RESTORATION WORKS AT SUMHURAM

(ARCHAEOLOGICAL PARK OF KHOR RORI)

(Sultanate of Oman)

CAMPAIGN October-December 2017

Italian Mission To Oman

Technical Report

16th October – 14th December 2017

Michele Chimienti – Emiliano Mura

ARCHITECTS

INTRODUCTION

During the mission SUM17C (October – December 2017) the following restoration works were carried out within the city:

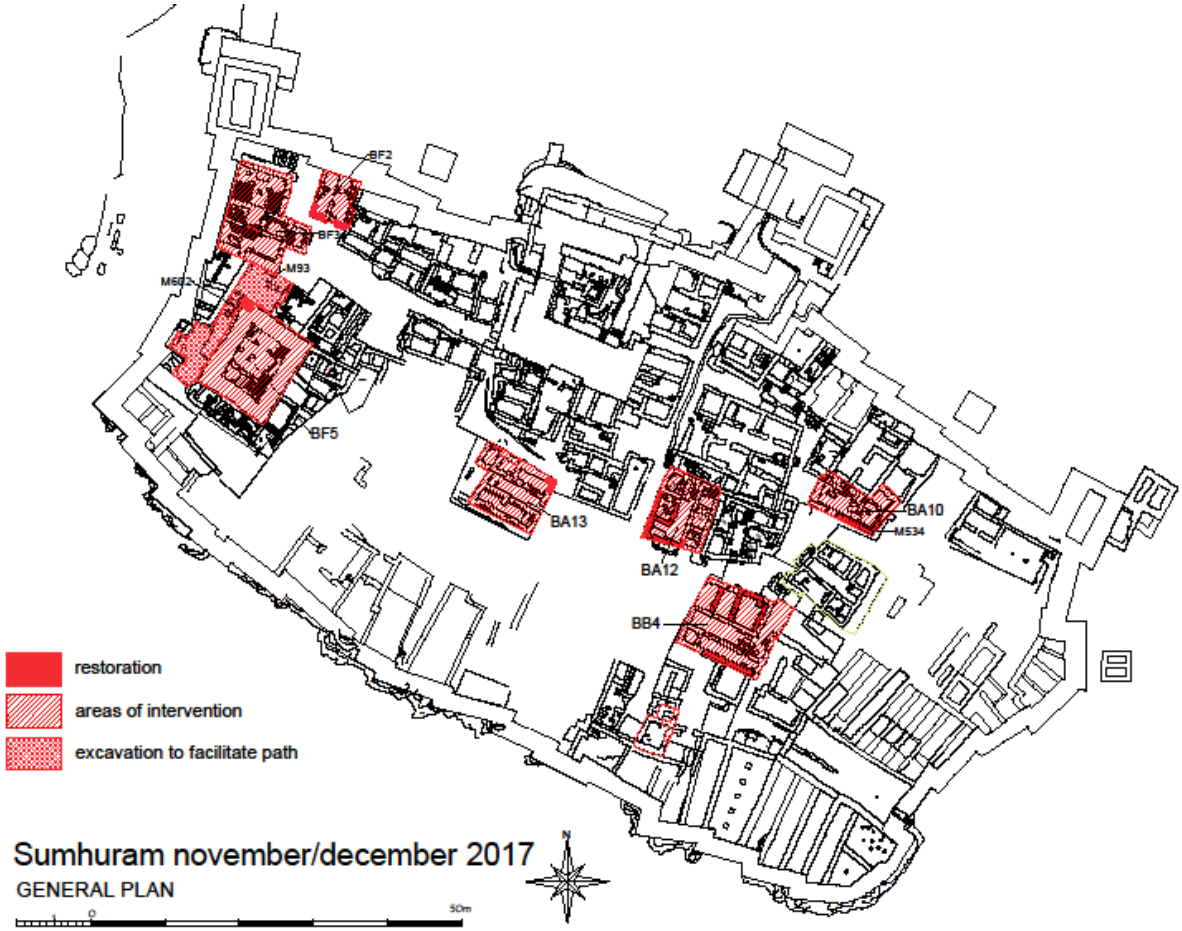
Arch. Michele Chimienti from 16th October – 14th December

- Building BA12. The restoration of the walls M185, M541, M542, M550, M554.
- Building BA13. The restoration of the wall M656.
- Building BB4. The restoration of the walls M578, M644, M645, M646, M653.
- Building BF2. The restoration of the walls M41, M42.
- Building BF3. The restoration of the walls M39, M49, M83.

