



**HAL**  
open science

**The Qalhât Project - Preliminary report on the third  
season of excavations of the French mission  
(30/10-17/12/2010)**

Axelle Rougeulle, Pauline Gaubert, Anna Ihr, Anne Joyard, Vincent Bernard,  
Hélène Renel, Olivier Barge, Emmanuelle Régagnon

► **To cite this version:**

Axelle Rougeulle, Pauline Gaubert, Anna Ihr, Anne Joyard, Vincent Bernard, et al.. The Qalhât Project - Preliminary report on the third season of excavations of the French mission (30/10-17/12/2010). [Research Report] CNRS-MHC. 2010. halshs-03334978

**HAL Id: halshs-03334978**

**<https://shs.hal.science/halshs-03334978>**

Submitted on 5 Sep 2021

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# The Qalhât Project

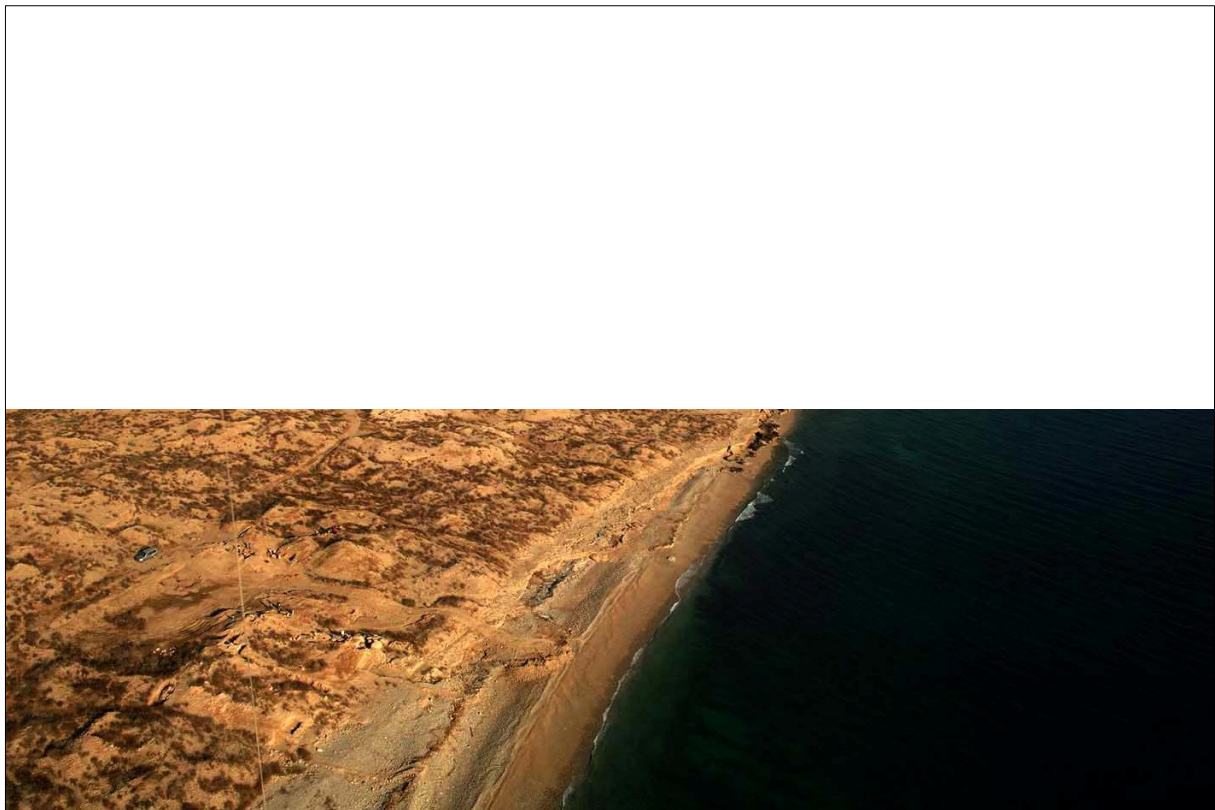
Ministry of Heritage and Culture

Sultanate of Oman

CNRS / Ministry of Foreign and European Affairs

France

Preliminary report on the third season of excavations  
of the French mission  
(30/10 -17/12/2010)



*Sultanate of Oman*  
*Ministry of Heritage & Culture*



سُلْطَانَةُ عُومَانِ  
وَزَارَةُ الْبَنَاءِ وَالْثِقَافَةِ

Axelle Rougeulle  
(Cnrs, Umr 8167)

Thomas Creissen (Eveha), Pauline Gaubert  
Anna Ihr (Göteborg University), Anne Joyard,  
Vincent Bernard, Hélène Renel (Cnrs)  
Olivier Barge (Cnrs), Emmanuelle Regagnon (Geofil)

## Introduction

The third season of excavations of the Qalhât French Project took place from October 30<sup>th</sup> to December 17<sup>th</sup> 2010. The expedition was held under the authority of the Ministry of Heritage and Culture of the Sultanate of Oman, with the joint financial support of the MHC on the Omani side and of the Archaeological Committee of the Ministry of Foreign Affairs and National Centre for Scientific Research (Cnrs) on the French side.

Members of the team were:

Dr Axelle Rougeulle (Cnrs, Umr 8167, Paris), archaeologist, director of the Project  
Dr Thomas Creissen (Eveha, Limoges), archaeologist (exc.B2, B6-B7, B12 / trench S15)  
Ms Anna Ihr (Göteborg University), archaeologist (slags survey, exc. B12 / S3, S14, S15)  
Ms Anne Joyard (AKTC, Paris), archaeologist (exc. B12 / S16-S20, B13 / S3, S5)  
Ms Pauline Gaubert, archaeologist (exc. B9, B13 / S2, S4A, S4B)  
Mr Vincent Bernard, archaeologist, draughtsman, architect, plans and analyse of architecture  
Ms H el ene Morel-Renel (Cnrs, Paris), ceramologist, registration and study of the material  
Ms Emmanuelle Regagnon (Cnrs, Umr 5133, Lyon), topographer, head of the topographical project  
Mr Olivier Barge (Cnrs, Umr 5133, Lyon), topographer, topographical project

Special thanks are due to the Department of Excavations and Archaeological Studies of the Ministry of Heritage and Culture of the Sultanate of Oman, to its Director Ms Biubwa Ali al-Sabri and all the staff, for their very kind and efficient help and support all along the expedition, and especially to Mr Kham s N aser al- Amr i in the Sur region. As in 2008 and 2009, the mission could not have been so successful without the collaboration of the French National Centre for Scientific Research which sent, beside the Director of the mission, Ms H el ene Morel-Renel as a specialist for the registration and study of the Qalh at material, and Mr Olivier Barge as an expert topographer for the Topographical Project. As in 2008 and 2009 Eveha, a French archaeological consulting agency specialized in contract archaeology and heritage development, kindly put at the disposal of the mission one of its members, Mr Thomas Creissen. Furthermore, an extra sponsorship fund was granted this year by the Total Group to achieve the topographical project of planning of the ancient city of Qalh at. Also, the OmanAir company, Corporate Communications & Media Department, very kindly provided three plane tickets. The Towell Infrastructure Projects company brought also a significant help lending for some hours one of its bulldozer for the evacuation of the rubbish from excavations.

The main objects of the 2010 season were as follows:

- continuation of the excavations at the Friday Mosque (B12) started during the 2009 season, mainly in the northern wall of the building, the northern annexe, and the northern and western courtyards, to check the accesses and general organisation and evolution of the B12-B13 complex.
- excavations in the large building B13 nearby to check its identification (palace ?), plan, connection with B12, and dating
- excavation at the corner of the fortification walls B6 and B7 to check their chronology
- excavations in the outside cistern B9 to verify its plan, capacity, water collecting system, and dating
- clearing of one of the funerary terraces in the western quarter
- study of the 2010 archaeological material
- third phase of the topographical GIS project sponsored by the Total Group Paris: detailed planning of the ruins visible on the surface in order to draw the plan of the medieval city
- in connection with this topographical project, continuation of the surface survey, identification of the streets of the city, checking of the fortifications (gates, towers ...), main buildings, w ad is

...

## 1. The great mosque complex B12

Twelve soundings (S1-S12) were opened in the great mosque in 2009 and its plan and chronology were then recognized, together with a preliminary hypothesis of the elevation of the building. The aim of the 2010 season was to complete the study of the northern wall, which was barely excavated last year and where it was thought that the gate to the mosque was located. Also to study the surroundings, i.e. the associated structures and mainly the ablution system, the north-eastern and western courtyards, the surrounding walls and the access to the mosque complex. Eight new soundings were therefore opened in this area (S13-S20, excavations directed by V. Bernard, T. Creissen, A. Ihr and A. Joyard).

### 1-1. Access to the mosque complex.

During the 2009 season two accesses to the mosque complex were found, connecting the beach to the north-eastern courtyard. As it was more than probable that existed also an entrance from the city to the west, giving access to the western courtyard, several soundings were opened on this side of the complex, along the western retaining wall. An important section of this wall was cleared (S16) and no gate was found on all the distance until the north-western corner of the courtyard. At that place, the wall abuts against an annexe structure, a long isolated east-west room (B95, see *infra*). Between the northern wall of this structure and the southern wall of B13 a passageway was found, connecting the city to the western courtyard.

This passageway is 4m large and 13m long. On the city side it starts from the street running along the western limit of the B12-B13 complex, around level  $\Delta$  17.30. The passage was at a time reduced to 2.60m with the construction of a buttress against the southern corner and it was maybe preceded by a porch or some advanced structure as the start of a narrow wall projecting into the street is visible in the sounding. A strange fitting is located against the northern corner, opposite the buttress : it is a regular almond-shaped stone 50cm high, standing vertically with a blocking of small blocks, as a landmark.



