation campaign that has so far revealed many of its features.<sup>1</sup>

### **General description of Ja'bar Castle:**

The castle is 320 m × 170 m and is enclosed by two huge walls surrounding the castle's facilities. In the center of the castle a mosque was built, and its minaret is still majestic after it was restored. The castle is located at the following coordinates: 35°53'48.80"N38°28'52.09"E

The castle, which looks like an island in the middle of Lake Assad, is connected to the mainland by a small road. The castle is based on a promontory of limestone. These

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<sup>1</sup> Group of researchers: Geographical Dictionary of The Syrian Arab republic, Part II, Center for Military Studies p. 677

rocks determine the bed of the river that is formed by the erosion during the long life of the river. The lake exceeds these boundaries only in a few places when this rocky strip disappears, and the banks of the valley turn into low-rise plateaus consisting of compact blocks of flint, and this riverbed on both sides of the river consists of plains of the right covered by the soil known as Limon, the most fertile land in the region and named after the local custom (al-Zour) and invested in agricultural work<sup>2</sup>.



Aerial view of Ja'bar Castle 2022

The Citadel of Ja'bar was surrounded by many sites and archaeological hills, most of which were flooded by the rising water level of the lake. Archaeological excavation missions were formed through an international appeal to preserve archaeological sites in the area of the immersion of the Euphrates Dam, such as the sites of Abu Hurira, Debsi al-Faraj, Al-Marit, Tal Sheikh Hassan (submerged sites), Old Meskana, Tal al-Feri and Halawa.

### **Ja'bar Castle during the Syrian crisis:**

In early 2011, Raqqa was under the Syrian government, and for nearly two years it was subject to sporadic military tensions of several factions, the most important of which were the Free Syrian Army factions, the "Omanaa Al-Raqqa".

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<sup>2</sup> Al-Rihawi, Abdul Qadir: Saving Antiquities in the Euphrates Dam Area, Syrian Archaeological Magazine Hawliat, Volume 15, 1965, p. 17.

In March 2013, this faction took control of Raqqa after battles involving Ahrar al-Sham factions mainly with the symbolic assistance of Jabhat al-Nusra, which quickly took control of government buildings, including the Raqqa Museum, from which quite a few artifacts and museum pieces were looted. On June 6, artifacts were stolen from the Ja'bar Castle Museum, located in the Aliaa Tower (T30), which numbered 17 artifacts containing many pottery and small statues. Between May and July 2013 ISIS cells began to emerge and carry out a series of kidnappings that turned into an open war (which lasted from mid-August 2013 until January 1, 2014) between factions and extremist organizations to control the area.



Artifacts stolen from The Ja'bar Castle Museum in 2013

ISIS also used the newly restored wall as a shield for the training of the cubs of the caliphate (Ashbal al-Khilafa) in live shooting. On Thursday, January 5, 2017, the SDF took control of Jabbar Castle, and on 17 October 2017, the SDF brought Raqqa city under control with all areas and areas around the city.



A picture showing the effects of the (Ashbal al-Khilafa) training on firing on the newly restored retaining wall in the western part of the walls of The Citadel of Ja'bar

### **Archaeological excavations and previous restoration work at Ja'bar Castle:**

The initial excavations carried out at the castle were during the French Mandate period (1920-1946). Some of the excavations were carried out at the top of the castle during 1929, as well as a restoration of the minaret through the establishment of a square base to strengthen it and protect it from collapse by the Syrian Antiquities Department.<sup>3</sup>



An old aerial view of Ja'bar Castle before the construction of the Euphrates Dam and the Assad Lake (Ifpo 1939)

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<sup>3</sup> Al-Rihawi, Abdul Qadir: Saving Antiquities in the Euphrates Dam Area, Syrian Archaeological Magazine Hawliat, Volume 15, 1965, p. 343.

During 1963, public surveys of the area around the Euphrates River were conducted before the formation of the industrial lake at the request of the Directorate General of Antiquities and Museums of Syria and with the support of UNESCO, where the attention turned to The Citadel of Ja'bar .

The beginning of excavations at Ja'bar Castle during 1967 in the administration of Dahman and Jabali was limited to some inspection, accompanied by cleaning work for the fence area, but the works were not documented unfortunately. <sup>4</sup> These studies of the castle's surface were aimed at learning the history of the scattered pottery, where pottery dating back to the Byzantine period was found at the bottom of the Islamic layer, confirming that the castle went through two phases.

Then the excavations of the castle continued intermittently during the period between 1970 and 1983 by the Directorate of Antiquities in Hama under the administration of Abdul Razaq Zaqzouq, also accompanied by cleaning and restoration work that continued under the supervision of the Raqqa Antiquities Office.

Excavations focused around the minaret area and on the southwest side of the castle's surface. Unfortunately, most of the discovered artifacts were moved to Hama, and disappeared during the events of Hama in 1982, as well as the pieces preserved in the Citadel of Ja'bar, whose documents disappeared later.

The late Qassim Toir and Marhif al-Khalaf also worked with the participation of the late Zaqzouq in the archaeological excavations for three seasons, and the National Mission established a wooden house above the castle, located to the north near the minaret, and revealed the mosque, which resembles the construction of mosques built in the Abbasid era, similar to the Mosque of Raqqa. The excavation work also extended to the south, where a palace of harem or the wife of the ruler was revealed, but the excavation work did not continue long because of lack of support.

Excavations in the castle returned during 1992 and a restoration of the castle was conducted during the following years, which focused on the walls, towers, and entrance, as well as on the strengthening of the rock mass on which the castle rests. This was done both from the bottom of the lake side by strengthening it with stone blocks as well as from the land side by strengthening the voids in the rock block with brick.

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<sup>4</sup> Al-Rihawi, Abdul Qadir: Saving Antiquities in the Euphrates Dam Area, Syrian Archaeological Magazine Hawliat, Volume 15, 1965, p. 25.

Excavations and restoration work continued in parallel. The restoration was carried out under the supervision of the Directorate General of Antiquities and Museums in Damascus, and the Department of Antiquities of Raqqa continued for a long time in these restoration work until 2010. The restoration work dealt initially with the strengthening of the outer wall. The Military Housing Corporation restored this vast area of the western wall of the castle with modern brick material that does not conform to archaeological specifications, due to the use of cement material. The restoration work was continued by the Directorate General of Antiquities and Museums, focusing on part of the outer and interior walls and some towers, in addition to cleaning and restoring the inner corridor to the castle, as well as renovations of some rooms to the right of the castle's main corridor, which were once used as warehouses and horse stables. Restoration work also included the Aliaa tower (T30), which was later converted into a museum containing the artifacts discovered in the castle.

The Russian company carrying out the work of strengthening the rock mass of the base of Ja'bar Castle also built a concrete curtain surrounding the castle using an iron-supported cement mat. The strengthening was stronger in the southern and southwestern parts, which is facing the waves; preparations for these walls first began in 1972, when the lake was flooded<sup>5</sup>.

On February 24, 2021, the Directorate of Antiquities of the Civil Council in Raqqa carried out minor restoration work in Burj al-Ghraib (T15), one of the circular base towers built with bricks 15 m in diameter and 170 cm high, and then over which a pentagonal base is carried out along each side 3 m.

The work included digging a trench behind the outer wall and placing a layer of brown gravel to isolate moisture from the base, which was connected with a drainage network of castle water outwards, in addition to complementing broken and eroded bricks with bricks from the castle itself. Except for the work of leveling the roof of the tower and injecting cracks with brown plaster, all work was done with the hand works and materials suitable for restoration work in the castle.

