

The Umm al-Surab and Samah Churches Project

Recording the past in forgotten churches of Southern Hawran

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Abstract: The Umm al-Surab and Samah Building Archaeology project aims to record through photogrammetry the sites' churches of Umm al-Surab and Samah, in the Southern Hawran area, north region of modern Jordan. The sites are characterized by well-preserved ancient basalt buildings, sometimes still standing up to the second floor. Umm al Surab lies on a directory of the Via Traiana Nova, connecting the Red Sea to the Great Syria: three churches tested the importance in the past of this village, while Samah is remember through documents for having proved a lively Christian activity far more after the islamic conquest. Of the once two clearly detectable churches at Samah only one survives nowadays, while of the three churches at Umm al Surab only two have been identified. The sites are facing today an increasing danger by the modern villages risen nearby using the ancient sites as building materials caves, by heavy restorations or negligence's consecutions. Threats even more dangerous for sites with few documentation and almost forgotten by archaeology. The project's goal is to record the churches in order to:

- Confront and implement the previous records of the sites.
- Individuate building's techniques and reconstruct the buildings' history.

The project uses the Zscan and Zmap softwares to generate from photos RGB eventually texturized point clouds, geometric correct Ortophotos, D.E.M. The choice of photogrammetry has proved to be the best in order to:

- Quickly record on the field of complex buildings and large areas, which is capital, given the huge amount of still standing buildings.
- Offer outputs that can be confronted and easily shared with a large public of researches.

Finally, detecting the sites in a non-destructive method means an environment-economically sustainable archaeology.

Keywords: Building Archaeology, Late Antiquity, Oriental Churches, Photogrammetry.

South Hawran

Umma al Surab and Samah archaeological sites are both lying in the modern Jordanian district of Mafraq, near to the Syrian border. This land is historically part of the Hawran, a basaltic desert region actually parted between modern Jordan and modern Syria: the north Hawran belongs to Syria, the south one to Jordan. The Hawran has nonetheless maintained a substantial continuity through history for mineral sources, building techniques and settlements typology: the region, known as the "Black Desert" due to its peculiar landscape ruled by basalt stones, flourishes with archaeological sites of outstanding dimensions, extensions, and preservation. This area gained importance under roman's dominion with the building of the Via Nova Traiana, the route that was linking Bostra, the capital of the Arabia Petraea province, to Amman (antique

Philadelphia): Amman was by then one of the most flourishing city among the Decapolis alliance, and it lied midway between the ancient Nabateans' capital, Petra, and the last Nabateans' central city, Bostra itself. In 106 a.C., when the Romans deducted the Arabia Petraea province and ended Nabateans' rule over the country, Petra gradually lost power and influence, while Philadelphia and Bostra became together with Gerasa (modern Jerash), the most important cities of the region, heads of capital commercial routes that were linking east and west, north and south of the oriental empire's part. The center of the vital commercial routes that were sewing together these three cities was, and still is, the Hawran: meaning "cave land" in Aramaic, this volcanic plateau extends from the Mt. Hermon near Damascus in the North to the Ajloun Jordanian mountains in the South, and it's strongly characterized by plenty of basalt stones. The volcanic soils made this region one of the most fertile among Arabia Petraea, with above average precipitation but almost without rivers: this is the reason for the constant presence of cisterns and water deposits among each and every ancient settlement. Thanks to the soil's conditions and to its geographical value under the Romans the area was committed to both trade and agriculture. Minor settlements arouse near to main commercial routes, trimming the landscapes with prosperous villages that during late antiquity were sometimes transformed into real cities (as for Umm el Jimal): villages offered both agricultural production and comfortable stops-by for traders and caravans. Since the territory's poorness of wood and forests, the one and only building material used was the basalt stone that so generously covered this land: ceilings, arches, even vaults were built with refined and outstanding building techniques sometimes inherited by the Nabateans' knowledge. Slowly the trade routes drawing the Amman-Bostra-Jerash triangle were embroidered by tiny or wide agricultural settlements, together with military camps for the Limes protection.