*The entrance to the passageway*



*Northern platform near the door of*

In its last stage the passageway was made of a central narrow ramp, not more than 1.50m wide, bordered by two sidewalks. The ramp was sloping down to the level of the courtyard, around  $\Delta$  15.00 probably, when the sidewalks were made of two long horizontal plastered platforms separated by a step around 90cm high ( $\Delta$  17.10 and 16.20). The step is situated 8.30m from the entrance, 1m before a door in the northern wall leading inside B13 (see *infra*). Several fragments of a pillar with mouldings and wood strapping against earthquake were found there, in a position indicating that it was probably standing in the corner of the step and the door. Fragments of wooden beams were also found. Although two downspouts are visible on the walls, which seems to indicate that we are here in an open area, it is therefore also possible that this passage was a covered hallway.

## 1-2. Building B95

To the south of the passageway, in the north-western corner of the western courtyard is an elongated structure 13 x 5.50m. The surface clearing and a deep sounding 8 x 1.50m showed that this was probably made of a single wide room, 11.50m long and 3.70m wide. Its southern wall, against the courtyard, is 1m thick when the northern one, against the passageway, is 70cm thick. A line of rectangular pillars, 60 x 80cm, was built against the plaster of this wall, 60cm apart, reducing the width of the room to 3.10m. Five of them were cleared, three more can be restored, and their function is unclear. The floor of this room is at level  $\Delta$  16.08, associated with the base of the pillars which are preserved, as the walls, more than 2m high. This altitude corresponds to the level of the platform of the passageway on the other side of the wall and it is thus probable that this platform was turning round the eastern extremity of the structure and that the access to the room was located in this area, directly from the mosque courtyard. The function of this structure is unclear but it was therefore clearly connected with the mosque activities, maybe a madrasa.



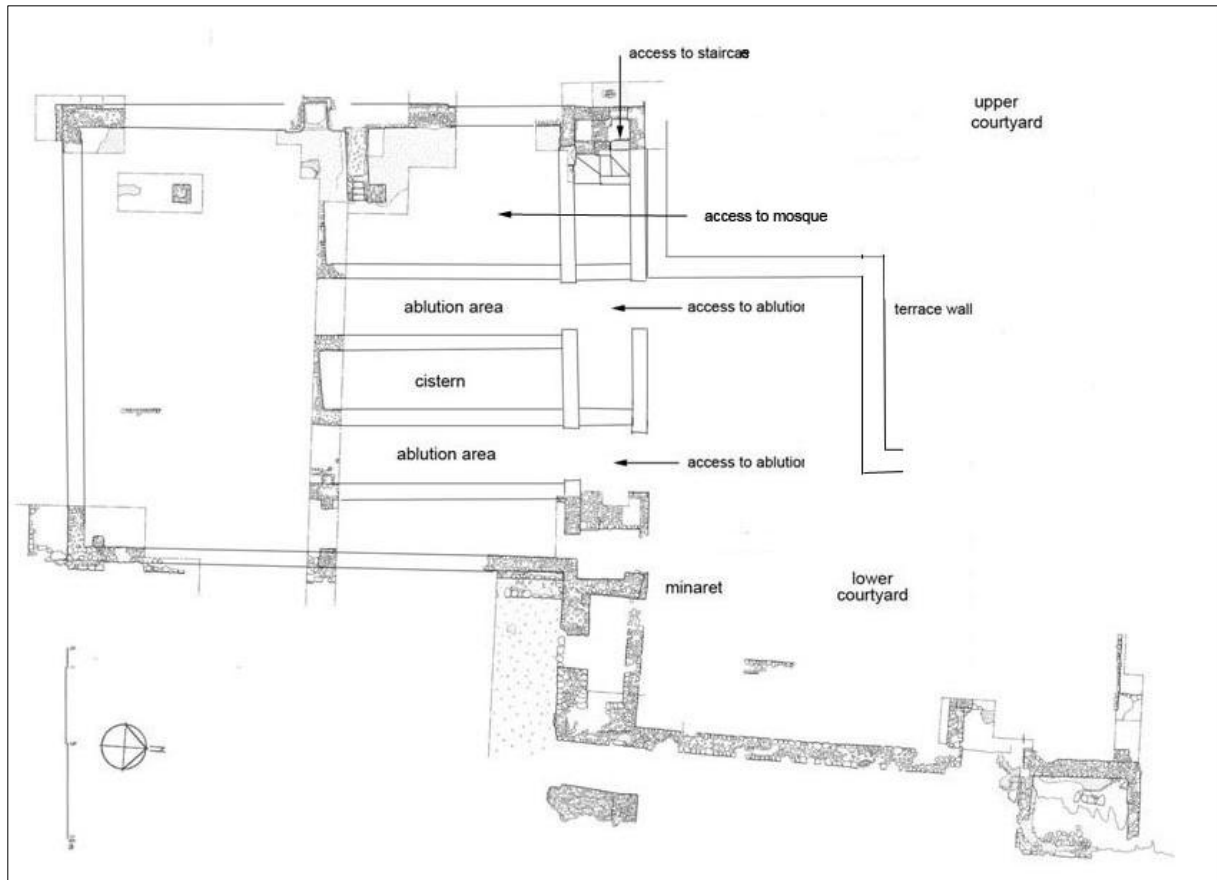
*Structure B95, with the line of pillars against the northern wall*

Two deep soundings were dug in connection with this structure, one under the floor of the room, the other against the outside face of the wall in the passageway. The northern wall of B95 is founded at around level  $\Delta$  15.00, and it was associated in its first architectural phase, before the construction of the floor and pillars, with a perpendicular wall running north-south.

## 1-3. The courtyards

As seen from the present surface, the wide area which surrounds the mosque on its western and northern sides shows a strong declivity following an approximate line between the middle of the northern wall of the mosque and the south-eastern corner of B13. As a matter of fact, excavations in 2009 showed that the surface of the western courtyard on the *qibla* side was about level  $\Delta$  14.50 in its first stage,  $\Delta$  16.00 in its last period, and that the surface of the eastern courtyard near the beach was around 12.00.

Excavations in the area between B12 and B13 lead to the discovery of a massive terrace wall, 1.10m thick, built in large limestone blocks, pebbles and fragments of pounding bedrock. This wall was founded on the bedrock and was acting as a retaining wall for a backfill which was deposited here to level the surface of earlier occupations at the time of the building of the first mosque around 1300, then for a second backfill of good earth which was possibly brought to create a garden in the 14th or 15th century. The northern extremity was not excavated, located under the bulldozer track, but there was probably here a ramp or a staircase connecting the two courtyards. As a matter of fact, this ramp should have been located in direct line between the . Southwards the wall makes a double angle to create a low square area against the northern extension of the mosque (see infra), which is now buried under masses of collapse and was not excavated. It is therefore impossible to say whether this area was open air or covered with a roof resting on pillars or columns.



*Schematic plan of B12 showing the upper and lower courtyards, the northern wing, cistern and ablution facilities, the north-east minaret and north-west staircase, the possible access to the mosque..*

#### 1-4. The northern wing and the ablution areas

Excavations on the northern wall of the basement of the mosque led to very interesting discoveries. As a matter of fact, it appears that a line of rooms was located against this wall, connecting in a direct line two structures excavated in 2009, the minaret at the north-eastern corner and a small square construction whose function had not been explained at the north-western corner. Three rooms were found but the excavations were not dug down to the bottom in the whole trench and it is possible that there was altogether six rooms (including entrance to minaret) each of them corresponding to one of the compartments of the basement.

These rooms were accessible from the lower courtyard, their floor at approximately the same level (three successive floors were found). Two of them were connected through wide gates to the 2d and 4th inside compartments of the basement, and the function and organisation of this basement is now very clear. In fact, as seen in the central trench excavated in 2009, the 3d compartment was covered, walls and floor, with an extremely strong coating and was most probably an under-floor cistern collecting water from the roof of the mosque. The two doors therefore certainly gave access to two ablution rooms located on both sides of this cistern. This kind of mosque, built on a basement with under-floor cistern and ablution facilities is well-known in India and Qalhât is famous in literary sources for its strong connexion with this country. Each access had a wooden threshold and door, now completely vanished except for some brown powder and very small fragments found on the threshold. Anyway, all these elements were badly destroyed by the final collapse of the mosque and excavation were not extended inside to avoid further destruction.

The function of the small square structure located against the north-western corner of the mosque was also deciphered. As a matter of fact, it is a stairwell for a spiral staircase accessible

through a door from the upper courtyard. To the right of the door, two steps lead to a narrow opening in the northern wall of the mosque, near the corner with the *qibla* wall, which was probably a private access for important personalities, maybe the ones living in the large building B13 nearby (see *infra*). In front of the door is the start of a stair leading down to the westernmost room of the northern wing. Six steps, average 35cm high each, were excavated, which are mostly built on a very loose filling and are sometimes hardly visible now except for traces of plaster on the wall. Holes for small beams in the facade of the basement wall and on the side of the 6th step indicate that there was a door at that place, but the staircase is still going down after the door. Unfortunately excavation was not extended in this direction given the huge thickness of the collapse and the final aim of the western room of the northern wing is unknown maybe a private ablution area or some other special function.



*The staircase*

#### 1-5. The gate to the mosque

The main objective of the 2010 excavations against the northern wall of the basement was to find out some sort of big ramp or staircase allowing the worshippers to reach the level of the floor of the mosque, some 4m above the surface of the lower courtyard. Eventually, no such structure was located against the basement, as shown by the presence of the northern wing and the accesses to the ablution areas. The only possible way to enter the mosque was therefore from the upper courtyard, then through a terrace arranged on top of the roof of the northern wing, between the stairwell and the terrace wall. No trace of this gate will ever be found as the superstructures of the mosque are here entirely destroyed lower than the level of the floor.