Arch. Emiliano Mura from 15th November – 14th December

- Building BA10. The restoration of the walls M534,M553.
- Building BF5. The restoration of the walls M92,M93.
- Building BF2. The restoration of the wall M44.
- Building BA13. The restoration of the corner wall M485.

The following map shows all the locations:



Worker Teams

Two teams of workers have engaged to work out all the operations to complete the reconstruction of the above-mentioned areas. One team of six people was engaged to prepare the mortar and two teams of five people each have engaged for the restoration of the walls.

Working progress status

In order to check the advancement of the works, we daily took a significant number of pictures of the areas. The number of the pictures and the point of viewing from which they are taken from, are those considered necessary for a good comprehension about the working progress status.

Mortar preparation

The mortar we used for the connection between the stones is the same used during the previous campaigns:

- **80** grams of brown colour with **200** grams of yellow colour.
- The oxide colours, mentioned above, plus 4 buckets of sand composes the mix of the mortar with eight scoops (**600 grams**) of lime powder.

The percentage of lime on sand is 1:6, and then we have two different kinds of mortar:

- **Stone mortar**, used for the external faces of walls, obtained by the mix of sieved sand, hydrated lime, brown and yellow oxides for the chromatic tone.
- **Filling mortar**, used for the back filling of the structure, made with the same components, except the use of raw sand instead of sieved sand without any brown and yellow oxides.

01_ MICHELE CHIMIENTI

The restoration and reconstruction works followed and directed by architect Michele Chimienti during the Mission SUM17C concerned buildings BA12, BB4, BA13, BF3 and BF2 (Fig. 1).

The work in this mission was carried out after careful analysis of the surrounding original wall structures, especially those not yet restored in previous missions. Throughout the archaeological site of Sumhuram, the walls are double faced, with outer faces in rough stone blocks and mortar and filling in small stones, sand and mortar. Orthogonal binding stones are very rarely present (Fig. 2).

All restored and reconstructed masonry sections were built in accordance with the original construction technology, using stone blocks from the site and mortar with local sand as inert. Stone blocks were chosen to be as much similar as possible to those of the original parts, both in size, shape and color. The wall texture of the restored and reconstructed portions was set up with very retracted mortar in order to homogenize new rebuilt sections with the surrounding built environment (Fig. 3).

Whenever a new wall section was built or a detached portion was removed and reassembled, a layer of geotextile was interposed between the untouched and the new or reconstructed masonry part. The geotextile layer was placed only under the two faces (Fig. 4).

New masonry sections were realized a row at a time, at first realizing the two outer faces, with rough stone blocks and mortar, then filling the gap with small stones and finally saturating the core with very smooth mortar to level everything and prepare a good laying plan for the next row (Fig. 5). When it was the upper row, the core was not completely filled but rather the upper surface was shaped to give the appearance of ruins (Fig. 6). Prior to each new row, the bottom surface was wet until saturation to prevent absorption of the mix water.

Below are the reports for each area of intervention.