Fig. 1 – The Amman-Bostra-Jerash routes’ triangle.

The striking peculiarity of these agricultural or military settlements was the one we can still be amazed of nowadays: the total absence of wood in any buildings’ part. Everything was built with the hard black basalt stone, that lasted through centuries, from the Nabateans reign to the Romans dominion, and the Byzantines’ one, and then the Muslim’s one. Similar building techniques, identical building material and a remarkable long-lasting life’s continuity on the same sites shaped the Hawran’s villages and ancient military camps as it is today. After the Islamic conquest and a series of devastating earthquakes the agriculture was nonetheless gradually abandoned in the region for a nomadic pastoral economy: there is no sign of stable village’s occupation after the VIII century until the sites’ XX century re-occupation. While the lack of stable occupation from the VIII to the XX century has so carefully preserved a “frozen” image of these sites, the modern re-occupation has been a heavy strike to these outstanding sky-open “Pompeis” safeguard: the sites have in fact been used as building material caves, or suitable places for goat-herding, often illegally excavated by

nearby inhabitants searching for treasures. Even if the recent attention that a sensible Jordanian Department of Antiquities has oriented towards these sites' is helping to preserve some of them, it is clearly not enough, also for the lack of studies and documentation that affects the majority of these sites. Such a richness in ancient building techniques, so well preserved to be in some cases still standing for meters, (people can still climb almost to the top of the minaret at Umm al Surab, or could easily enter to the second floor of many IV century houses at Umm al Jimal), so unique for it offers the chance to study the evolution of techniques on the same material and same sites through centuries, but so little known and so scarcely studied is nowadays threatened to disappear also for the Syrian war consequences. The ancient sites and buildings are used also for recovering refugees, (in Jordan), if not for hiding rebels (in Syria). The Umm al Surab project was carried out as a Master Degree Thesis within the more wide "Building Archaeology in Jordan" project (Director Prof. R. Parenti, University of Siena): the thesis aims to reconstruct and document through photogrammetry the buildings' history of the two still detectable churches at Umm al Surab and the main church at Samah, both sites standing in the South Hawran.



Fig. 2 – An aerial view of the major basalt settlement in South Hawran, Umm el Jimal. (Kindly granted by Apaame, 2009. All rights reserved)

Umm al Surab

Ss. Sergius and Bacchus

The Umm al Surab archaeological sites spreads today on 33ha, with three main housing clusters: 13 km north-east from Mafraq and 12 km north-west from Umm el Jimal it lies on a trade route linking the Via Nova Traiana (Amman-Bostra) with a secondary trail connecting Bostra to Gerasa. The site has been studied mainly during the Princeton Syria Expedition by Howard Crosby Butler, between 1904 and 1909. The

expedition recorded and drew each and every Hawran ancient settlements, with particular care for the architectonic structures, their evolutions and typologies. Prof. Butler together with the epigraphist Enno Littmann identified three churches in the Umm al Surab village: the main and larger one had an apse and a turret on his north side, and a cluster of buildings developing around the church structure, that were defined as a cloister; a greek epigraph on the central front door dedicated the church to Saint Sergius and Saint Bacchus (BUTLER 1909) . The other two churches were apse-less, as well as epigraph-less, with minor dimension and a far worse state of preservation: they were called as “North Church” and “South Church”. Also the architect Keppel Archibald Cameron Cresswell studied the Ss.Segius and Bacchus church in 1960s, for a study on the minaret origins. The last study that was carried out on the site was the Geoffrey King’s one, that in the 1980s tried to define a first reconstruction of the building phases at Umm al Surab (KING 1983). Between 2009 and 2012 the Building Archaeology Laboratory of the University of Siena developed a study on the architectural phases of the church and of the site, crossing the data from elderly records with the present state of fact.