## 2. The large building B13

The large building B13 is located just north of B12, the B12 and B13 units being part of the same wide architectural complex located in the middle of the ancient quarter of the town, on the sea-shore. The aim of the excavations at B13 was to recognize the plan, chronology and function of that important edifice, and five soundings were opened there (S1-S5, excavations directed by Pauline Gaubert and Anne Joyard).



*Ruins of B13 seen from the courtyard of the great mosque*

The walls are hidden beneath huge heaps of stones and it was not possible to draw a complete plan of the structure. It is a rectangular edifice approximately 26 x 30m, with several rooms around a central courtyard and probably several storeys high. The layout is not perfectly orthogonal, the western wall being in two halves making a strong angle, maybe to fit with the topography of the ground which shows several natural ridges in this area. The main entrance was probably located on that side, in the angle at the junction of the two parts of the wall, limited to the south by a projecting structure whose shape and function is not established. A secondary gate was leading south to the mosque courtyard. The outside walls are 90cm thick. They are preserved on more than 3m high and a tall ruin at the south-eastern corner, maybe a tower, is still dominating the surface from more than 4.50m. The excavations proved that B13 was erected about the same period as the great mosque, around the second half or end of the 13th century, and that it underwent a heavy occupation with at least three main architectural phases, each of them with several sub-phases. A complete study would need a large investment in time and money, including the use of a mechanical shovel especially as the evacuation of the rubbish is rather difficult. Furthermore B13 seems to have been strongly weakened, possibly by an earthquake, and deep excavations here are rather dangerous.

### 2-1. The southern sounding S1

A sounding 1.5m large was open in 2009 against this wall to get preliminary information on the function and dating of the building before the 2010 season. The wall is built with large limestone blocks, and preserved up to about 3m ( $\Delta$  17.80).

The base of the wall, at 14.85, lies on a thick layer of compacted light brown clay with small gravels, with some intermediary lens of ashes, 35cm thick. Under is an occupation layer with ashes, some charcoal, and gravels, 15cm thick. Then is another layer of compacted clay, associated with a small pit with a filling of small pebbles near the northern section of the sounding. This in turn lies on a thick level of medium pebbles, which becomes more and more compacted as excavation goes down, with no human traces. Although this is probably not the bedrock proper, it seems a natural deposit, and excavations were therefore stopped at level  $\Delta$  13.80.

Ceramics found in this sounding was rather specific when compared with the archaeological material found in most of the excavated areas. As a matter of fact the levels down the wall yielded an early assemblage, with Iranian sgraffiatos of the 12-13<sup>th</sup> centuries and no local production of the 14-15<sup>th</sup> and few Mustard Ware of about 1250-1350. These layers can therefore probably be dated to around the middle of the 13th century. Even the levels leaning against the base of the wall are rather ancient, around the end of the 13<sup>th</sup> or early 14<sup>th</sup> century.





*Sounding S2, seen from north*

## 2-2. The northern sounding S2

S2 (2 x 3m) is located against the outside façade of the northern wall of B13, rather symmetrical to S1, and produced similar information. The base of the outside wall is here at  $\Delta 14.20$ , resting on a strong foundation cut in previous layers down to  $\Delta 13.30$ , nearly 4m under the surface when excavation was stopped due to the danger of stones falling from the section. As in S1, levels prior to the construction of B13 yielded sgraffiato ceramics and some mustard ware and can be dated to the second half of the 13th. The occupation levels associated with

the base of the wall delivered a similar assemblage and could be dated to the end of the 13th / first half of 14th century.

A second architectural phase then starts at  $\Delta 14.60$  when a buttress was built against the façade, resting on a strong pisé massif 80cm thick, probably in the 15th century according to the preliminary study of the ceramic. This reinforcement of the northern wall of B13 seems to be associated with the construction of an outside structure and all this area was later used as a dump, with thick layers of organic waste, bones, ashes, charcoal, and much ceramics, including many cooking-pots, which can be dated to the 16th century.

Clearing of the wall of B13 to find its inner face delivered only one row of stones on several courses, and this wall therefore seems to have been badly damaged which is probably the reason why the buttress was built.

## 2-3. Soundings S4A and S4B

Two other deep soundings were dug in the middle of the building, one inside the courtyard against its eastern wall, the other on the other side of this wall in the eastern wing of the construction (altogether 4.80 x 2.20m). The sounding in the courtyard (S4B) reached the bedrock 4.60m down the surface, at  $\Delta 12.90$ . The sounding inside (S4A) stopped at  $\Delta 14.60$  as many walls in this sounding progressively reduced the size of the excavation. Three main architectural phases were registered in this area.

Two layers of earth with traces of occupation, altogether 1.20m thick, are found under the first construction in sounding S4B; diagnostic ceramic was limited and dated to the 12th-13th centuries. These pre-B13 layers are surmounted by a wall starting at  $\Delta 14.20$ , bordering the courtyard to the east and probably associated with an inside parallel wall visible in S4A at the same altitude. Two layers of occupation were registered during this period in the courtyard, the last one being a rubbish dump which seems dated to the 14th century according to the preliminary study of the ceramic.



*Sounding S4A, seen from south, with the courtyard to the left*

A second phase of construction starts at about  $\Delta 15.40/50$  with the reconstruction of the court-

yard wall which is now associated with a perpendicular wall and a paved floor at  $\Delta$  15.70. This phase is associated in the courtyard with a thick layer of fragments of stones and some ceramics dated to the 14th-15th centuries.

To conclude the last phase of construction started from level  $\Delta$  16.20, and four sub-phases were identified. First the wall between the inside and the courtyard had a narrow and long plastered niche which was at a time filled and the wall reinforced and thickened, its two faces not parallel anymore. Then a buttress was built against the inner face to create a plastered passageway to the north. Then this passageway was itself closed with stones and mortar. All this occupation is dated by ceramics to the 15th-16th centuries.

#### 2-4. Sounding S5

As already stated, the main gate to B13 was probably located in the western wall, opening on the same public space as the entrance to the great mosque. But an other door was found in the southern wall of the building, giving access to the hallway or street leading to the mosque complex, 9.50m after the entrance to the street. Its is rather narrow, 0.80m, and the threshold is covered with black shiny stones, at  $\Delta$  16.47. It is therefore dating to the last period of occupation of the building and was most probably a private access to the mosque for its inhabitants.

#### 2-5. Conclusions

Although excavations in this building were not as extended as originally planned due to the huge amounts of ruins, lot of information was drawn from the soundings excavated. This is a large edifice, larger than the mosque itself, which was probably built at the same time as the mosque as a part of the same architectural complex. The limited area excavated does not allow to draw the plan nor detailed chronological evolution of the construction but it underwent at least three main architectural phases. Its owner deserved a private entrance to the mosque complex and was therefore a very important personality of the city. As a matter of fact it is possible that this building was the residence of the governor of Qalhât, built at the same time as the mosque by Ayaz and Bibi Maryam, around 1300.

### 3. The fortifications

Some new elements of the defensive system of the city were also studied this year (excavations by T. Creissen, survey by O. Barge and E. Regagnon)

#### 3-1. The fortification walls B6 and B7

As it is visible now, the city is entirely protected by surrounding fortification walls, in the shape of a regular triangle ca 900m on each side. But the western corner is separated from the rest of the city by an intermediary wall (B6). Since those wall are partially collapsed, their faces were not visible everywhere and the relation between them was not completely clear. From the surface this intermediary wall seems a later addition, but a drawing of the city by Ibn al-Mujawir, around 1230, shows a fortification in the shape of a trapeze, i.e. without the western corner.

*Qalhât as drawn by Ibn al-Mujawir around 1230*

Two mains hypothesis were then conceivable. Either the southern wall B7 was built in one part from the sea to the mountain and the intermediary wall B6 was added later, to separate the western quarter from the rest of the city. Or the southern wall B7 was originally linked with wall B6, shaping the city as a trapeze, and the western corner wad added later. As regards the reason of such a modification, we can assume that it has something to do with the presence of the coastal road which was obliged to cross the western corner as it is the only place where a communication between Qalhât's plateau and the Wadi Hilm is possible.



*The western corner of the city, with location of the soundings*

The aim of the soundings open in the area of the junction of B6-B7 (Dir. T. Creissen) was therefore to check the relative chronology of these two walls.

#### 3-1-1. The sounding against the southern face of wall B7

This part of the wall has been clear recently (*ca.* one year ago), and must of the collapsing layers have disappeared. In the face of the wall surmounting that sounding it is possible to observe an irregularity. The purpose of the excavations was to check if that irregularity continues in the lower layer therefore testifying of several architectural phases in the wall.

At the top the sounding was covered by a thick layer of dust which is really recent and was yet not numbered.

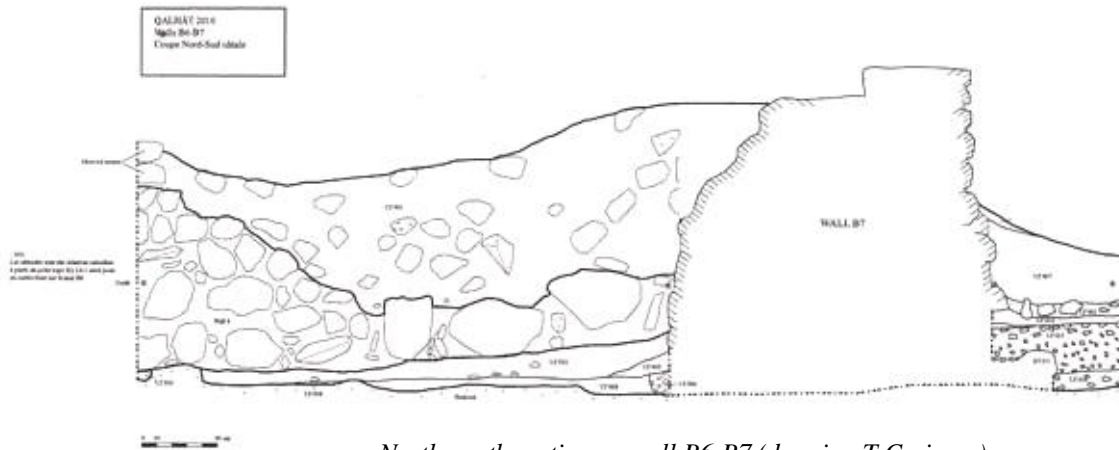
The first real layer (Uf 918) fill a small hole located in the eastern part of the sounding which is *ca.* 30 cm deep maximum. Uf 918 is mostly made of quite compact grey sediment including few stones. It tops Uf 902, which is made of the same kind of light grey sediment. It includes few inclusions and no big stones. Some sherds were present. This layer leans on the southern face of B7, were it form a small slope.