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<sup>5</sup> Interview with Archeologist Mohammed al-Azzo (former curator of the Raqqa Museum) on April 1, 2022.  
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### **Ja'bar Castle Museum (Aliaa Tower T30):**

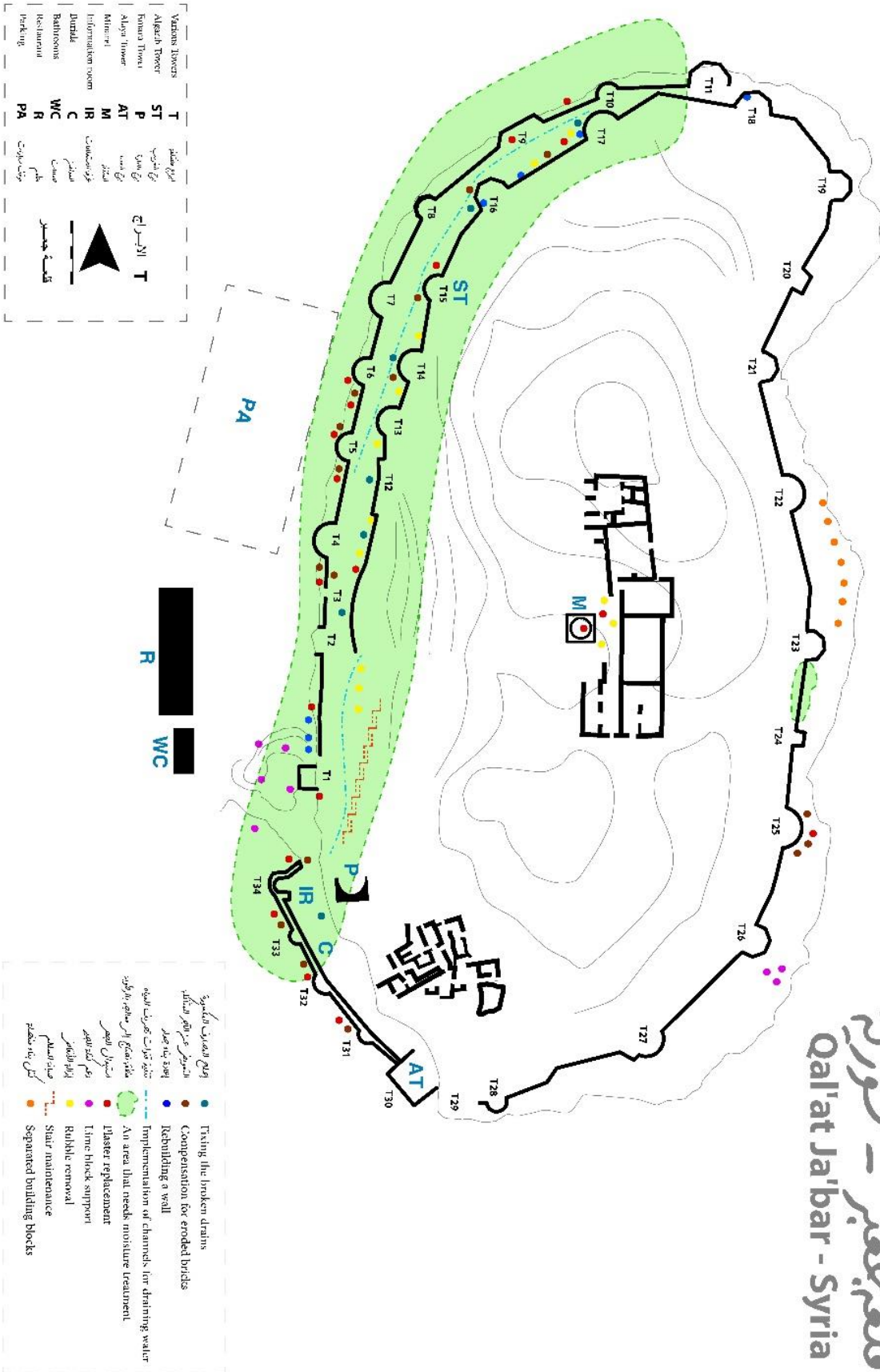
This newly renovated museum contained many Abbasid artifacts (Zinki, Ayyubid) such as pottery jars and ceramic plates, as well as ceramic jars (locally called Qaishani), as well as a variety of lamps. In addition to many of the artifacts discovered in the sites near the Citadel of Ja'bar , such as Tal al-Abd, Tal Al-Salnakhia and Enab Al-Safinah, where they were displayed in a half room in the entrance courtyard before the main corridor leading to the roof of the castle, where some of the transferred stone coffins dating back to the Christian period were placed. All artifacts were stolen from the Museum of the Citadel of Ja'bar at the beginning of events in Syria, and unfortunately there are currently no artifacts belonging to the Citadel of Ja'bar. There is also no documentation available in the Raqqa Archaeological department, indicating excavations or restorations at the Ja'bar Castle Museum.



Aliaa Tower (T30) hit by light and medium weapons, Photograph: Zardasht Ezzo, February 2021



قلاع جبعية - سورية  
Qal'at Ja'bar - Syria



Damage chart in Ja'bar Castle

## Assessment of the situation and damage at Jabbar Castle:

### A. The outer wall on the south side of the castle:

The wall between the Aliaa Tower and the main gate of the castle on the south side of the castle. Built with brick and brown plaster as a bond material, this wall is built from the outside and the bricks form the outer surfaces of the wall.

#### Status and damage:

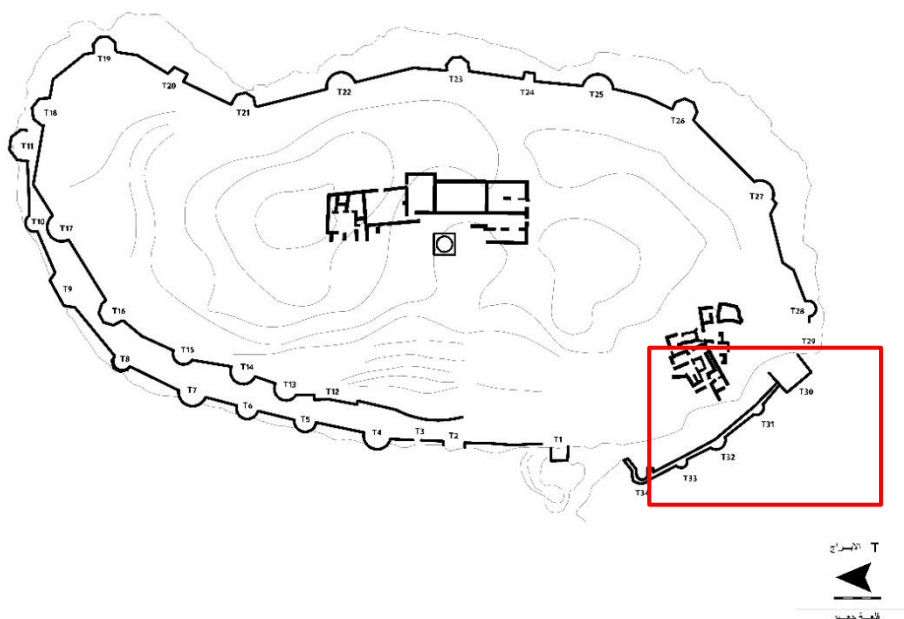
High humidity eroded the brick and fragmented the bonding material. The corrosion of the mortar is estimated at about 40% of the wall area, while the erosion of parts of the wall-shaped brick is about 45-50%.