Fig. 3 – An aerial view of the Ss. Sergius and Bacchus church at Umm al Surab (Kindly granted by Apaame, 2009. All rights reserved)

Ss. Sergius and Bacchus church is a north-east oriented and apsed church rising in the center of the main buildings’ cluster of ancient Umm al Surab: 18m long and 12 wide. We can surely date its construction at the 20th of April 489 a.C., thanks to the dedicatory epigraph (BUTLER 1909). Clerestory and roof and columns are collapsed, but Butler already concluded by counting the stone debris that the church originally had three aisles, parted by arches standing on columns (an oddity since in the surrounding the majority of churches uses pillars; this exception can also be found at the near Umm al Jimal). In the front side three doors open, connecting the inside of the church to the outside, where a stone-pavement area was clearly detectable at

Butler's days, but completely erased now. The dedicatory epigraph, that King photographed on the central door's lintel, lies now broken in front of the church (KING 1983): it's one of the consequences of the restoration that the Department of Antiquities carried on in 2007. The front of the church was in fact lowered during the intervention and the central door was altered and reconstructed. Other changes that the restoration brought are: the south wall, still completely crumbled and covered by debris at King's time, was cleared and partially rebuilt; the wall that was closing the cancel arch, built during Islamic era, has been demolished; the apses has been partially rebuilt; the north wall, the one to whom the cloister buildings are leaning on, suffered of a contained collapse; the whole area has been cleared by the stone debris. The 2D church plant may be quite surely drawn: the church follows the three aisles cathedral scheme, with two lateral aisle topped by galleries with access through the diaconicon on south and prothesis on north (KING 1983). A room leaning to the south-west church external corner was also part of the church, maybe a secondary access to the south gallery. The Islamic conquest brought the transformation of the prothesis in tower, the closure of the cancel arch and a possible creation a mirhab in the south wall. The church seems to stand over and reuse a precedent structure.

Building Phases

West Side: the external church front is the most modified part of the structure. The ancient original fabric, with huge carefully squared cut basalt stones laid down with thin precise joints and smoothed surface, it can be detected up to the fourth stone line on the north door lintel. On the contrary the stone rows around the central door are fuzzy and messed up, due to the recent restoration. The original central door lintel, the one that was bearing the dedicatory epigraph, it has been removed; the once flat arch that was resting on the lintel is now the lintel itself, while the door jambs are most likely still the original ones. The original fabric carries on until the south door: after it only the two lowest stones row show the same features, while the higher ones are broken stones or re-used debris. Butler and King saw two colymbia framing the central door, but now we can only see one, and heavily damaged (BUTLER 1909).

North Side: a recent collapse divides in two sections the north church wall. This side is characterized by three different building techniques. The older one is detectable in the north-east angle, in four rows of perfectly square cut stones with martellina tracks on the surface, stones that are laid down with extreme care and precision. A second technique takes over in central part of the wall (to the west and to the east of the collapsed section): regular rows but full of broken or clearly re-used stones, mostly un-squared and with a rough surface (KING 1983). Finally we can detect the same ancient technique we find in the front in the west part of the wall (that forms the corner with the front).

South Side: Butler and King could barely see this side of the Church, so many debris were covering it. During the Department of Antiquities restoration the debris has been removed, and the side can be easily analyzed. The building technique is homogeneous: regular rows of raw-surface average size stone blocks. The last restoration has risen up the west section, and has closed a central gap: this closed gap may be of capital relevance since it could be the original mirhab, opened in the south wall aiming Mecca during the first years of Islamic conquest. The west door jambs look original and contemporary to the wall's construction, as for the little room the door leads to. Nonetheless the two jambs are most likely built with stones of a

precedent occupation: the basalt stones strike in fact for their dimension, the cure of their cut, the smooth surface.

Cancel Arch: Once closed with a wall opened by a central door, the cancel arch has been brought back to his original shape during the last restoration. The building technique is characterized by rectangular long blocks roughly squared and smaller in the higher rows. The fabric is interrupted on the north part after the closed window in the minaret: all the rows from there up are showing regular rows but longer and thinner stone blocks, with plenty of stone fragments and re-used debris (KING 1983) .