Just under is Uf 903 which is *ca.* 5/10 cm thick and is mostly made off gravels mixed with grey earth. As the former layer, it leans on B7.

Below, Uf 919 is made of soft grey sediment containing few inclusions. This layer continues under the wall B7.



*Southern face of wall B7, from top*



North-south section on wall B6-B7 (drawing T. Creissen)

Under the former layer, Uf 914/920 is a very localized occupation layer with many sherds resting on ashes mixed with gravels. Just under, Uf 915 is quite thick – *ca.* 60 cm maximum - and contains mostly gravels mixed with little earth. Few pottery sherds could be associated with it. This gravel level continues below the wall B7 and it covers a row of big stones (B7-F1) lined up in front of the southern face of that wall. Those stones are big pebbles bounded with some kind of grey clay mortar.

Under the stones and under Uf 915 there is a layer (Uf 916) made of chestnut earth including many pebbles (the bigger ones *ca.* 10 x 10 cm). It is quite hard and few pottery sherds were found in the limited part excavated.

This layer covered the bedrock, which surface is here very irregular: there is a deep slope toward the east forming some kind of basin.

### 3-1-2. Wall B7, description and dating

The sounding opened against the southern face of the southern wall B7 therefore proved that this wall was built in one single architectural phase on its whole length. The reason of the irregularity observed in the south face could be found in the irregular profile of the bedrock (as this natural “basin” also justify the upper hole and its filling by Uf 918). This bedrock was first covered with a thin occupation layer prior to the wall B7 which was built just on top of this layer. First is a single row of large pebbles bounded with grey mortar, covered by a thick layer of gravels, both acting as a foundation on top of which the fortification itself was then erected, 2.10m large, with faces in large stones bounded with a grey mortar or clay and a filling seemingly also in big stones. Its maximum height is 1.50m and it is still possible to observe on top the presence of a narrower wall (80cm) as a parapet for a walkway. The ceramic material associated with the wall is rather poor, but contains several ancient wares as Iranian sgraffiatos of the 12-13<sup>th</sup> centuries and Yemeni mustard ware of the 13-14<sup>th</sup> centuries. As in the sounding opened in 2008 at the northern gate B38, this seems to confirm the notation of Ibn al-Mujawir saying that the fortifications of Qalhât were built in 1217/18.

### 3-1-3. The sounding in the western corner of walls B6-B7, junction of the walls

The second test trench was opened in the western corner formed by the junction of wall B6 and B7. Both walls were collapsed, and their face has not been cleared so it was not possible to understand how they were related

Many pottery sherds were found in the surface of the sounding (Uf 900). Some were lying above the collapsed part, some on the top of the wall

In the top, the north part of the sounding is mostly made of gravels, *ca.* 10 x 10 cm maximum (Uf 904). Just below is a very thick layer made of stones – mostly pebbles – and very few corals blocks mixed with a light chestnut earth, soft in the surface, harder and darker in the bottom (Uf 901). This layer covered the destroyed parts of walls B6 and B7 and lean on their faces, where it form slopes. In some parts, it is around 1m50 thick. Some pottery sherds are associated it.

Just below this layer, located in the eastern part, Uf 909 is made of a yellowish and very hard clay.

It forms a slope leaning against the lower part of wall B6 and it is very similar to the “mortar” used to bind the stones of that wall. This layer is not present in the western part.

UF 909 covered a level made of rather soft grey earth and few stones which continues under the wall B6 (UF 910).

In the western part, the first layer below the collapse layer UF 901 is Uf 907. It is hard, with grey-brown earth and few pottery sherds are included in it. The relation between Uf 907 and the Uf 910/909 is not clear.

Just below Uf 907 and 910, Uf 905 is a homogeneous layer made of grey earth. It is only present along the lower part of wall B7. It continues under that wall.

Below, Uf 908 is a very hard layer, made of grey chestnut earth and few stones, which covered the bedrock in most of the sounding. Along the north face of wall B7, this layer has been cut by a small trench filled with gravels (Uf 906). Those gravels continue under wall B6.

The cleaning of the faces of both walls and the analysis of the stratigraphy therefore reveal that wall B6 lean on wall B7 and is clearly later. In the lower part, some big stones were used for B6, and few small ones were added to fill the gap in the junction with B7. According to the stratigraphy, the older layer is Uf 908 which covered the bedrock. It has then the same stratigraphical position as Uf 916 observed in the other sounding south of B7, but it is much harder and have a different color.

The gravels filling the small trench (Uf 906) could be linked with Uf 915 as Uf 905 might be equivalent to Uf 919: both those layers are connected with the construction of wall B7. On the northern face of that wall lean Uf 907 and 910, which could correspond to occupation layers. It is above Uf 910 that wall B6 has been built, which clearly demonstrate that this wall is later than the other one. At the same building phase should be associate Uf 910, probably the clay used to bind the stones of B6 that has been trampled during the construction. No occupation layer could be associated with wall B6. All the layers situated above UF 910 are collapsing one's.

### 3-1-4. Wall B6, description

B6 is approximately 2m50 wide. The highest preserved part are *ca.* 1m20, but the wall was certainly higher. It is made of big stones bounded with a yellowish clay in the part that have been cleared. On the eastern side of wall B6 remains of an east-west wall were visible (B6-F1). Part of it has been cleaned after moving the collapse layer (UF 911). This wall is curved towards the east, but it was not possible to observe all its southern parts, so its general layout is still not known. Yet, it probably correspond to a semi-circular structure (a tower ?). This wall lean on B6, but we can assume that he belongs to the same building phase. It is *ca.* 1m20 wide. Big stones are used for the faces as same as for the filling, and bigger ones are present in the curved part.



*The angle of B6 and B7, with the curved structure B6-F1*

### 3-2. The main northern gate

The main gate of Qalhât on the northern side was certainly located in the area of the hammam, on the intermediary terrace allowing connexion between the western quarter of the city and the Wadi Hilm. This sector of the site was largely destroyed by the building of the modern track but many walls built with large boulders are visible on both sides, in the steep slope leading up to the plateau as downwards near the gardens bordering the wâdî bed, which were registered by the Topographical Project this year. The general organization of this entrance, the layout of the ancient track and of the defensive system is now destroyed by the modern road but it is clear that this side of the city was strongly guarded.

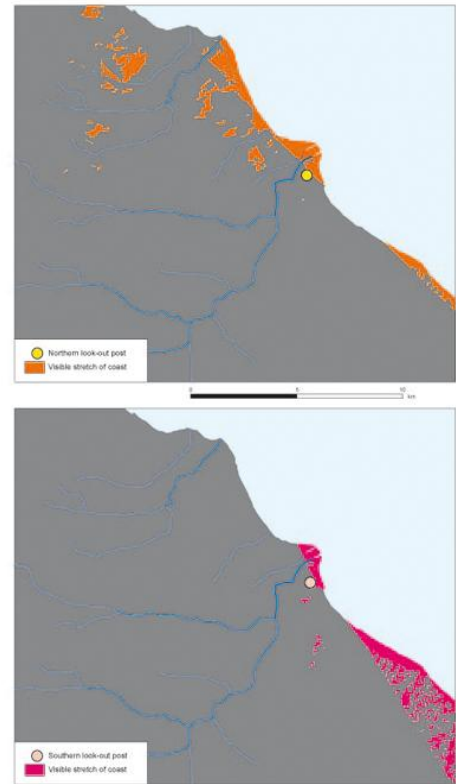
### 3-3. The *extra-muros* structures

The defensive system of Qalhât was extended outside the city proper and several *extra-muros* structures of that type were also studied this year by the Topographical Project (O. Barge & E. Régagnon).

#### 3-3-1. The look-out posts

Immediately to the west of Qalhât, a rather wide plateau makes the lower foot of the Jebel al-Akhdar, overlooking the city from about 140m. The slopes are steep and the natural passages to climb up are few. One of them was landscaped with retaining walls to build a winding mule path leading to two look-out posts. Its lower part is now destroyed by the highway but it was starting approximately from the area of the southern gate in the western corner of the city, near the Bibi Maryam mausoleum.

The ramp is rather wide, up to about 4m at some points. It ends with a long straight section leading northwards up to a rather flat area where is located a small cistern, 3.45 x 2.30m. Its depth could no be checked. The tank is limited by narrow walls 35cm wide which are preserved up to 55cm higher than the highest surrounding surface. Rain water could be supplied by a rocky area gently sloping from the north-west down to the western wall of the structure and an overflow is situated on the northern wall. Some 200m south of the cistern on the edge of the plateau is a group of three structures including a small terrace with peripheral walls in blocks and a filling of large stone chips, a small mosque and a small building. From this position, the view extends on Qalhât, on the sea, and on the northern coastal plain as far as 7.5km. 300m further south, on the other side of a shallow thalweg, a wide rectangular structure is standing on the edge of the plateau, from where the view extends southwards as far as Sur. Each post was visible from the other, both were visible from Qalhât, and this installation therefore allowed a complete scrutiny of the sea, of the roads south and north, and an immediate warning of the city in case of approaching boat or of danger.