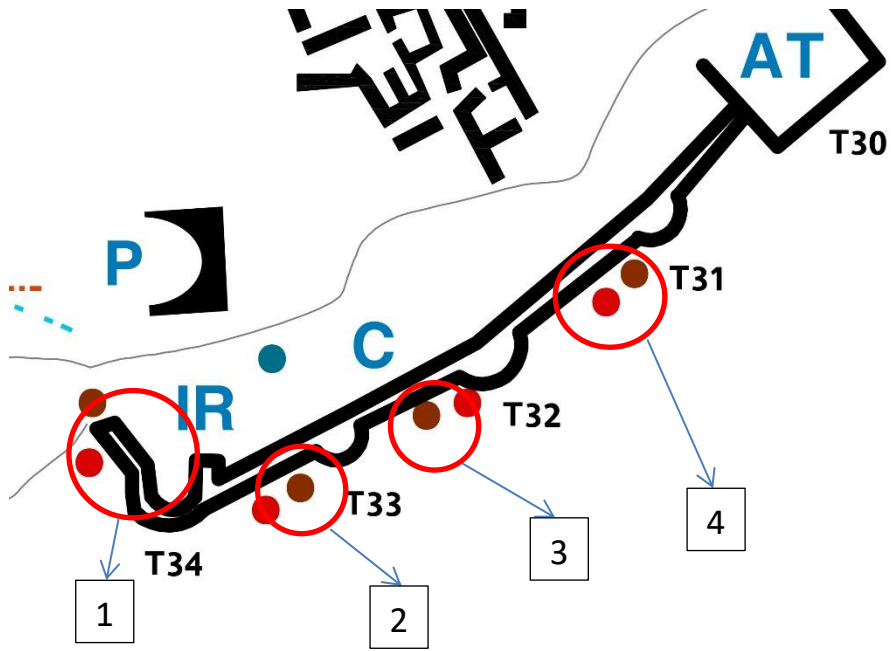
The general condition of the wall is estimated to be (minor damage), which is superficial damage without many changes.

As for the exposure of this part to risks, in the event of non-response and treatment and the persistence of moisture in this part, it will, over time, lead to its collapse. This requires a short-term intervention within a year.

#### Recommendations:

- Treating the cause of dampness by opening and fixing broken drains.
- Replacing the eroded brick.
- Replace the plaster between the brick





Damage at point 1 of the outer wall to the right of the main gate



Damage at point 2 of the outer wall to the right of the main gate overlooking the river



Damage at point 3 of the outer wall



Damage at point 4 of the outer wall

### **B. The wall between the Emirate Tower (T34) and the first tower (T1):**

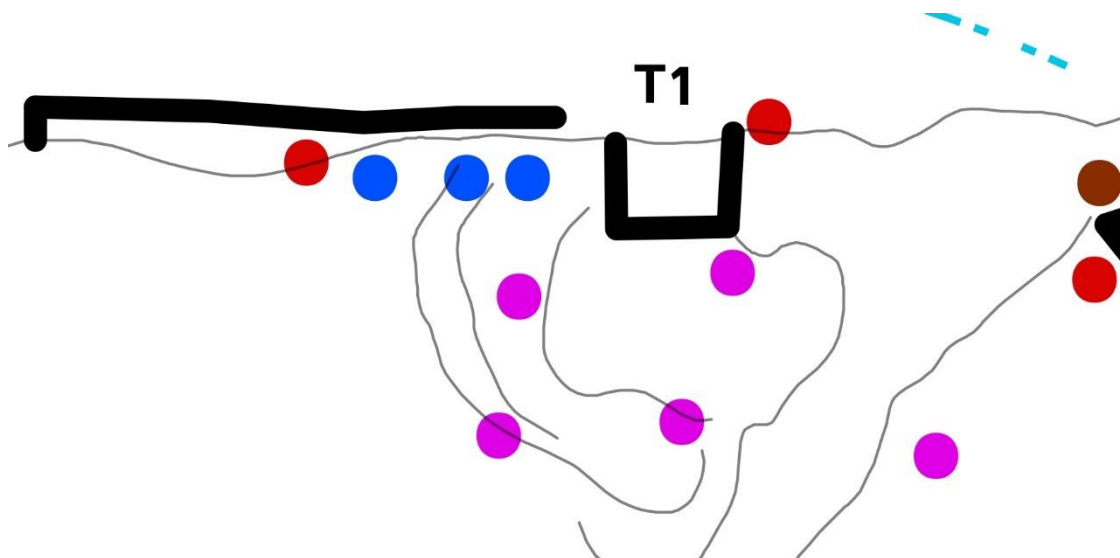
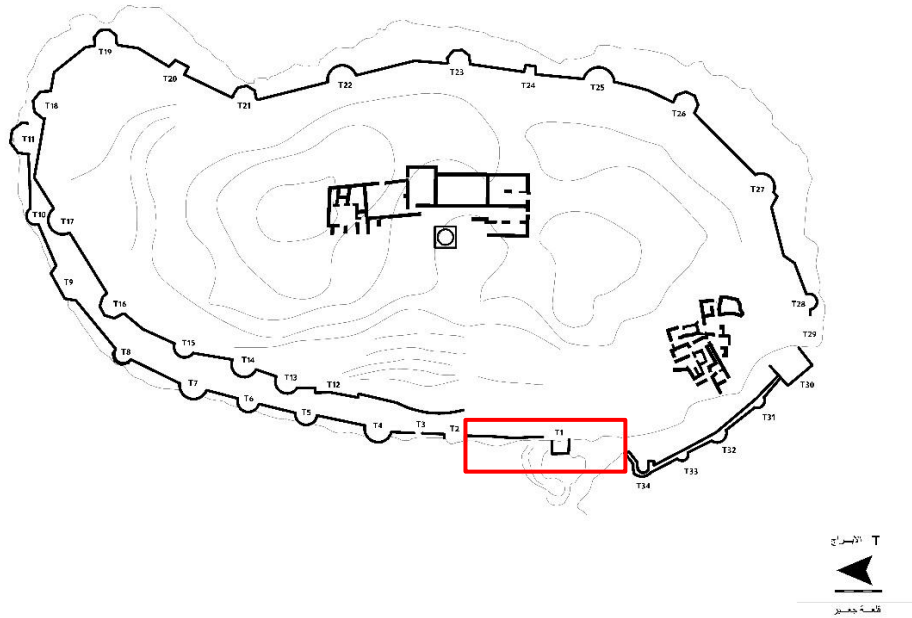
It is a 2-metre-thick wall built of brick with a length of 27 m; brown plaster is a bonding material for bricks.

#### **Status and damage:**

The loss of two blocks of wall as a result of natural factors; it is an unstable mass as a result of the loss of connectivity with the rest of the wall. The situation is also estimated to be severely damaged by the loss of two blocks from the beginning of the wall linking the towers, but the danger is structural, leading to the collapse of the rest of the wall and the dredging of the dirt and the cliff supporting it. This requires necessary intervention of no more than six months.

## Recommendations:

- Rebuilding the wall between the two towers.
- Support the limestone blocks behind the fence.





Damage point of the outer wall from the emirate Tower to the first tower

### **C. Below the outer wall from the first tower (T1) to the fourth tower (T4):**

It is a brick wall with a black plaster bonding material.

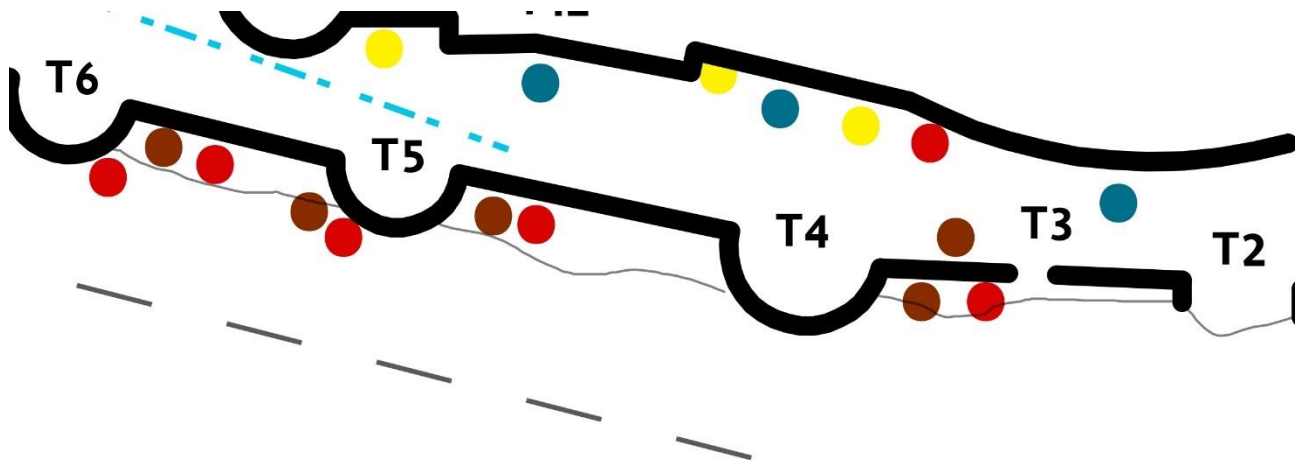
#### **Status and damage:**

High humidity that led to the erosion of bonding materials and bricks because of digging work below the outer wall resulting in the pool of water below the wall.