Minaret and Prothesis south side: On the south side of the minaret (the church's prothesis once) the building technique is consistent: the door originally leading to the prothesis is now the minaret's entry. Even today it is possible to climb up to the top the tower by using the original winding staircase. All the wall rests on the cancel arch, showing to be posterior to it. The building techniques fit with the second one from the north church wall.

Minaret east side: building technique homogeneous with the south side.

Minaret north side: this side of the prothesis-minaret was closed sometimes after the church's construction in a square room. Further studies on the relations between the church wall and the room's ones may be essential to understand the timing and functions of all the rooms attached to the church and assigned by Butler to the role of "cloister". There is a first building technique in the lower rows of basalt blocks, the very same technique of the older one in the north side church wall. A second phases rest upon this one, characterized by smaller blocks with raw surfaces, that can be found also in the lower 5 rows of blocks in west side of the tower. This phase, also detectable as the more ancient in the front, and as technique number three in the north side, and in the cancel arch, and in the south side of the church as well, should be considered as the original church technique. The church was therefore leaning and re-using some precedent structure(KING 1983) . The third technique, with smaller but longer stone roughly squared is the same on all the upper parts of the four minaret's sides, and its consistent with the room's walls' one. This fact doesn't mean that the room is contemporary to the minaret, (ipohesis that would deny the monastery use of the rooms that Butler was thinking of): for now we may only state that the actually readable room walls are consistent with the minaret's technique. The room may nonetheless have exist and been rebuilt during the transformation of the prothesis into a minaret (BUTLER 1909).



Fig. 4 – The Ss. Sergius and Bacchus church central front door newly restored.