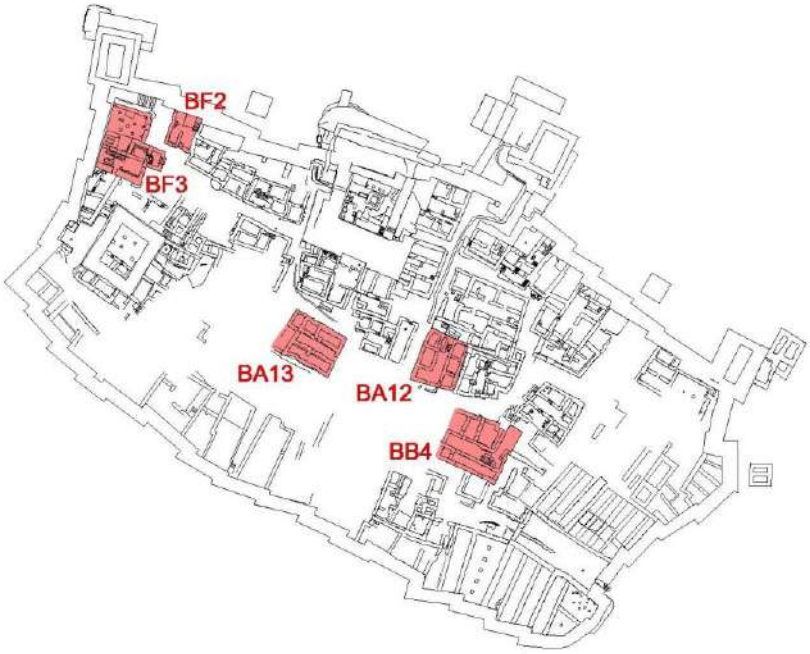


Fig. 1 – Sumhuram plan with highlighted the restoration areas.

Fig. 2 – Typical masonry section in Sumhuram archeological site.

Fig. 3 – New (on the left) and old (on the right) masonry texture. Building BA12, wall M185.

Fig. 4 – Geotextile layer placed between the original masonry and the reconstructed wall. Building BB4, wall M645.

Fig. 5 – Realization of a new masonry wall, with the two outer faces in rough stone blocks and with the core filled with small stones and mortar. Building BB4, wall M646.

Fig. 6 – Top row of restorated walls. Building BB4, wall M646.

RESTORATION OF BA12

The first part of the Mission concerned the restoration of part of BA12. In particular, it was rebuilt the corner between the walls M541 and M542, the upper part of the the walls M541 and M542, the western part of the wall M554 and the southern part of the wall M185, and it was disassembled and reconstructed the upper part of the southern area of the wall M550 (Figs. 7).

Before the restoration, the corner between the walls M541 and M542 was almost completely collapsed, especially the south and east faces. Before rebuilding the corner, the unstable stones were removed to have a solid foundation for new wall sections. Moreover, as explained in the introduction, the upper surface of the support was abundantly wet and a geotextile layer was placed above the original masonry. The upper surface of the new corner and of the masonries M541 and M542 was reshaped to make it similar to the surrounding ruins, and not similar to that of a new wall (Figs. 8).

Afterwards, it was rebuilt the wall M554, between the alignments M185 and M550, and the southern part of the wall M185. In order to avoid future subsidences and cracks in the new masonry, the foundation plan was placed about 50 cm below the countryside plan. To reinforce the foundation of the wall, the first two rows were realized with plentiful mortar in joints. Following to the indications of Mr. Sedov, in the middle of the reconstructed part of the wall M554 it was made an opening of about 85 cm (Figs. 9).

Subsequently, the top of the southern end of the wall M550 was disassembled and reconstructed (Figs. 10).

Finally, the area of the BA12, that in previuos missions was digged deeply, was filled with sand to reach the original ground floor level. Before filling with sand it was positioned a geotextile layer.

The works in the area BA12 started on October 16th and ended on October 31st. Some little modifications were carried on from the 12th to the 15th and on the 25th and 26th of November.