The amount of damage is estimated at 40% of the joint plaster mortar and 40% of the brick parts forming the wall. However, the general condition of the wall is estimated as (minor damage), which is temporary surface damage. It is more destructive if it is not treated. Where moisture will persist, and this will lead to the collapse of the wall over time. This requires an intervention within one year.

## Recommendations:

- Treating the cause of dampness by opening broken drains.
- Replacing the eroded bricks.
- Replace the plaster between the bricks





Humidity in the face down the wall and towers from the first to the fourth towers of the outer wall



Moisture at the bottom of the wall from the first tower to the fourth tower is eroding the bond between the bricks

#### **D. The outer wall from the main gate to tower T11:**

It is a brick-built wall with brown plaster bonding materials, interspersed with 11 defensive towers, surrounding the limestone mass on which the castle is based.

Brick surfaces are shaped like bows and crossed knots, some of which are coated with a layer of white plaster.

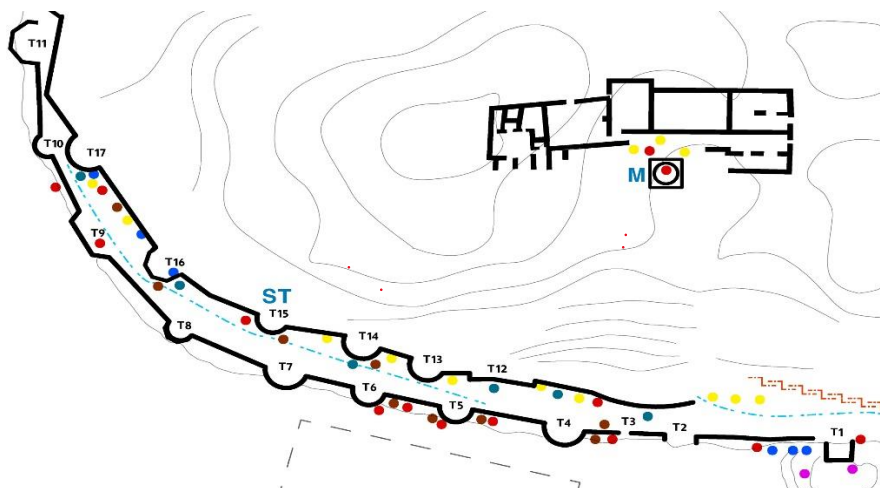
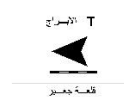
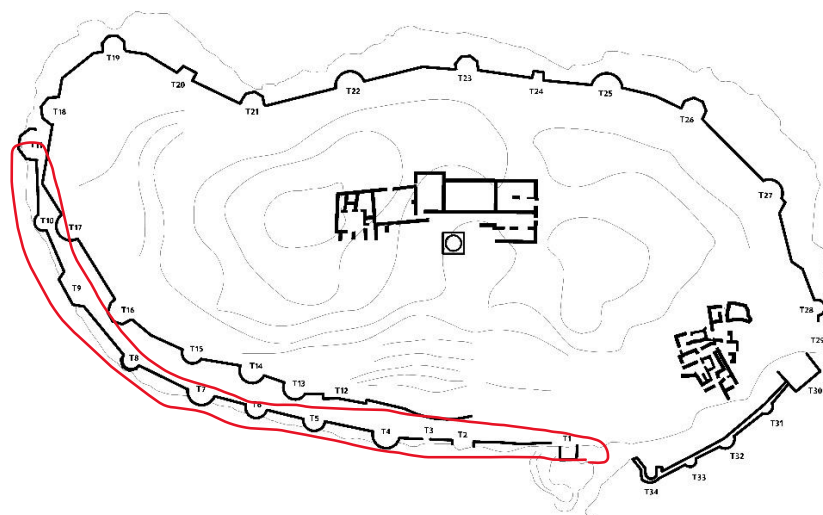


## Status and damage:

- 60% total loss of building surfaces above towers.
- 40% partial loss of bricks at a distance of 1 m due to natural factors of moisture and exposure led to the erosion of the plaster matter linking the bricks.
- 70% loss and fall of plaster covering the roofs of the arches. This requires necessary intervention of no more than six months.

## Recommendations:

- Address the cause of moisture by opening broken drains on the castle surface in the corridors, removing debris and leveling floors.
- Repair for corroded bricks.
- Replace the plaster between the bricks and cover the surfaces with a plaster layer.





General view of one of the towers of the inner wall of the castle T5



Brick erosion in the corner of buildings attached to the towers of the outer wall



Corrosion and loss of bricks in the buildings attached to the towers of the outer wall

#### **E. The inner wall built with brick with mortar of brown plaster:**

It extends from the tower (T12) to the tower (T18) and is interspersed with a set of circular towers. The thickness of the wall varies depending on the bumps of the limestone mass on which the castle is based, and the average thickness of the inner wall is about 1/m.

#### **Status and damage:**

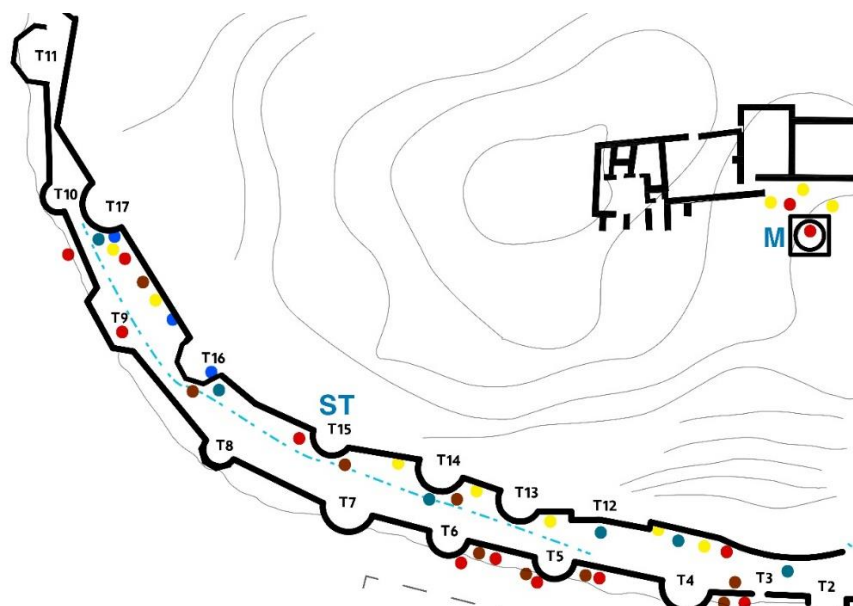
- Loss of part of the inner wall.
- Loss of parts of the brick's component of the wall, 70 cm thick over the height of the wall 6 m and the length of 60 m.
- The disintegration and separation of part of the wall from the mass based on it because of natural conditions.
- A superficial loss of plaster bonding between the brick buildings formed by the body of the wall.

The size of the loss of bricks in this part of the fence (from Tower 12 to Tower 18) is estimated at 60 m. The risk of crumbling bricks in most of the towers is 40%, in the event of non-treatment, continued humidity and weather factors and the

disintegration of the limestone mass supporting the wall. This will lead over time to the collapse of the wall, which will destroy parts of the outer wall.

**Recommendations:**

- Dismantle the separated parts and rebuilt them.
- Replace the missing bricks in the wall with the implementation of bonding supports within the old mass to increase cohesion and protect surfaces with a layer of plaster.
- Replace the lost plaster among the bricks
- Implementation of drainage channels at the top of walls to prevent water penetration.
- Remove debris at the bottom of walls and level corridors to prevent water pooling.