*Stretches of coast visible from the northern (up) and southern (down) look-out posts (Topographical Project)*



*The southern look-out post*

#### 3-3-2. The advanced north fortification

The city of Qalhât was protected to the south by an advanced wall cutting the coastal plain from sea to mountain. But it was also entirely protected to the north. As a matter of fact, the look-out posts are associated with a long fortification wall more than 1m wide, which extends northwards on the

ridge of the mountain down to the wâdî cliff and is now preserved on about 262m. It was connected with a similar wall running on the edge of the wâdî from the foot of the mountain to the western tip of the city near the main northern gate. Qalhât was therefore entirely protected on the northern and western sides, from the Wadi Hilm as from the mountain.

#### *3-3-4. The northern building*

A large ancient building, now totally ruined, is located just on top of the steep cliff overlooking the northern arm of the Wâdî Hilm, opposite Qalhât, near the border of the plateau up the coastal plain and therefore commanding the coastal road and the lower course of the Wâdî Hilm. It is a wide irregular construction, ca 25m x 35m (ca 900m<sup>2</sup>) including a large courtyard to the west and several rooms to the east. The walls are hardly visible under their ruins but lines of pinkish plaster similar to the one used on many buildings at Qalhât are visible on places. Some sherds were found on the surface, in and around the building, which are dated to the 14<sup>th</sup> century onwards. Although this building is described by local informants as the house of a famous shaykh, Shaykh Mohammad Sa'id Qulhâti, and dated to around 200 years old, it is possible that its construction goes back to the period of Qalhât, maybe a small fort controlling the coastal road north of the city.

The base of a circular tower (Burg Shaykh) is found nearby to the west, but it is much later as shown by the many palm trunks protruding from it. Another tower, of square shape, is located further west, at the edge of a small branch of the Wadi Hilm, overlooking the present village. Its date is not known either but it is also most probably late

## 4. The water supply system

One of the main questions arising about the ancient city of Qalhât is the way the town was supplied with water (excavations by P. Gaubert, survey by O. Barge, and E. Régagnon)

When he visited the site in September 1874, Miles travelled by donkey some way up the Wâdî Qalhât, identifying several deep pools. He also mentioned traces of a qanat (*falaj*) all along the left-hand side of wâdî. A few miles further up, at the junction with an other wadi, Miles tells us that the qanat 'is distinctively visible, and the remains show that this was the terminus' (S.B. Miles, *The Countries and Tribes of the Persian Gulf*, London, Franck Cass & Co. Ltd 1919, 2d edition 1966. During the 2003 excavation season Tom Vosmer studied this question and especially tried to recognize the qanat described by Miles but he could find no trace of such a system (Vosmer 2004, Qalhât an ancient port of Oman: results of the first mission, *Proceedings of the Seminar for Arabian Studies* 34, p. 392). To-day nothing was registered either on the wâdî cliff by the Topographical Project. As a matter of fact, the site of Qalhât culminates at nearly  $\Delta 40.00$ . This means that such a qanat should have to originate more than three kilometres upstream, and to be built following a gentle slope reaching about mid height of the escarpment of the wâdî cliff the be able to reach the city, a huge work given the precipitous banks of the wâdî and the many irregularities of the escarpment.

In any case, the famous Arab geographer al-Idrisi states in the middle of the 12<sup>th</sup> century that the people from Qalhât took water from wells (Idrîsî, *Nuzhat al-muštāq*, Port Sa'îd, s. d., [= Napoli ed] p. 155). Except for two wells located in the area of the northern gate near the hammam, on the intermediary terrace near the track leading down to the wâdî (see *infra*), one possible well only was discovered until now at Qalhât although the site was completely surveyed in detail in 2008-2010 by the team of the Topographical Project. It is a square structure located in a curve of the inside wâdî on the left bank, which has still to be excavated for identification. As a matter of fact the majority of the wells supplying Qalhât were most probably, as they are now, located down in or near the wâdî bed itself, thus reaching the water very easily without being obliged to dig deeply in the strong pudding-stone bedrock of the site. Most of the time water had therefore to be searched for down in the wâdî and brought up to the city, maybe by donkeys. But several cisterns on the site could also collect water during the rainy season and store it for a while

### 4-1. The wells near the hammam (B4)

Two wells are located near the main northern gate, in the area of the hammam. They are situated at the border of the natural intermediary terrace and also their edge is rather high up the wâdî bed, they are probably mostly built up against the terrace rather than dug inside it. The well nearest to the hammam is about 2m in diameter, built in boulders about 30cm wide and 50cm long. It is now empty on about 15m a very impressive structure. The second well is located further down on the slope. It measures about 1.90m in diameter, is built with smaller boulders, and it is now completely filled up.



*The well near the hammâm*

### 4-2. The inside cistern B2

#### 4-2-1. Description

This cistern is located in the western corner of the city near the Bibi Maryam mausoleum, in the area which is enclosed by the main city wall (B7), but separated from the city itself by the wall B6. It is a rectangular structure 13.70m long and 4.10m large which had been dug in the bedrock, part of which can be seen included in the northern wall. Most of the walls are made of pebbles. In the



lower part, those pebbles could be around 30 x 40cm large, while they are smaller in the upper part. The upper eastern part of north and south walls are mostly made of quite small pebbles (ca.10 x 10 cm). In the northern wall, around 40 cm beneath the top, a line of mortar can be followed through most of this face. Despite of all these small changes, the construction is apparently homogeneous. The stones are bounded with a grey mortar, including many inclusions (small stones, pottery sherds, charcoal...). The surface is covered by a grey smooth coating with tiny inclusions. This coating is around 2cm thick and is probably hydraulic. In the south wall, most of the coating is pink, probably as a result of recent restoration.

The upper part of the cistern is covered with an arched roof emerging from the surface, which is now partly destroyed also it seemed in a better condition on rather recent photos. This roof is made of sections of barrel or elliptical vaults (two are preserved, and part of a third one also) alternating with arches of the same form (two and half are preserved). For these superstructures, small coral blocks bounded with pinkish mortar are used. What seems to be equivalent of wood board traces could be seen in the intrados of some of the vaults. In both sides, the lower part of this roof is buttressed by a wall made of pebbles which is ca. 70 cm large and 70 cm high in the south. In the northern side, this wall is irregular and the eastern part is thinner : it is only 40 cm thick. Those walls are larger at the bottom than at the top and they have a slopy section. This particular profile was done to receive the lower parts of both vaults and arches. Those buttress-walls have been mostly restored recently.



#### 4-2-2. Water supply

Also Miles described this cistern as being located in a water course, and therefore catching rainwater directly, nothing is now visible on the surface of such a watercourse. The cistern is furthermore built inside the *intra-muros* area, very near to the city walls and it could certainly not be supplied directly, by a wâdî or seasonal flooding on the surface. The only possibility should be that the water from the mountain and the area west of the fortification was channelled by low walls in the direction of the gate in the fortification, and from there to the cistern. No trace of such landscaping was found by the Topographical Project but all this area was strongly altered, by the construction of the modern track, of the electric transformer, and now by the highway embankment. It is anyway probable that the cistern was mostly filled manually, probably with water carried up from wells inside the wâdî bed, maybe by donkeys. In these conditions it is no very clear why the tank had to be so big, as water could never be renewed completely and stagnant water quickly becomes unfit for human consumption. The way water was drawn from inside is also unclear, as no trace of a staircase or similar structure is now preserved. Located as it is near the Bibi Maryam mausoleum and at the edge of the main track connecting Sûr to the northern coastal plain and the cities of Tiwi and Qurayyat, this cistern could have been used by the inhabitants of the city as by visitors and travellers, although these ones could find easy access to water in the outside cistern B9 southwards, at least during the rainy season, or in the wells in the wâdî northwards.

#### 4-2-3. Dating

The walls of the cistern are 3.80m high above the present surface inside. As the structure was restored recently it was thought that it had been emptied at that time. A small sounding was therefore opened in its north-east corner to clean the bottom and check the total depth and capacity. But the sounding was dug more than 1.30m deep without reaching the bottom and it is clear that the cistern was never emptied previously. As a matter of fact 4 archaeological layers with a lot of medieval material, ceramic and bones were found. The cistern is therefore at least 5.10m deep, which means it had a capacity of at least 285m<sup>3</sup>. The material found in the excavated layers is dated to the 15<sup>th</sup> century. No doubt that older wares could be found in lower layers and that the building of the cistern goes back to the period of major power and extension of the city in the end of 13<sup>th</sup> or in the 14<sup>th</sup> cen-

tury, maybe to the period of Ayaz and Bibi Maryam around 1300, contemporary with the mausoleum.

Just beneath the vegetation, the first layer is made of soft grey-brown earth including stones, bones and ceramics (Uf 912). It is around 40 cm thick and has a slight east-west slope.

Just underneath this layer lies Uf 913. It is separated from the former by a very thin sandy level.

The chestnut-brown sediment is a little bit denser. This layer contains stones (mostly pebbles, some of them around 20 x 20 cm big), ceramics and also many bones. It is around 15/20cm thick and, as the former, it has a slight east-west slope.

Just under is a hard layer made of light chestnut sediment including many pebbles, most of them quite small (ca. 10 x 10 cm). Few sherds and bones have been found.

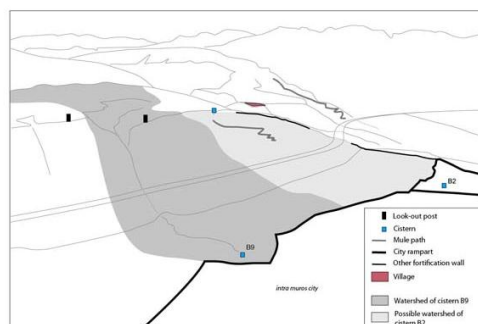
The bottom of this layer has not been reached since we have decided to stop the excavation due to the exiguity of the sounding. It is at least 80 cm thick.