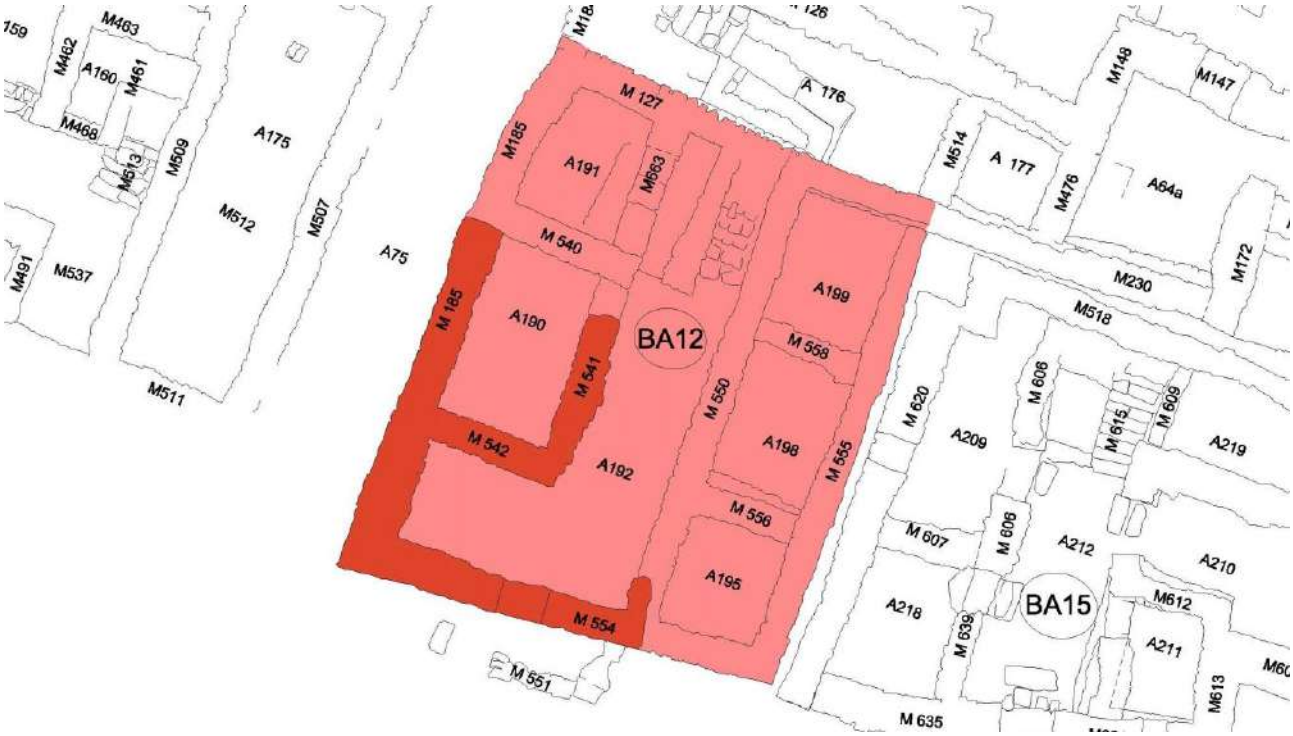


Fig. 7a – BA12 plan with highlighted the restorated walls.

Fig. 7b – BA12 before the restoration work (view from SW).

Fig. 7c – BA12 before the restoration work (view from S).

Fig. 7d – BA12 before the restoration work (view from SE).

Fig. 7e – BA12 after the restoration work (view from SW).

Fig. 7f – Details of restoration works of BA12 (view from SW).

Fig. 7g – BA12 after the restoration work (view from SE).

Fig. 7h – Details of restoration works of BA12 (view from SE).

Fig. 7i – BA12 after the restoration work (view from NE).

Fig. 7j – Details of restoration works of BA12 (view from NE).

Fig. 7k – BA12 after the restoration work (view from NW).

Fig. 7l – Details of restoration works of BA12 (view from NW).

Fig. 8a – BA12, corner between M541 and M542 before the restoration works.

Fig. 8b – BA12, corner between M541 and M542 during the restoration works.

Fig. 8c – BA12, corner between M541 and M542 after the restoration works (view from SE).

Fig. 8d – BA12, details of restoration works of the corner between M541 and M542 (view from SE).

Fig. 9a – BA12, wall M554 during the restoration works.

Fig. 9b – BA12, wall M554 and corner between walls M554 and M185 during the restoration works.

Fig. 9c – BA12, wall M554 after the restoration works (view from S).

Fig. 9d – BA12, details of the restorations works of the wall M554 (view from S).

Fig. 9e – BA12, wall M554 after the restoration works (view from N).