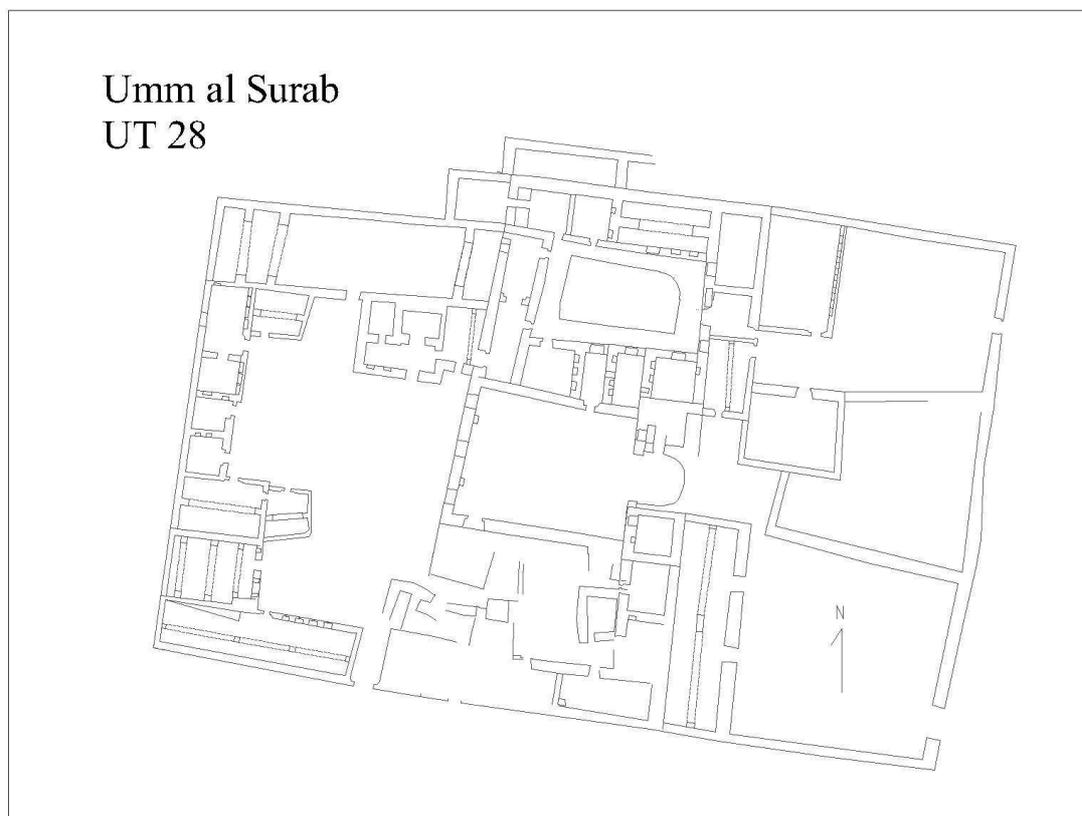


Fig. 5 – The 2D plan of the topographical unit in which Ss.Sergius and Bacchus raises.

The South Church

Butler was the first to report this more little Church in Umm al Surab, noting the existence of two apse-less churches on the south and one on the north of Ss. Sergius and Bacchus (BUTLER 1909). King managed to identify the south apse-less Church of Butler's drawings in a badly preserved east-oriented building 200 meters south-west from the central cluster. King noted that the loss of the apse was due to a closing wall erasing the cancel arch (KING 1983) , and cutting the apse away (the apse had been re-occupied by a separated room). The South Church's conditions are much the same as they were when King studied the site, because the recent restoration never interested this site area. So far there are no ancient documents or epigraph regarding this church: full and covered by debris the south wall, the cancel closing wall, the north-west corner are the only parts still standing up. The apse was identified in a curved wall inside a room leaning to the church structure, but there is no way to enter the room, therefore it was not possible to study it. The front and the north wall, even if almost completely crumbled, are still showing with their lowest stone rows their profile.



Fig. 6 – A frontal view of the South church as it is nowadays, with the central front lintel collapsed and the two still standing jambs of the central door. The apse-closing wall is shown on the background.

West Side: The front lays today partially collapsed and partially covered by stone debris. The central lintel, a huge carefully square cut basalt stone with smoothed surface and a cross carved in the center. Three doors slightly moved to the north may be identified: the north one is still standing with an undecorated lintel; the

central door, with its collapsed lintel close to it, and the south one, narrower than the two before, can be traced down by their jambs, still standing in their lower stone rows.

North Side: almost entirely collapsed except for the corner with the front. In the corner the west stone rows and the front ones are perfectly matched, pointing his being contemporary to the front (KING 1983). It has been possible to hypothesise his profile through the stone row now at the earth level.

East Side (closing-apse wall): This is the wall that according to King (and we decided to follow his interpretation), was built to close the apse. It has two doors, one on the north part of the wall leading to a closed room (re-using the apse wall), and another on the south part leading to an open room. The first building technique that strikes consist in five/six couples of stones perfectly squared in the north corner: since the north wall's profile turns south with a 90° angle in this very point, it is possible to believe this stones as a fossil of a cancel arch. Surely they belong to a phase precedent to the construction of the wall. The remaining part of the wall employs mostly re-use broken stones, with irregular rows and a caotic setting: the north door re-uses two decorative half columns probably taken from a door on the south wall (which has huge dimensions and lacks of the two higher jambs-stones). Towards the end of the wall, on his south part, the wall shows a neat nook: the wall showed after the nook its regular, with handsomely squared basalt stones displayed in perfect rows, framing a door. It has also to be noticed that the wall so far analyzed is actually leaning onto this section of the wall, as the corner shows. Confronting this situation to the Ss. Sergius and Bacchus Church we can observe that this wall section could be the door leading to a diaconicon, while the rest of the wall is a late apse closure with a door leading into a room using the apse itself, and a fossil of a cancel arch or the original Church wall on the north angle.

South Wall: studying the wall from west to east we can note: three rows of long stone blocks regularly squared, carefully displayed, and a door or maybe a window actually covered by debris; above the window and the three regular rows there are four caotic rows untidy settled also containing a little window ; the center of the wall shows a V filling; on the east side of the wall a wide door is opened, lacking of the upper jambs stones. The door and its correspondent building technique last until the door's lintel: the stone rows above has been clearly modified afterwards.