Loss of brick in one of the walls of the inner wall.



A separated block of the inner wall of the castle.



Erosion of the bricks in the tower of the inner wall of the castle

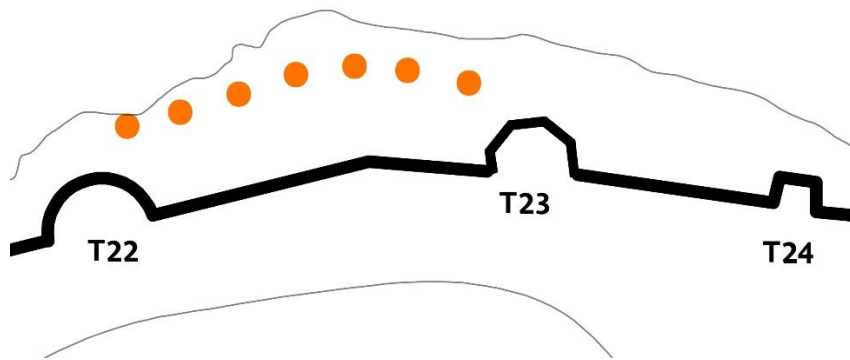
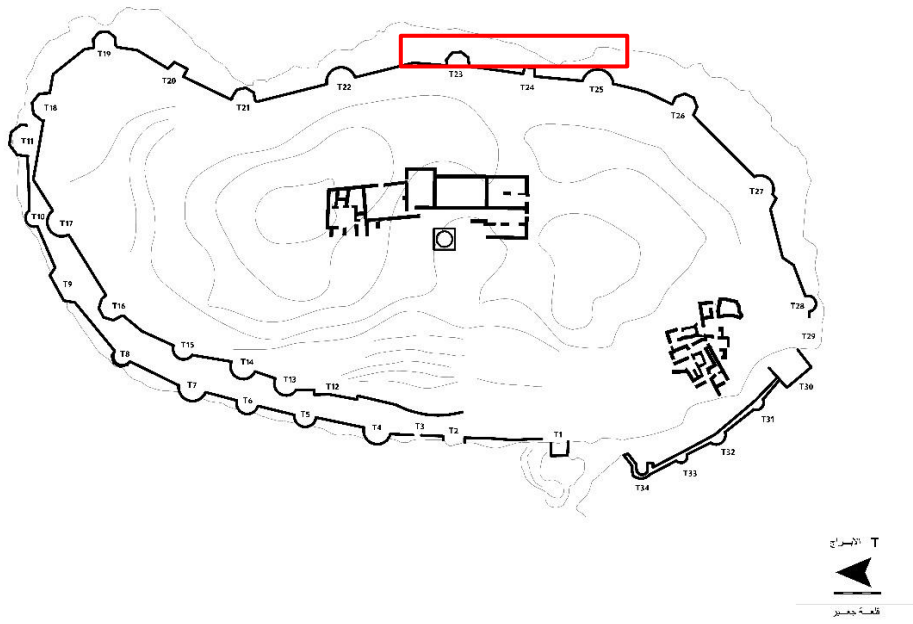
#### **F. The exterior wall under the interior wall between the towers T22-T24:**

##### **Status and damage:**

This damage is the separation of the building block of the outer brick wall in the confined area between towers T22-T24 (as the bulk of the outer wall collapsed over time).

##### **Recommendations:**

- Connect the building block to the rock base with wooden pillars (Khoabir).
- Inject the spaces formed behind the outer wall.
- Level the area between the walls to facilitate the drainage of rainwater into the lake.





### **G. The inner wall between the towers T23 - T24:**

It is a brick wall with a black plaster bonding material.

#### **Status and damage:**

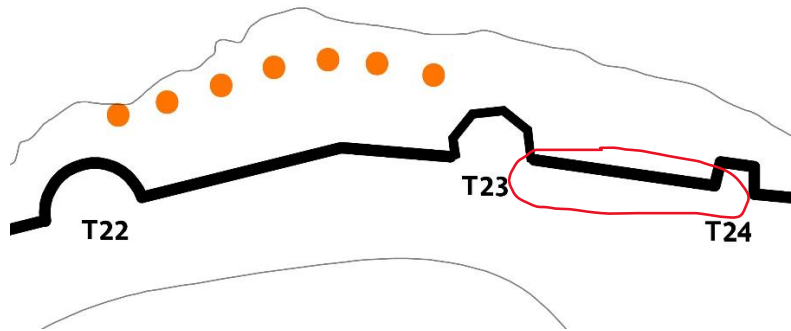
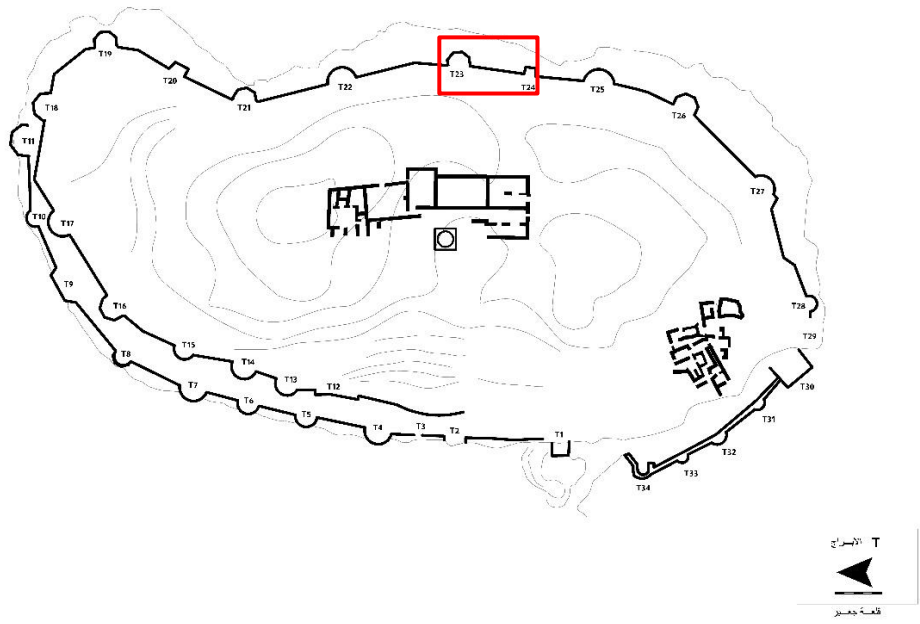
High humidity has led to the erosion of bonding materials and bricks as a result of losing the base below the outer wall resulting in the pooling of water below the fence.

The amount of damage is estimated at 20% of the mortar and 20% of the brick parts of the wall. The general condition of the wall is estimated to be (minor damage), which is temporary surface damage.

#### **Recommendations:**

- Carry out drainage work below the area between the towers 23-24 from the inside.
- Replace corroded bricks with new bricks.
- Repair for the plaster.