Fig. 9f – BA12, details of the restorations works of the wall M554 (view from N).

Fig. 9g – BA12, wall M185 after the restoration works (view from W).

Fig. 9h – BA12, details of the restorations works of the wall M185 (view from W).

Fig. 9i – BA12, wall M185 (between the alignments M554 and M542) after the restoration works (view from E).

Fig. 9j – BA12, details of the restorations works of the wall M185 between the alignments M554 and M542 (view from E).

Fig. 9k – BA12, wall M185 (between the alignments M542 and M540) after the restoration works (view from E).

Fig. 9l – BA12, details of the restorations works of the wall M185 between the alignments M542 and M540 (view from E).

Fig. 10a – BA12, southern part of the wall M550 before the restoration works.

Fig. 10b – BA12, southern part of the wall M550 during the restoration works.

Fig. 10c – BA12, southern part of the wall M550 after the restoration works (view from W).

Fig. 10d – BA12, details of the restoration works of the southern part of the wall M550 (view from W).

RESTORATION OF BB4

The second part of the mission was dedicated to the restoration of BB4. In particular, they were rebuilt the walls M645 and M653, a big part of the wall M578, the walls M644 and M646 with the corner between them and it was digged to find the foundation of the west border wall between the walls M581 and M646 (Figs. 11).

At first it was restored the wall M645. While the south corner was in good condition, the central part of the wall was widely collapsed. After removing the unstable stones and positioning the geotextile layers, the wall was rebuilt by shaping the top surface as ruin to connect the height of the wall M646 with that of the south end, that was substantially intact (Figs. 12).

Afterwards it was rebuilt the wall M653. The southern half of the wall was almost completely collapsed, with the exception of the first row of stones. Therefore it was possible to create the door in its original position, though there was a doubt jamb near the north transversal wall M646. Before rebuilding the masonry, the unsafe stones were removed and the geotextile layer was placed (Figs. 13).

During the restoration of the walls M645 and M653, it was also reconstructed the wall M578 between the alignments M698 and M235. After digging to find a solid surface on which to base the wall, all the first row was laid. From the second row on, the rows were interrupted to make an opening in the east part of the wall. Having no trace of the location of that door, it was created in the middle of the room to access (Figs. 14).

Later on, it was restored the corner between the walls M644 and M646, the east end of the wall M646 and all the wall M644. While the corner was completely collapsed, the two walls were at least detectable, with the wall M644 that kept only the first rows of the inner face, while the outer face was 2 meters high. Since from the state of the places it was unclear what was the planimetric shape of the corner, at first it was digged a survey in order to find its foundations and to deduce its shape. With the help of the archaeologists present on the site it was deduced that this was a concave angle (i.e. a W shape). To avoid losing track of the above-mentioned planimetry, the first rows were immediately reconstructed until the high of the wall M646 and of the inner face of the wall M644. After that, the rocking stones of the wall M644 were removed. At this point, the walls M644 and M646 were built simultaneously, with upward trend from west to east and from north to south (Figs. 15).

Simultaneously with the aforementioned restoration works, it was digged around the west border wall between the walls M581 and M646 to discover its foundation or the bedrock. During the excavation a stone basin was found outside the northwest corner of the building. Moreover, it appeared that the masonry consisted of three different faces: the east one in raw earth bricks and the western two in stones. However, analyzing the remains of the three wall faces, it seemed that the exterior stone face was out of the shape of the building, that was perfectly defined by the well preserved northwestern corner. Therefore, it was supposed that originally there were two different masonry: the building boundary wall, made by two faces (the inner in bricks and the exterior in stones), and an exterior wall, made by one stone face. Watching carefully the exterior face, it was noted that some stones adjacent to the stone basin were remarkably smooth. It was therefore conjectured that this was the threshold of an opening. However, the fact that this threshold wasn't present even in the most internal masonry (the two-faced wall) suggested that the two walls were built in two different periods. In order to clarify the situation, it was excavated a width of about 1 m and a depth of about 30 cm on the west of the wall in question, but nothing was found. Therefore, according with Mr. Sedov and with the archaeologists present on site, it was decided to postpone the restoration to a next mission, after enlarging the survey. In any case it was disassembled and temporarily reconstructed the north-west corner that was in precarious equilibrium conditions (Figs. 16).