Fig. 7 – An aerial view of the South Church topographic unit. (Kindly granted by Apaame, 2009. All rights reserved)

For the inside's shape of the Church there are no clues to determine the aisle number, but the absence of drums or capitals among nearby debris, and the presence on the contrary of arch-stones and pillars fragments, should indicate an organization with pillars and arches (KING 1983) . The final reconstruction of the Church's evolution could be summed in the following way:

1. A rectangular church with central apse, with an ipothetic diaconicon, with three doors in its front and two in the south one.
2. The apse is closed by a wall, that doesn't cover the diaconicon door.
3. The south wall collapses in a V scheme and it's built again, reshaping the wider door and transferring the decorating jambs to the central door of the closing-apse wall.

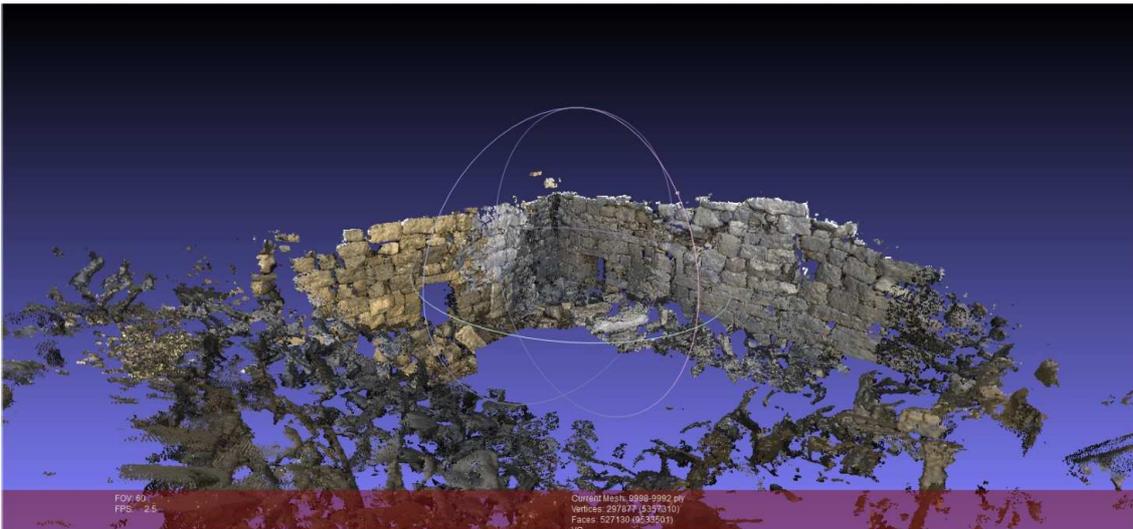


Fig. 8 – A screenshot from the Meshlab 3D model of the South Church.

Samah

The modern village of Samah lies 8 km west from Umm al Surab, and developed all-round the ancient site, but like Umm al Surab the archaeological site is clearly detectable and parted from modern constructions (BUTLER 1909). The Department of Antiquities restored the site from 2007 to 2009, clearing the Church from all the stone debris. The Butler's expedition recognized a second church, not far from the main one, and several rooms courting the central church that were identified as cloister. Both the second church and the rooms, with the exception of the on room attached to the church, were already gone by the time of King. K.A.C. Kresswell was the other one to study the only remaining complex, an east-oriented church with a tower, and he put the tower in relation with the tower-minaret of Umm al Surab.