## H. The Inner Wall of the Castle, Tower (T25).

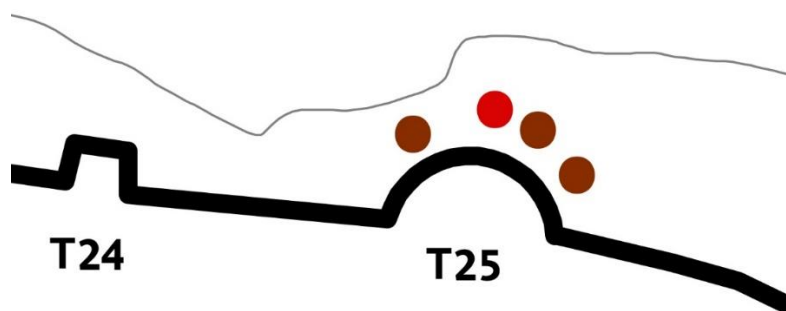
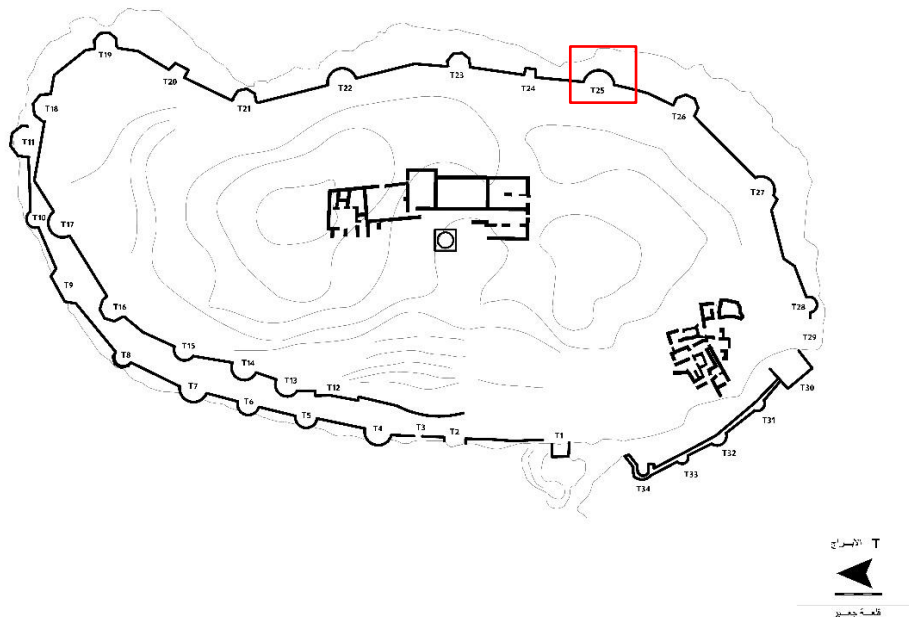
It is a brick wall with a black plaster bonding material.

### Status and damage:

The bricks fall, erode, and crumble horizontally, indicating that amounts of rainwater are stored inside the tower.

### Recommendations:

- Carry out drainage work below the tower (T25).
- Replace corroded bricks with new bricks .
- Repair for the plaster





### **I. Rock base down tower (T26):**

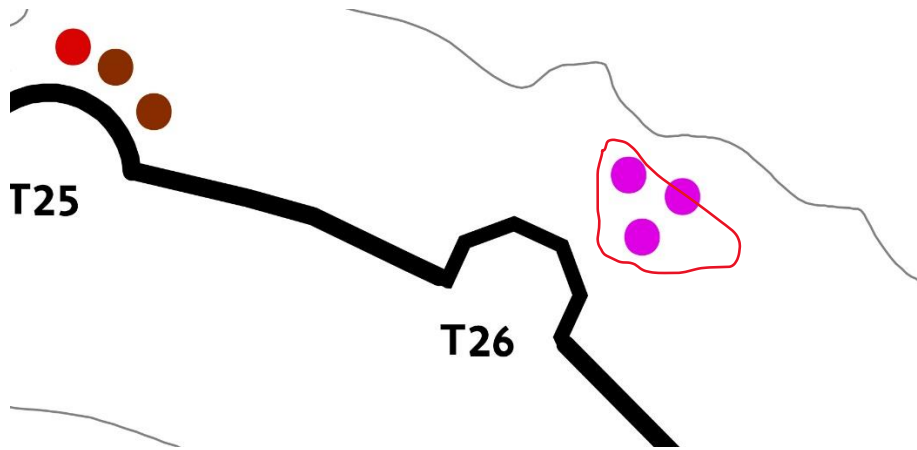
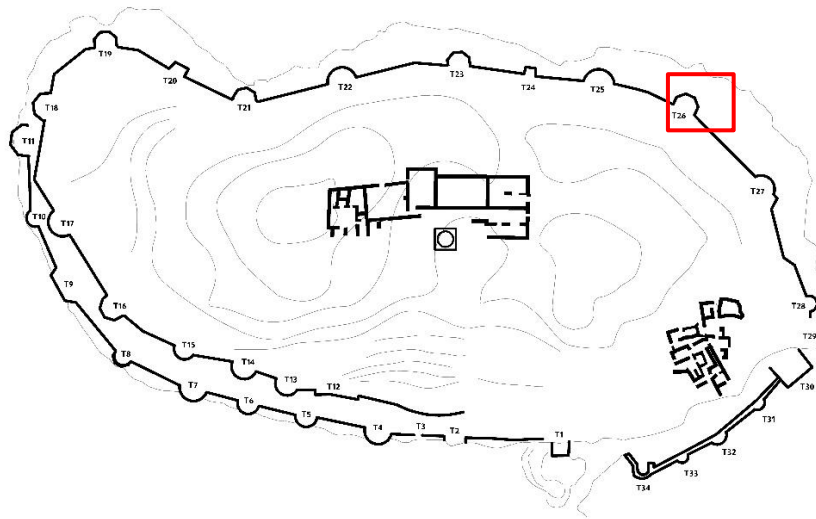
There are erosion and weathering at work below tower 26 on the south-east side of the castle's rock foundation.

#### **Status and damage:**

- The limestone layer of the rock base is revealed and eroded by wind and water.
- Partial loss of amounts of base-supporting soil below Tower 26, threatening one or more partial collapses.

#### **Recommendations:**

- Reinforcing the collapsible parts below Tower 26.
- Fill in/or cover the voids created by revealing the soft limestone layer.



## J. The castle's corridor and stairs ascending to the roof:

Access to the castle is through a tunnel carved into the limestone mass, with a stair carved into the rock; it is the only passageway to the castle.

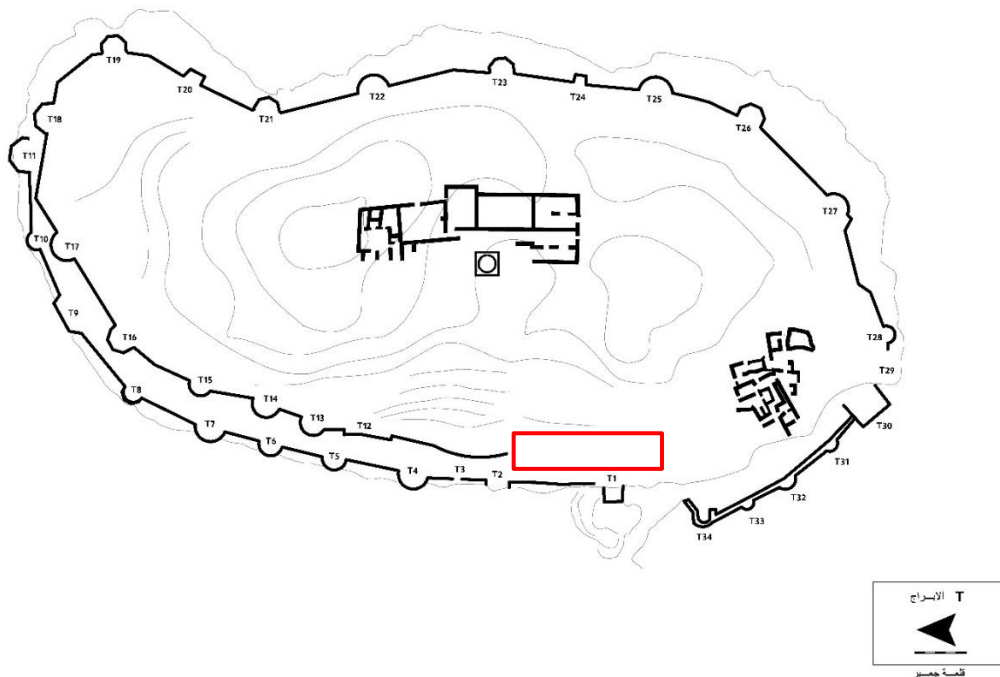
Stones have been added to the stairs with the addition of brown plaster in a dipping manner, as well as side shapes in the form of arches as side passages. The inner surfaces of the corridor are not coated with any material.