Finally, the surveys opened near the corner between the walls M644 and M646 and near the west border wall were closed with sand.

The works in the area BB4 started on October 30th and ended on November 27th.

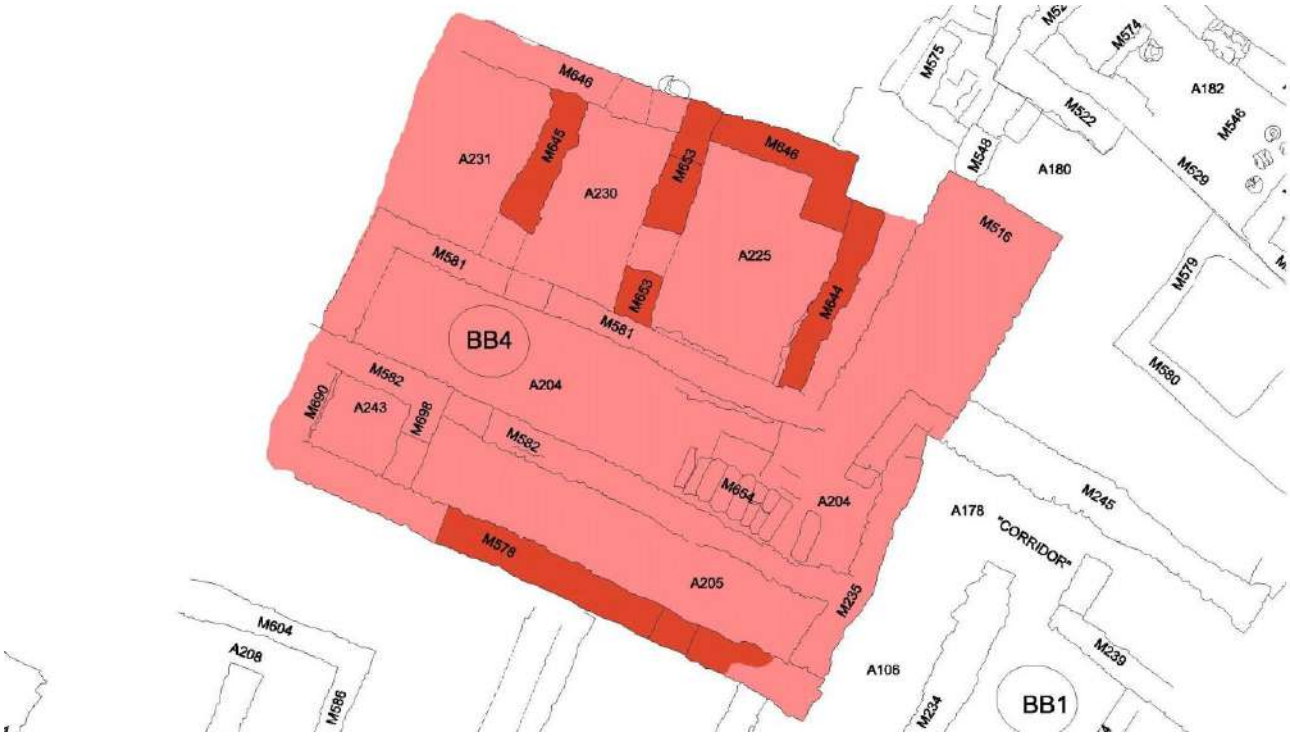


Fig. 11a – BB4 plan with highlighted the restorated walls.

Fig. 11b – BB4 before the restoration work (view from NW).

Fig. 11c – BB4 before the restoration work (view from W).

Fig. 11d – BB4 before the restoration work (view from SW).

Fig. 11e – BB4 after the restoration works (view from SW).

Fig. 11f – Details of restoration works of BB4 (view from SW).

Fig. 11g – BB4 after the restoration works (view from NW).

Fig. 11h – Details of restoration works of BB4 (view from NW).