It has to be noticed that no coral blocks or fragments of pinkish mortar have been found in any of these layers. A wider excavation should be planned one day to reach the bottom of the cistern, establish its capacity, and the dating of the earliest levels.

### 4-3. The extra-muros cistern (B9)

#### 4-3-1. Present state

The outside cistern is located just at the foot of the southern city wall not far from the coastal track, outside the city proper but in the area which is nevertheless protected by the advanced southern wall. In that place is a marked elongated west-east depression in the ground, as a rather deep wâdî bed, which is closed downstream, to the east, by three perpendicular walls as a dam. The inside surface is now very even, with soft earth covered by bushes, except along its southern side where it is now covered with a thick backfill coming from the ballast of the highway, more probably brought there by the heavy rains of the last typhoon (Fedh) last July, as this backfill was not there at the time of the 2009 expedition. It is to be feared that the cistern will be quickly completely filled up if nothing is done to prevent the erosion of the highway.



Watersheds of cisterns B2 and B9  
(Topographical project)

#### 4-3-2. Description

The aim of the excavation there was to study the organisation, capacity, water supply and dating of the structure. A complete clearing was made of the surroundings and three soundings were opened inside. They showed that the cistern was originally a closed rectangular structure, 13.70m x 15.60m, which was surrounded by a thick surrounding wall terracing both sides, south and north, of the depression up to the level of the surrounding surface, and closing this depression to the west and east. The western wall, upstream, has completely collapsed and is now invisible, its ruins covered by a thick layer of alluvium, when the eastern wall, downstream, is rather well preserved. The two soundings, against the inner face of the southern wall and in the north-east corner, found the bottom of the cistern 2.80m under the present inside surface, i.e about 3.50m under the summit of the terracing wall. Although the natural wâdî bed is hidden upstream by alluvium, it appears clearly downstream outside the cistern and it is more than probable that the natural wâdî bed was dug down, at least downstream. The capacity of the cistern could therefore reach about 750m<sup>3</sup>. The terrace walls were at a time surmounted by thinner wall in elevation, to avoid the pollution of water from surface elements. The walls are coated with a thick and strong pinkish plaster with many inclusions of small gravels and fragments of stones which most probably also covered the bottom of the cistern, and

traces of such a mortar were found at the bottom of the sounding, on the natural bedrock.

#### 4-3-3. Water supply

The terracing walls were at a time surmounted by elevation walls, thinner and made of larger limestone blocks, which are now preserved up to about 1.20m above the surrounding surface. They probably served to protect the water from dust, bushes and rubbish from the outside surface and a staircase was built in the south-eastern corner to reach the water level inside. It is now largely destroyed and was not excavated until this bottom. The cistern was supplied by water coming from a deep indentation in the slope of the mountain, then running through a shallow wâdî leading to the southern wall of the cistern where it was channelled inside by low walls;

#### 4-3-4. Dating

Very few pottery was found in the soundings, and most sherds were rolled by water and undiagnostic. It is therefore impossible to make a dating from archaeological material. It seems nevertheless that the southern fortification wall B7 was built according to this cistern, following an angle parallel to its sides, which means that the cistern could be earlier, or at least contemporary, with the wall, which was built, according to Ibn al-Mujawir, in 1217/18.

#### 4-4. Cisterns in the *intra-muros* area

Two small wâdîs are located inside the *intra-muros* city, nearly enclosing the ancient quarter QSE. The southern one (W2) originates from the outside cistern B9 and was therefore probably poorly provisioned in water, except when the cistern was already filled up with very heavy rains. It is a narrow and rather deep water-course whose edges seem to have been faced with stones, at least partly. A rectangular structure lined with low walls faced with strong mortar, most probably a cistern, was registered along its left bank, about mid-way to the sea. The northern wâdî W1 shows also low thin walls with strong mortar along its right bank, and perpendicular small walls across the wâdî-bed probably acting as small dams. Both wadis were therefore most probably well equipped to salvage as much water as possible in case of rain.

Potential basins or small cisterns were also registered on the surface of the site in the course of the topographical study, which are located in the northern part of the ancient quarter of the medieval town, just south of B15. These are small square tanks hardly visible on the present surface, limited by narrow walls covered with a thick mortar. Excavations should be made there to check the depth and confirm the identification.

#### 4-5. Private underfloor cisterns

As described in the 2009 report, the great mosque of Qalhât was built on a high basement which was divided by five long inside walls into six compartments, which were in turn subdivided in smaller rooms by perpendicular walls. One of the rooms brought to light in the trench excavated in 2009 had its walls and floor covered with a very thick and strong pink mortar and recent discussions with specialists led to the hypothesis that this space was in fact an underfloor cistern where rain-water from the roof of the mosque could be collected for ablutions. Given that the roof of the mosque covered about 675m<sup>2</sup>, and that the average yearly rainfall to-day is 110mm, the amount of water collected could be of about 75m<sup>3</sup> a year. Similar mosques are known in India. Excavations this year revealed the presence of two wide gates in the northern wall of the basement of the mosque, on each side of that cistern, which probably gave access to underfloor ablution areas (see *infra*). Many of the large houses at Qalhât show high ruins which indicate the presence of several storeys or of a basement as in the mosque. It is therefore possible, and even probable, that these private dwellings had also their own cistern, to collect all possible water from the roofs in case of rain.

## 5. The craft areas

(Anna Ihr)

A detailed survey of the surface of the site was conducted for three days, to locate any specific area where there might have been conducted craft production, especially craft in high temperature production. The searching was for any kind of slag on the surface, but also indications of kilns or pyres were accordingly marked out.

### 5-1. Ceramic

The ceramic slag is rather easy to locate as these pieces have one side with burned mud, often reddish and the other covered with a thick layer of glazy greenish melt of shiny matter. The shiny surface is caused by considerable heat in the kiln, melting mud and fuse into a crystalline matter. These pieces, exposed at exceedingly heat, giving a gas outlet in the substance and creating bubbles, thus they are very porous and light in weight.

One area of pottery slag was partly excavated in 2008, the so called B41-area, a ceramic kiln with its waste (see 2008 report). Crossing this point some five meters to the south, a number of slag appears in the surface, covering a large area. The B41 and its southern adherence was very important in Qalhât pottery production, dated to the 14th century according to the study of the imported associated ceramics. This area is likely to hold not only a kiln or two, but the entire compounds for the pottery maker's workshop.

Other areas found to hold ceramic slag, concentrate in the west and the north-west of the outskirts of the city. In the west the area is slightly levelled and flattened, sometimes the bedrock is

No	Material	Remarks	Location
C1 (T. Vosmer)	Ceramic	Not found	north of B46 close to the wadi; or out on the "tip/point" (ras).
C2 & C2/II	Ceramic	Very much	north of B19 the mosque: 20 steps north and 30 steps west. /II: 15 steps north and 20 steps west.
C3 B41	Ceramic	Very much: 14 <sup>th</sup> cent	south of B21 along the path
C4	Ceramic	Much	all way south of B41 to P1. Probably belongs to the same area as B41.
C5	Ceramic	Much	Opposite of C6 on the inside of the fortification in a grave, just south of B7.
C6	Ceramic	Not marked out. Few. From cleaning of the fortification wall?	just outside the tower fortification, the 2:nd north of B9
C7	Ceramic	Not found, or same as C12?	Between B25 and B8 just west of the big house.
C8	Ceramic	Few	Along the north wall triangle with B19 & B28.
C9	Ceramic	Very much	Between Bibi Mariam and B41
C10	Ceramic	Very much	30 m south of C9
C11	Ceramic	Very much	Continuation of C4 but south of the road behind the house with a tree inside.
C12 B93	Ceramic	Very much. 16 <sup>th</sup> century?	Elevated area, sloping downhill to the north a wadi. Kiln almost visible. Lot of burned fish bone. South quarter.

found at surface. This area holds three separated ceramic waste locations (C9-C11), were the amount of ceramic slag is enormous at all three of them.

The north-western area (C2 & C2/II), set just behind the small mosque called B19 holds two areas of once more a vast amount of ceramic slag. Although the bedrock can be seen in various places, there is a possibility to hold at least one ceramic kiln as the bedrock is uneven and thus drop right at the place of a waste location. Hence, one location here is most probably a ceramic production places, but the other might just as well be a dumping area.

A ceramic kiln (B93) was located in the southern quarter of the city, not far from the southern fortification wall. It has not been excavated but surface investigation has shown kiln interiors with a huge amount of burned fish bones, just as in B41. The slag found is yet again massive. Associated shards found on the surface are dated to around 16<sup>th</sup> century, and this kiln could therefore be later than B41. All in all, we have so far located and possibly found six areas of ceramic production in different time phases. The far south seems to be the youngest; the B41 is located in the middle of Qalhât settlement both in time and geography, while the ones in the western outskirts could be of older occasion.

## 5-2. Iron

Iron slag can be found throughout the site, but always only one or few smidgens at time and place. Therefore, any remarks of iron slag concentrations counts more than three pieces of slag, often one or two hands full. This iron slag may not be confused with a local stone, reddish-black in colour and as heavy as iron slag. To ensure it was iron, I had consequently to break all iron slag to visually examine for a metallic inside. This shiny metallic vision does of cause not occur in the local stone. All iron slag had more or less a magnetic attraction, but only when broken.