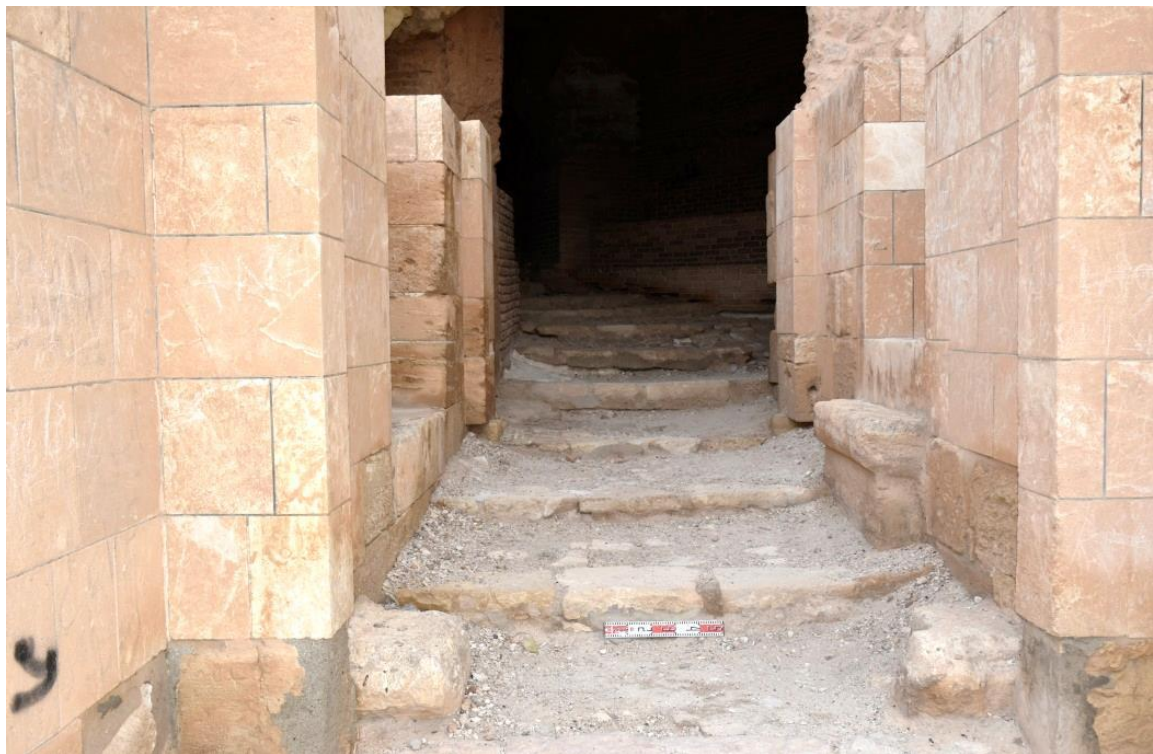
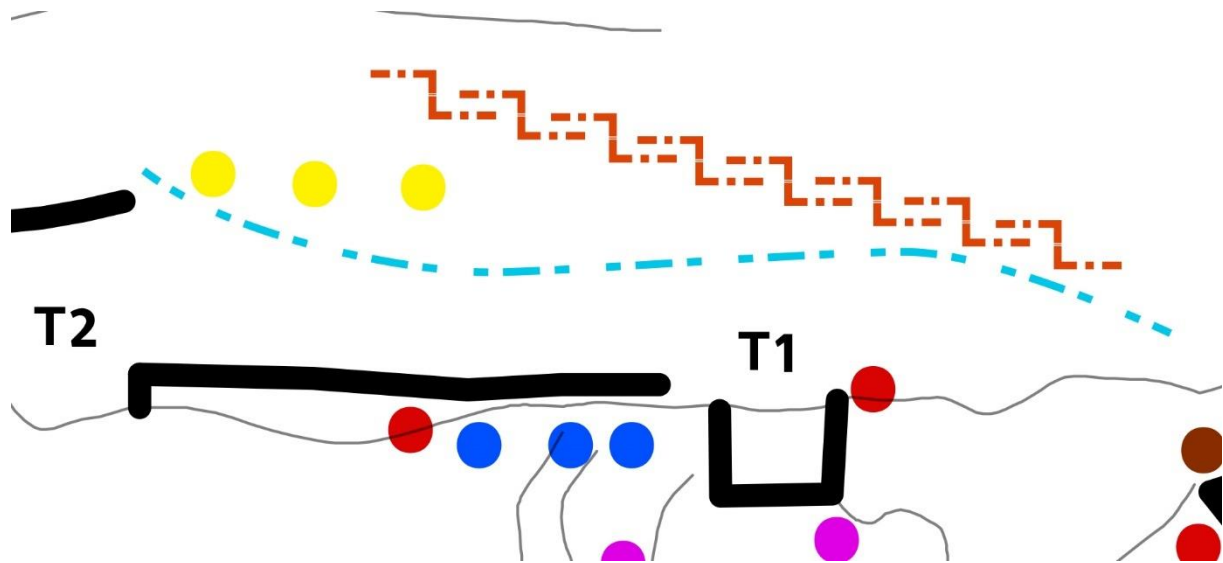
### Status and damage:

- Erosion of grades as a result of natural factors, rainwater and accumulation of debris within parts of the corridor. Maintenance is necessary for up to two months.
- 20% partial loss of stair structure
- If not maintained, it prevents visitors' access to the site.

### Recommendations:

- Remove and clean debris from the entrance to the site.
- Processing and implementing rainwater drainage channels.
- Maintenance of the stairs.





Entrance to the tunnel leading to the roof of the castle



Corrosion in the staircase of the access tunnel to the roof of the castle

### **K. The minaret of the Mosque of The Citadel of Ja'bar :**

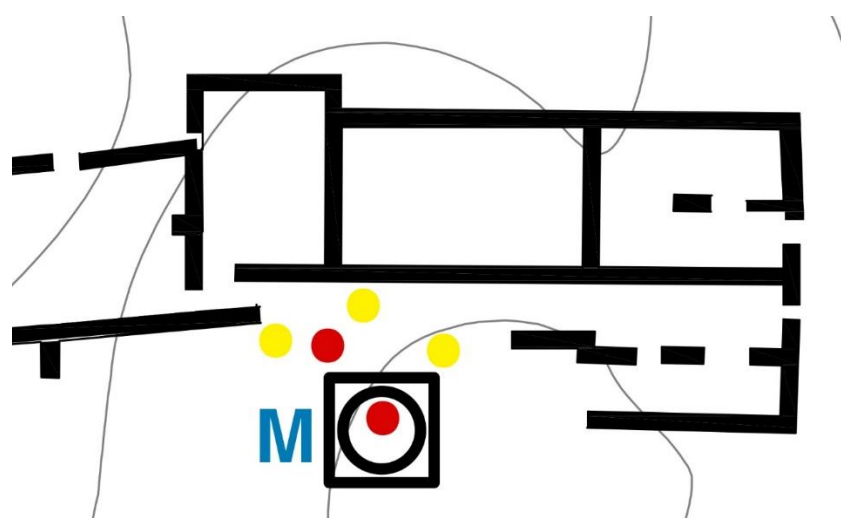
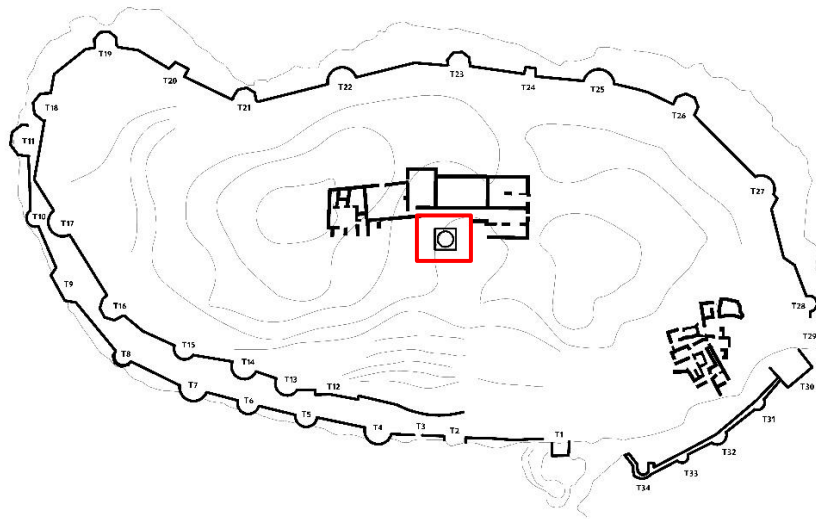
It is a cylindrical minaret based on a square base of  $5.40 \times 5.40$  m built of bricks and bonding materials of "brown plaster".