Fig. 11i – BB4 after the restoration works (view from NE).

Fig. 11j – Details of restoration works of BB4 (view from NE).

Fig. 11k – BB4 after the restoration works (view from SE).

Fig. 11l – Details of restoration works of BB4 (view from SE).

Fig. 12a – BB4, wall M645 before the restoration work (view from E).

Fig. 12b – BB4, wall M645 before the restoration work (view from W).

Fig. 12c – BB4, wall M645 after the restoration works (view from E).

Fig. 12d – BB4, details of the restoration works of the wall M645 (view from E).

Fig. 12e – BB4, wall M645 after the restoration works (view from W).

Fig. 12f – BB4, detaisl of the restoration works of the wall M645 (view from W).

Fig. 13a – BB4, wall M653 before the restoration work (view from E).

Fig. 13b – BB4, wall M653 before the restoration work (view from W).

Fig. 13c – BB4, wall M653 after the restoration works (view from E).

Fig. 13d – BB4, details of the restoration works of the wall M653 (view from E).

Fig. 13e – BB4, wall M653 after the restoration works (view from W).

Fig. 13f – BB4, details of the restoration works of the wall M653 (view from W).

Fig. 14a – BB4, wall M578 before the restoration work (view from NW).

Fig. 14b – BB4, wall M578 before the restoration work (view from SE).

Fig. 14c – BB4, wall M578 after the restoration works (view from NW).

Fig. 14d – BB4, details of the restoration works of the wall M578 (view from NW).

Fig. 14e – BB4, wall M578 after the restoration works (view from NE).

Fig. 14f – BB4, details of the restoration works of the wall M578 (view from NE).

Fig. 14g – BB4, wall M578 after the restoration works (view from SE).

Fig. 14h – BB4, details of the restoration works of the wall M578 (view from SE).

Fig. 14i – BB4, wall M578 after the restoration works (view from SW).

Fig. 14j – BB4, details of the restoration works of the wall M578 (view from SW).

Fig. 15a – BB4, wall M644 before the restoration works (view from NW).

Fig. 15b – BB4, survey to find the foundation of the corner between walls M644 and M646 (view from E).

Fig. 15c – BB4, survey to find the foundation of the corner between walls M644 and M646 (view from SW).

Fig. 15d – BB4, corner between walls M644 and M646 during the restoration works (view from SW).

Fig. 15e – BB4, wall M644 during the restoration works (view from W).

Fig. 15f – BB4, corner between walls M644 and M646 during the restoration works (view from SW).

Fig. 15g – BB4, corner between walls M644 and M646 after the restoration works (view from SW).

Fig. 15h – BB4, details of the restoration works of the corner between walls M644 and M646 (view from SW).

Fig. 15i – BB4, wall M644 after the restoration works (view from W).

Fig. 15j – BB4, details of the restoration works of the wall M644 (view from W).

Fig. 15k – BB4, wall M646 after the restoration works (view from S).

Fig. 15l – BB4, details of the restoration works of the wall M646 (view from S).

Fig. 15m – BB4, corner between walls M644 and M646 after the restoration works (view from NE).

Fig. 15n – BB4, details of the restoration works of the corner between walls M644 and M646 (view from NE).

Fig. 15o – BB4, corner between walls M644 and M646 after the restoration works (view from NW).

Fig. 15p – BB4, details of the restoration works of the corner between walls M644 and M646 (view from NW).

Fig. 15q – BB4, wall M646 after the restoration works (view from N).

Fig. 15r – BB4, details of the restoration works of the wall M646 (view from N).

Fig. 16a – BB4, basin discovered near the NW corner (view from NW).

Fig. 16b – BB4, basin discovered near the NW corner (view from SW).

Fig. 16c – BB4, west border wall between walls M581 and M646 during the excavation (view from N).

Fig. 16d – BB4, west border wall between walls M581 and M646 during the excavation (view from E). It is possible to note the presence of the three wall faces.