Iron seems to be concentrated around the north-eastern tip of the site, in the corner of the Wadi Hilm and the sea, except of one area in the far south. In the north three good locations for iron production can be found (I4-I6). The southern (I8) is placed just east of the cistern B9, some 5 meters east of the fortification wall. Here the actual surrounding is flat and the place of slag concentration is

I1	Iron	Not found	Just southwest of B28.
I2	Iron	Not found, but black stone structure was found.	South of B12 the great mosque on the other side of the small wadi; or southwest just north of the wadi.
I3	Iron	Few. 4-5 pieces	North of B9 inside the fortification, around a grave, just south of C5.
I4	Iron	Very much. > 2 hands full	Very north, out on the tip (ras) at its southern side.
I5	Iron	6-7 pieces	North-eastern tip, close to the wadi.
I6	Iron	7-8 pieces	West of the wadi, close to B18
I7	Iron Ceramic	Much	East of covered Birka, 30 m east of the fortification wall.
I8	Iron	Very much	Just east of the open Birka, east of the wall.
I9	Glass Iron Ceramic	Much glass, medium ceramic, 5-6 pieces iron.	Just north of the road P1, elevated area (grave?) behind the tree.
I10	“Tom”	Not found	South of the city outside the fortification close to the beach
I11	Glass	Medium, three crucibles.	West of the Great Mosque.

slightly elevated into a small mound.

Iron smelting kilns and melting furnaces are usually constructed in stone and dressed in clay. Alike, tuyères and bellows are usually made in clay, thus ceramic slag ought to be found aside iron, at any iron production site located in Qalhât. So has been the case at two locations. Therefore, the epicentre of melting activity would be these two locations. One in the far south (I8) and one in the far north (I4), both having access to the natural resources desirable in metal production, which is water. Outcrops of clay are found in near vicinity, in the local mountains.

No unequivocal evidence for the iron production has been found, rather the iron oxide content in the slag found at Qalhât ought to be microscopical analysed before any conclusion can be taken for smelting and smithing at this site, unless an actual iron kiln or blast furnace is found and excavated. Oman is not known for its high content of natural resources in iron, instead there are known kilns and quarries for copper production. Iron ore is though found in India, and it is known that Indian iron was exported to the Middle East (for further readings see wootz steel). As Qalhât was a famous harbour for the kingdom of Hormouz, it is plausible they imported their Iron ore from India but might have forged it locally. As no blast or bloomery furnace has been excavated at Qalhât we cannot expect to find any tap slag nor furnace parts like tuyères or nozzles, usually good indications for smelting production. Rather, considering the fine magnetic attraction, the iron slag found is hammerscale, thus, secondary smithing or forging slag, rather than primary smelting of iron ore. Hence, we might expect a melting process in Qalhât, while smelting is highly unlikely.

### 5-3. Glass

Unfortunately but not surprisingly, few pieces of alleged raw glass were located during the survey. Again, the material was badly corroded, as in the case of iron slag, requiring breaking a small bit off its body to ensure the substance in question. Two small smidgens were found close to the western area of ceramic production. Just slightly east, an elevated area is located (I9) with little iron slag, few raw glass pieces and some ceramic slag. Noticeably, a small drop of glass was found. Two other smidgens of dark blue or grey were found. Broken they shine, but these items are very similar to small parts of ceramic slag, why any definite conclusion of their material are difficult to say, though their weight indicate glass. Few meters to the north-east a small piece of turquoise transparent raw glass was located. Here shards of glass were also found, which is common throughout the site. Intriguingly is though, that glass is not frequently found in the actual excavation soundings. This might indicate glass to be of a more expensive substance and hereof items of glass might have been taken thorough care of and if broken, remelted in a new batch of glass mass.

A second area is found, located west of the Great Mosque, thus set inside the Ancient parts of the city of Qalhât. This location held three shards of three different crucibles, whereof one has solidified greenish rest production at its interior wall, indicating a copper/brass manufacturing. A slightly larger quantity of raw glass, transparent green and a small transparent turquoise were sited here. Raw glass is though not expected at surface layers in any large amount. Aside the crucibles, few interior furnace slag of clay were also located here. Not surprisingly, we can in this area locate several different slag or waste materials of high temperature in the same area.

### 5-4. Limes

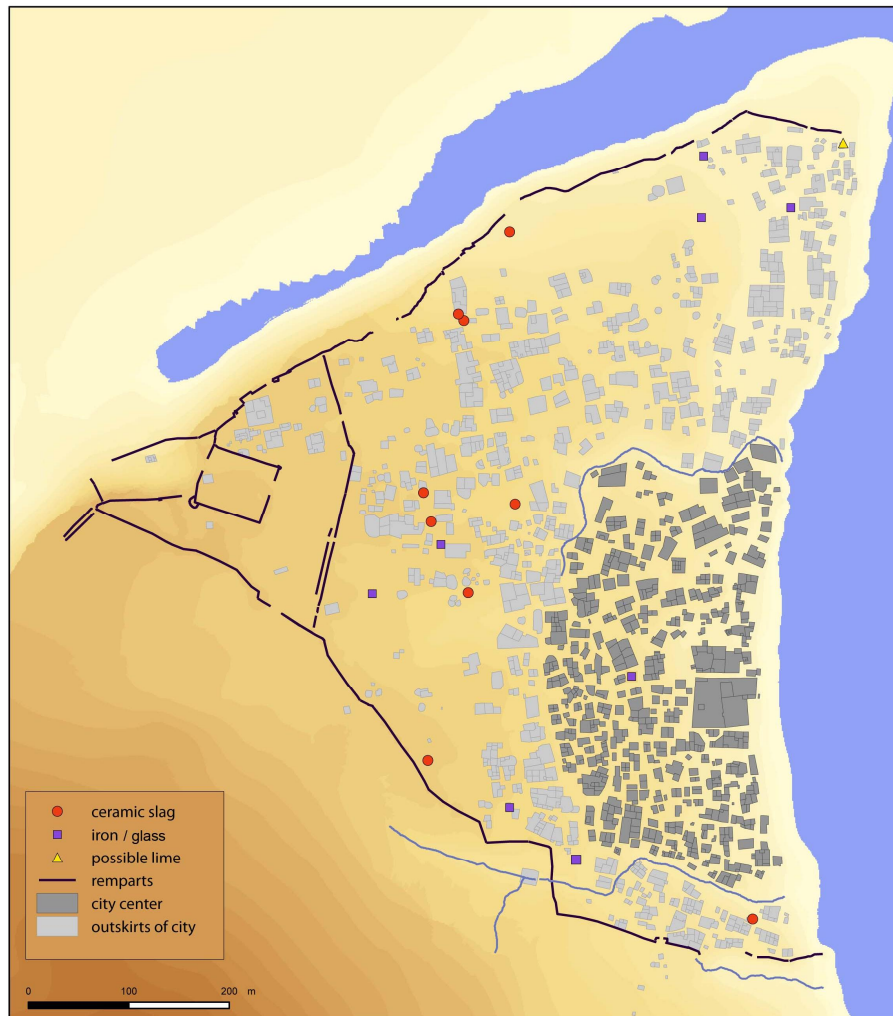
One possible lime production spot is to be found in the far north, inside the fortification wall, next to the sea. The place in question is a round structure containing vast quantities of small coral pieces; hence we are here not concerned with lime production by limestone from the mountain. Rather, we deal with an open pyre for burning of coral, as a production of lime. The difference in lime production from limestone and from coral is that limestone found in the mountains is used for manufacturing white slip as to whitening houses. The burning of coral is used for the production of plaster, which is widely used in Qalhât.

## 5-5. Summary

Not all places of slag have been discussed here as the ones with little waste are less likely to reveal any kiln in case of an excavation. Intriguingly, generally it was revealed that craft areas are found in neighbourhood of graveyards, actually one grave is completely filled with ceramic waste and ceramic slag. A few remarks considering slag were made by Tom Vosmer and his project in 1998. These locations could unfortunately not be rediscovered in 2010, though it might be of an interest that his locations are alike set nearby graves.

Kiln types of any above discussed material except for the coral lime, ought to be closed structures considering the heat needed for the melting process. This counts for iron, glazing of ceramic and glass mass production the same. Kiln slag is generally green shiny on one side, while reddish clay appears on the other. The tempering of kiln clay seems to be coral from the sea by visual examination.

Recommendation for future excavation might be to enlarge the B41 area to the north and to the west. As we already do have some knowledge here of presumably many more kilns, the excavation of this whole area would give an overall view of a pottery craft quarter. The western area with the two nearby slag concentrations are alike very interesting as the B41 is younger than presumably this quarter. High temperature productions are for convenience often placed close to each other, why the last located area, west of the Great Mosque is of vital interest as the indication there is craft production of several materials. Crucibles found show of a melting manufacturing.



*Location of ceramics (red) iron (purple) and lime (yellow) possible production areas*

## 6. The Topographical Project (E. Regagnon, O. Barge)

### 6-1. Planning of the city

Originally, the Topographical Project sponsored by the Total group was intended to build the DEM of the site only, and was planned for two years (2008-2009). The DEM was in fact completed in one season only (2008), so the 2009 season was devoted to a tentative planning of the ruins of the city itself. Although these ruins are extremely difficult to interpret on the ground, the Topographical Project succeeded great achievement, producing a preliminary map of the medieval city of rather accurate standard. An extra fund for a third season was therefore granted by the Total Group, to complete that map and study the surroundings of Qalhât. Beside studying the water supply, the look-out posts and the advanced fortification walls (see *supra*), the Topographical Project was mainly therefore devoted this year to the achievement of the planning of the city.

As a matter of fact, the whole *intra muros* area had been already mapped in 2009, but in several places this map was drawn from kite photographs only, without detailed ground verification, and only the outside frame of the buildings was then recognized. The detailed surface survey with the differential GPS was therefore completed this year in these remaining sectors and a much more accurate map was recorded. New buildings were also registered and, all in all, more than 2800 architectural “units” (as a room, a group of rooms, a terrace ...) have been identified. This survey also allowed understanding more clearly the organisation of public spaces. These are mostly in the shape of low terraces limited on two or three sides by low walls and covered with minus white pebbles, sometimes associated by two or three to make wide squares. Given the marked relief characteristic of most of the *intra-muros* city, these terraces allow the building of flat areas, nested into each other; when the slope is really steep we can observe up to 5 associated terraces. The steepest the slope the smallest the terraces, which at the end turn to wide steps, as on the banks of the two *intra-muros* wadis and the ridge overlooking the great mosque.