#### **Status and damage:**

- Deviation in the minaret due to natural conditions with structural stability, with a very low risk ratio (less than 5%).
- Small cracks at the base do not reach the trunk of the minaret.
- Mortar erosion between the brick.

#### **Recommendations**

- Remove metal waste or move it from the minaret base.
- Remove the debris around the base and level the perimeter of the base to prevent water gathering around it.
- Apply brown plaster among the brick.



Minaret of The Citadel Mosque

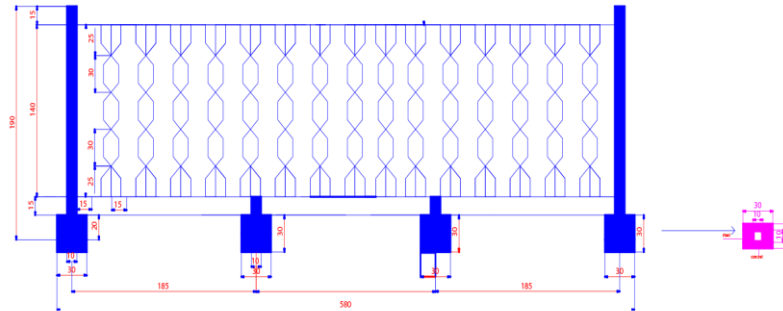




Erosion in the bricks and plaster

### **Proposed works and future interventions at Qalat Ja'bar:**

1. Removing the rubble and moving the remains.
  - The Work must be done manually and without the use any heavy equipment or machines to protect the site
  - Debris is sorted between bricks and gravel and transported to the site determined by the supervisors
  
2. Rebuilding, fixing and cleaning of drainage points
  - This work must be carried out manually and cautiously during digging works
  - Smoothing the surface of the drainage point with a leveling of its floor to prevent pooling of water
  - The layer thickness should be around 5cm
  
3. Digging works for the installation of the drainpipe
  - Digging must be done manually and in dimensions of 0.6\*0.6 per 1/m longitudinal
  - Removing all the results of the dig as sands and stones
  - Applying layers of sand and gravel according to the supervision
  - Applying the drainage tube at a depth of 60cm
  - Make a checkpoint every 40m.
  
4. Providing and installing protection and metal fence for the wall
  - Install caution signs in the dangerous areas
  - The iron frame unit must be between 5 to 6m wide and 1.5m high
  - Build and install good metal base to hold the frame (each 150/200 cm)
  - Installation must be done according to supervision and charts within the site
  - The color of the frame must be close to the brick color on the site



5. Cleaning and replacing the plaster work for the walls
  - The cleaning process is done manually to reach the areas between bricks using suitable brushes without the use of automatic equipment
  - Clean the surfaces of dust and dirt stuck on the wall
  - Hydrate plaster before application
  - Extending plaster with solutions with thicknesses commensurate with the eroded parts
  - Cleaning of walls from plaster residue
  
6. Providing insulation for the roofs using a layer of plaster
  - Removing the old, corroded gypsum mortar
  - Thorough cleaning of the surfaces of dust and dirt, especially cracks with water washing
  - Applying the plaster on surfaces with a thickness of at least 5cm
  - Smoothing of the plaster layer toward the direction of the water drains
  
7. Rebuilding works and using new clay brick
  - The clay bricks with measurements must be similar to the original size in the site
  - The bricks are flat and free of cracks that affect their structure.
  - The Plaster layer between the bricks must be at least 1cm thick
  
8. Removing the dilapidated brick and replacing it
  - The work must be done by hand to remove the eroded and dilapidated bricks
  - Sorting the brick to reuse the original good bricks.
  - Cleaning the place and use a good plaster in the replacement progress
  - The construction process is carried out in layers along the wall at a rate of four bricks per day.
  
9. Documentation and archaeological drawings
  - Create an accurate archaeological plan for the entire castle
  - Drawing the facades of the castle with its towers
  - Create a 3D model of the entire castle

| M | Interference                         | Intervention point   | Damage status category |              |                 |                  |               | Category of need to respond to damage |                           |                             |  |   | Area | Length | display | Height | Image code |   |
|---|--------------------------------------|--|------------------------|--------------|-----------------|------------------|---------------|---------------------------------------|---------------------------|-----------------------------|--|---|------|--------|---------|--------|------------|---|
|   |                                      |  | Damage free            | Minor damage | Moderate damage | Extensive damage | Complete loss | Long-term (after 3 years)             | Average range (1-3 years) | Short range (within a year) | Urgent and immediate (within 3 months) |   |      |        |         |        |            |   |
| 1 | Moisture treatment drain maintenance | beneath Tower 1 to 4 Full location, between towers 23 and 24                     |                        |              | +               |                  |               |                                       |                           |                             |  |   |      |        |         |        |            | 1, 2, 3, 4                                  |
| 2 | Remove debris                        | whole site   |                        |              |                 | +                |               |                                       |                           |                             |  |   |      |        |         |        |            | 5, 6, 7                                     |
| 3 | plaster                              | Exterior interior wall emirate tower - minaret                                   |                        |              | +               |                  |               |                                       |                           |                             |  | + |      |        |         |        |            | 8, 8, 10, 11, 12                            |
| 4 | replacing crumbling brick.           | Internal wall  |                        |              |                 | +                |               |                                       |                           |                             |  |   |      |        |         |        |            | 13, 14, 15                                  |
| 5 | Building new bricks                  | Exterior interior wall, tower 25   |                        |              |                 |                  | +             |                                       |                           |                             |  |   |      |        |         |        |            | 16, 17, 18, 19, 20                          |
| 6 | Strengthening the limestone mass     | Between the towers. 4.6 Exterior, between towers 22 and 24, and beneath tower 26 |                        |              | +               |                  |               |                                       |                           |                             |  |   |      |        |         |        |            | 27, 28 (A-B-C-D), 29 (A-B-C), 30 (A-B-C-D), |
| 7 | Metal protective fence               | Outer wall   |                        |              |                 |                  |               | +                                     |                           |                             |  |   |      |        |         |        |            | 21, 22, 23, 24                              |
| 8 | Plaster surface insulation           | Tower External wall Entrance   |                        |              | +               |                  |               |                                       |                           |                             |  |   |      |        |         |        |            | 25, 26                                      |



2



1



4



3



6



5



8



7



10



9



12



11



14



13



16



15



18



17



20



19



22



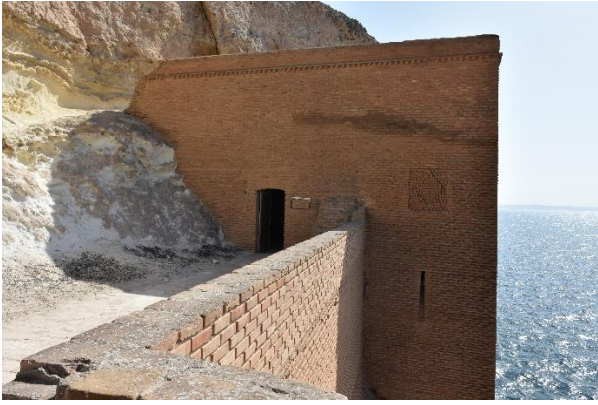
21



24



23



26



25



28-A



27



28-B



28-C



28-D



29-A



29-B



29-C



30-A



30-B



30-C



30-D

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