Fig. 16e – BB4, west border wall between walls M581 and M646 during the excavation (view from S). It is possible to note the presence of the three wall faces and the fact that the west one (on the left in the picture) is out of the building profile.

Fig. 16f – BB4, detail of the three smooth stones near the basin.

Fig. 16g – BB4, north-west corner after the restoration works.

Fig. 16h – BB4, details of the restoration works of the north-west corner.

RESTORATION OF BA13

A little part of the mission was dedicated to the restoration of BA13. In particular, it was just disassembled and reconstructed the wall M656 (Fig. 17).

Before the restoration works, the wall M656 appeared in precarious equilibrium conditions, showing an evident collapse towards the north. Therefore, for the safety of tourists, the aforementioned wall was disassembled and rebuilt with the same stones. Moreover, in agreement with the archaeologists present on site, the wall was rebuilt lower to facilitate a future disassembly of the same in order to investigate thoroughly the environment of BA13 closed by the wall M656 and the road at north of it (Figs. 18).

The works in the area BA13 started on November 26th and ended on November 28th.

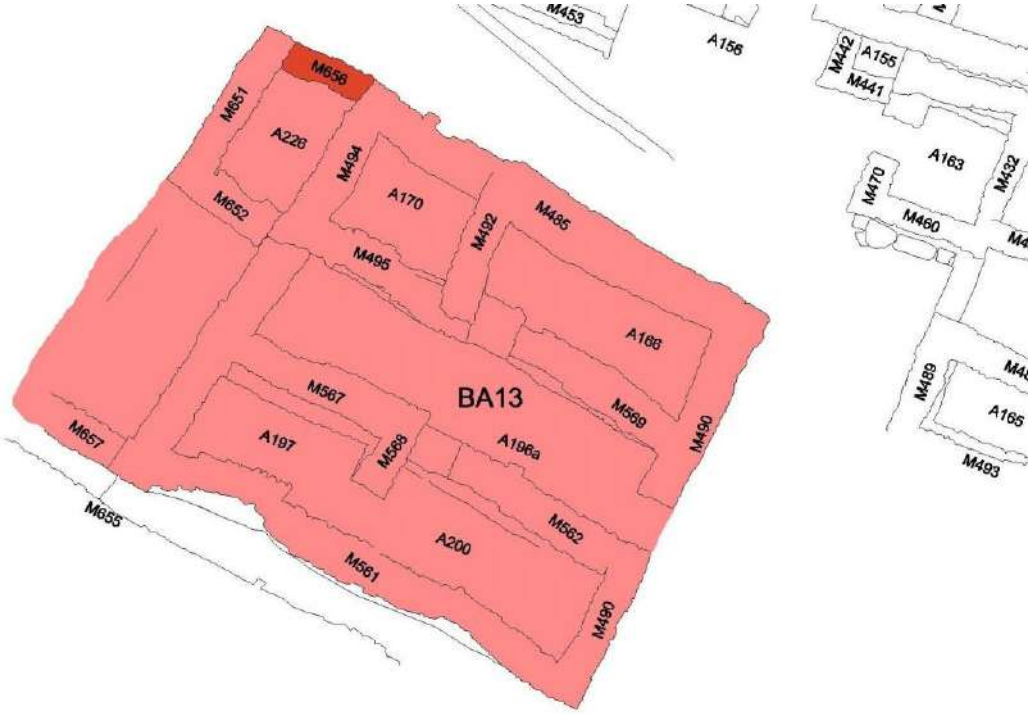


Fig. 17 – BA13 plan with highlighted the restorated wall.

Fig. 18a – BA13, wall M656 before the restoration works (view from NW).

Fig. 18b – BA13, wall M656 before the restoration works (view from S).

Fig. 18c – BA13, wall M656 during the restoration works (view from NW).

Fig. 18d – BA13, wall M656 during the restoration works (view from NW).

Fig. 18e – BA13, wall M656 after the restoration works (view from N).

Fig. 18f – Details of the restoration works of the wall M656 (view from N).

Fig. 18g – BA13, wall M656 after the restoration works (view from S).

Fig. 18h – Details of the restoration works of the wall M656 (view from S).