1683 graves were also georeferenced, and the funerary zones were delineated. A mapping of the outcrops of the bedrock was also achieved which will allow a mapping of the surface of the area before the foundation of the city.

The 2010 season of the Topographical Project therefore brought a lot of new data which now deserves an important further post-field treatment on computers to be allowed to produced new drawings, maps and 3D models. This post-field works include:

Structuration of information about architectural units (driven form a topological model)

Computer input for the checking of kite photographs

Achievement of the medieval city map

Achievement of a map presenting the reliability of the information

Computer input of the data about bedrock and modelisation of the topographical surface under the archaeological layers

Computer input of the plan of excavated buildings and structuration of the information in three levels, surroundings, city, buildings

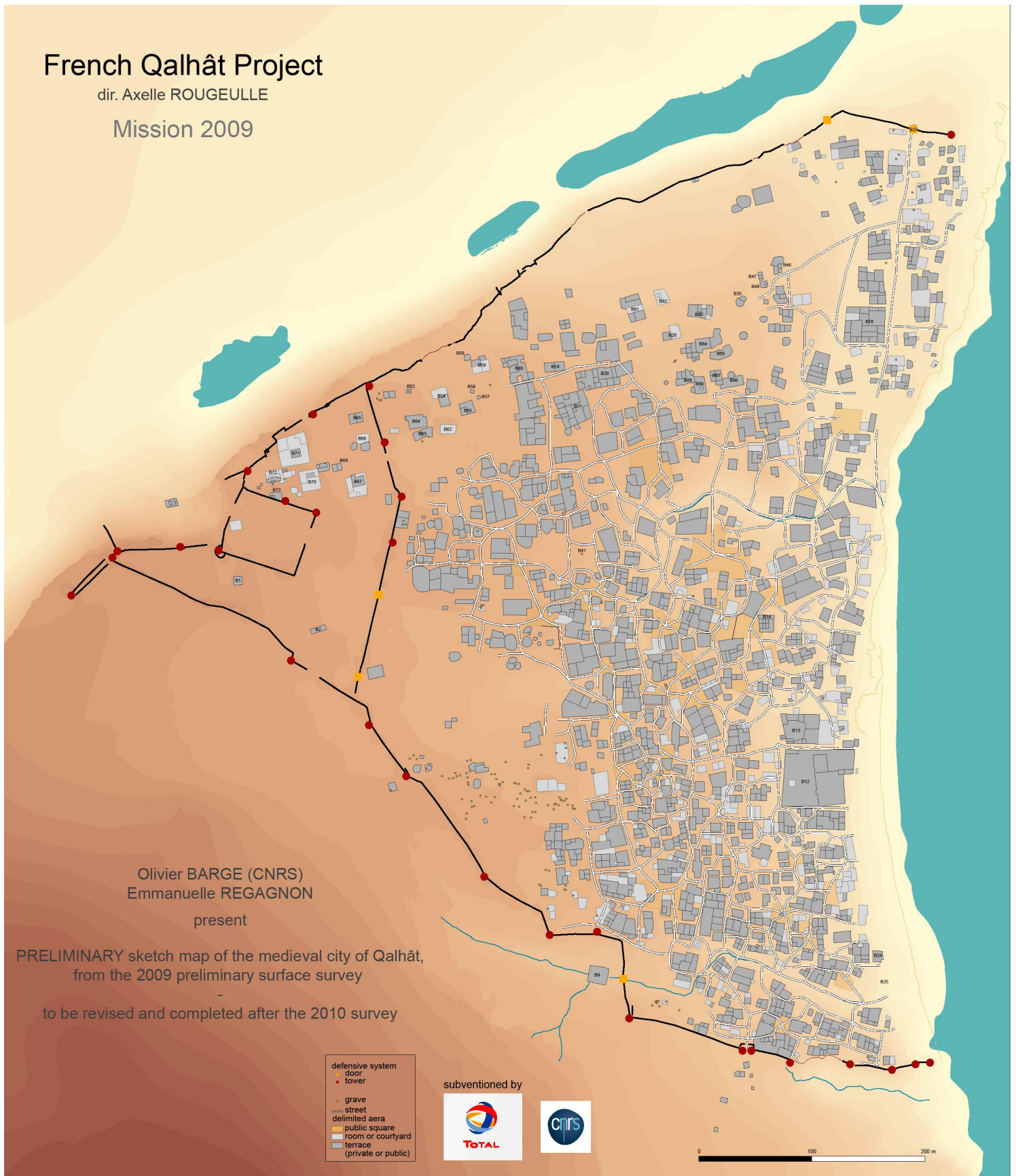
Achievement of perspective views and 3D models

### 6-2. The *extra-muros* survey

The 2010 season was also devoted to the survey of the surroundings of the city. Beside the outside fortifications (northern advanced wall and look-out posts) and the water supply (cisterns and wells), the survey studied the Wadi Hilm and the southern enclosure. It revealed the low density



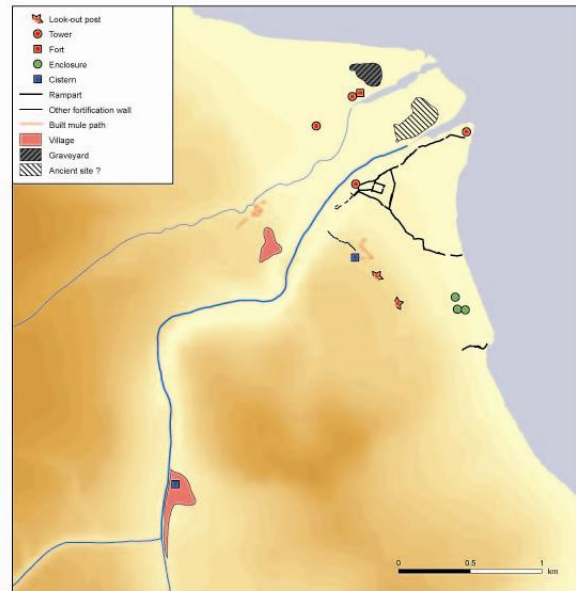
of occupation outside the city itself during the medieval period



*Preliminary map of the medieval city of Qalhât according to the 2009 survey of the Topographical Project*

A village with about 20 houses is located on a narrow shoulder of the mountain, near the edge of the ridge which overlooks the bed of the Wadi Hilm, on the left bank. The pottery and architecture are very coarse and this settlement has probably no chronological connection with Qalhât

Another abandoned village is located about 4km upstream the Wadi Hilm, on the right bank, opposite the mouth of a small affluent of the wâdî. The ruins of some houses are still visible on the slope overlooking a qanat running about 10m over the wâdî bed, the inhabitants taking advantage of the rather heavy flow of the wâdî which reached about 50 litre per second at the time of the survey . At the end of this qanat is a cistern measuring about 12 x 8m, with an approximate depth of 2m. A valve at the bottom of the cistern allowed the water to flow into small canals supplying terraces. The ceramic is scarce and does not allow a precise dating of the site, maybe contemporary with Qalhât.



*Location of extra-muros areas and structures studied by the Topographical Project.*

The survey in the southern area, between the southern fortification and the south advanced wall showed that most of the structures there are concentrated near the city-wall. These are the outside cistern B9 (see *supra*), many graves along the wall, several high terraces in front of the city gate B8, probably funerary structures, and three small enclosures further south. No water supply system was found in the bed of the wâdî, although rather important, which crosses the coastal plain in this area.

## Conclusion

The 2010 season has fulfilled most of its objective and answered most of the pending questions about the mosque, its surroundings, courtyards, accesses, gates and associated structures. As a matter of fact this mosque was a very impressive and complex structure, a unique piece of architecture in medieval Oman

Although extensive excavations at B13 proved impossible due to the huge amounts of collapse and the thickness of the archaeological deposits, excavations there also brought interesting information as to its dating and function. It was certainly the residence of a very important personality, probably the governor of the city, and it was built around the same period of the mosque, so possibly at the time of Bibi Maryam and Ayaz. Further analyze of the ceramic material must nevertheless be achieved to confirm this hypothesis.

The Topographical Project was achieved this year thanks to an extra fund from the Total Group. When all the collected data will be entered and analyzed on computers a rather accurate map and 3D model of the medieval city will be produced which will allow a detailed study of the spatial organisation and evolution of the city and its surroundings. Further surveys and test excavations also brought important data on the water supply and defensive system of the city, as on the localisation of craft areas.

Due to a shortage of workers it was not possible this year to study a funerary terrace as it was planned and this study will therefore be realized in 2011. If enough workers are allowed next year, the study of the ceramic kiln B41 will also be resumed. A kiln was excavated in 2008 but we need more information about the workshop itself to be able to understand the complete procedure of fabrication of the Qalhât ceramic. But the next season will be mostly devoted to the study of a private house which presents a surface outline similar to many other buildings on the site including B13 (regular shape, central courtyard with surrounding rooms, elevated structure as a tower in a corner). The object is to get general information on a typical house of Qalhât, which could be extended theoretically to similar structures all over the site, and also to get information on the daily life of the inhabitants of the city.

House B96 in the north-western quarter will probably be chosen for several reasons =

- it is located beside a recent bulldozer track and so it is easily accessible to workers and machines.
- It is situated near a wide flat area where the rubbish from excavation may be deposited and then taken out of the site with a bulldozer
- The bedrock is visible in the vicinity and B96 could therefore be rather extensively excavated without being obliged to dig deep soundings.
- It is also located not far from the large funerary terrace B9 and the ceramic kiln B41
- It is near the group of buildings including B19 and B21 which were already partly excavated in 2008, and all these buildings could be restored and become an interesting part of the development project