Fig.9 An aerial view of the S.Sergius church at Samah. (Kindly granted by Apaame, 2009. All rights reserved)

Two epigraphs, one still standing as the room-closed-to-the-church lintel, tell that the Church was dedicated to S. George between 624 and 625 a.C. It is a capital date for the Jordanian history, since muslims were soon to be come, yet not only the church is not the last to be dedicated, (Al-Fudein churches were dedicated up to 730 a.C.), but also the church had a long lasting activity before being converted into a mosque. The

complex appears as a rectangular church, with the apse parted by a wall and a turret re-using part of the apse, with a room on his south north side linked to the church. The south side and the front of the church have suffered heavy destruction and have been rebuilt by the Department for their first four or five rows: the front shows two close entrances in the north side and only one in the front. There is an other opening, or should be said there was, in the south wall: King studies (KING 1988) are showing this opening 6.50 m from the south east angle and 6.45 from the south-west; it's a narrow opening and it lacks of jambs, or collapsed lintel nearby. Even if nowadays the opening can't be seen because of the restoration rebuilt everything, the current hypothesis is that it was a late mirhab.

Closing apse wall and east side: the wall is linked to the tower that raises on its north part and two staircases are leading to the entrance of the tower: their fabric is not the best, with re-used un polished stones irregularly cut. The original cancel fabric is still detectable in the north-est angle, for five stones in horizontal and three rows in vertical, largely covered by a later plaster, and for some stones above the staircase, that is probably covering the other original ones underneath. This fabric is of an outstanding quality, with average sized stones set in regular rows and thin joints, carefully squared cut, smoothed in the surface. The upper part, both of the wall and the tower, is consistent: rows of re-used stones with plenty of wedges, with a diatoni row in the middle (KING 1988) . The wall remains parted from the apse behind, with which shows no correspondence at all. Otherwise the tower is strictly entwined to the wall, making almost impossible to decide whether its construction was posterior or not to the wall. The tower and the wall are linked in a area that is near tower door, probably re-using stones from an ancient cancel arch (of whom nothing remained), and its angle with the even more hypothetical north aisle. The tricky detail of this side is that the second fabric, the one used to close the apse, possibly destroying an older cancel arch, is a late-antiquity fabric, well known in more studied sites such as Umm el Jimal, not posterior to the ending decades of the V century. The 625 a.C. dating epigraph therefore, standing on the room leaning to the church, may be referred just to the complex around the church, if not the only room itself (BUTLER 1909).



Fig. 10 - A Meshlab screenshot showing the north wall, the closing-apse wall and the entrance to the tower.

North Side (of the Church): the side shows two entrances, but the western one has been most likely completely rebuilt during the last restoration. With the exception of this part, and of the tower staircase and leans also on this side, this wall too has two main building techniques. The older one consists in the lower five rows, with average sized stones set in regular rows and thin joints, very rare wedges, carefully squared cut, smoothed in the surface. After a diatoni row, the upper part of the wall changes: re-used stones with larger joints and irregular rows. It is the same fabric of the tower and the closing-apse wall.

The apse: the actual apse is the result of a thorough anastilosis from the Department: in fact in King's pictures the apse was completely erased and only the lowest stone row was surviving (KING 1988). It is however possible to notice inside how a part of the apse has been used as a foundation wall by the minaret standing aside.



Fig. 11 - The newly restored apse. (Picture from 2012 University of Siena on field survey)

West side of Room A: This side includes both the west wall of this tiny room and the tower that is leaning on it. In the north part of the wall a door opens carrying the dating lintel-epigraph. The whole wall leans on the apse, and it is carrying the minaret tower: therefore its construction must have been completed after the Church's one but before the tower. The highest stone row of the wall is a recent reconstruction, the over part can be divided in three phases; the lower five rows, with the door jambs but excluding the lintel are the more ancient fabric: large stones roughly squared and unsmoothed surface, set in regular rows with plaster traces in the wide joints, and plenty of tiny wedges. The second building technique recall the second one of the other two sides, and it includes the sixth diatoni row of the wall, the upper four row including the door's lintel,

and in the tower the two corbels' rows with the stone row above them: no trace of any plaster, smaller but better squared stones. King thought the two corbels' rows were the remaining trace of what once was the church's roof. The third building technique characterizes the upper part of the tower in regular rows (KING 1988). Square cut stones of every size, and usually re-used, rather thin joints.

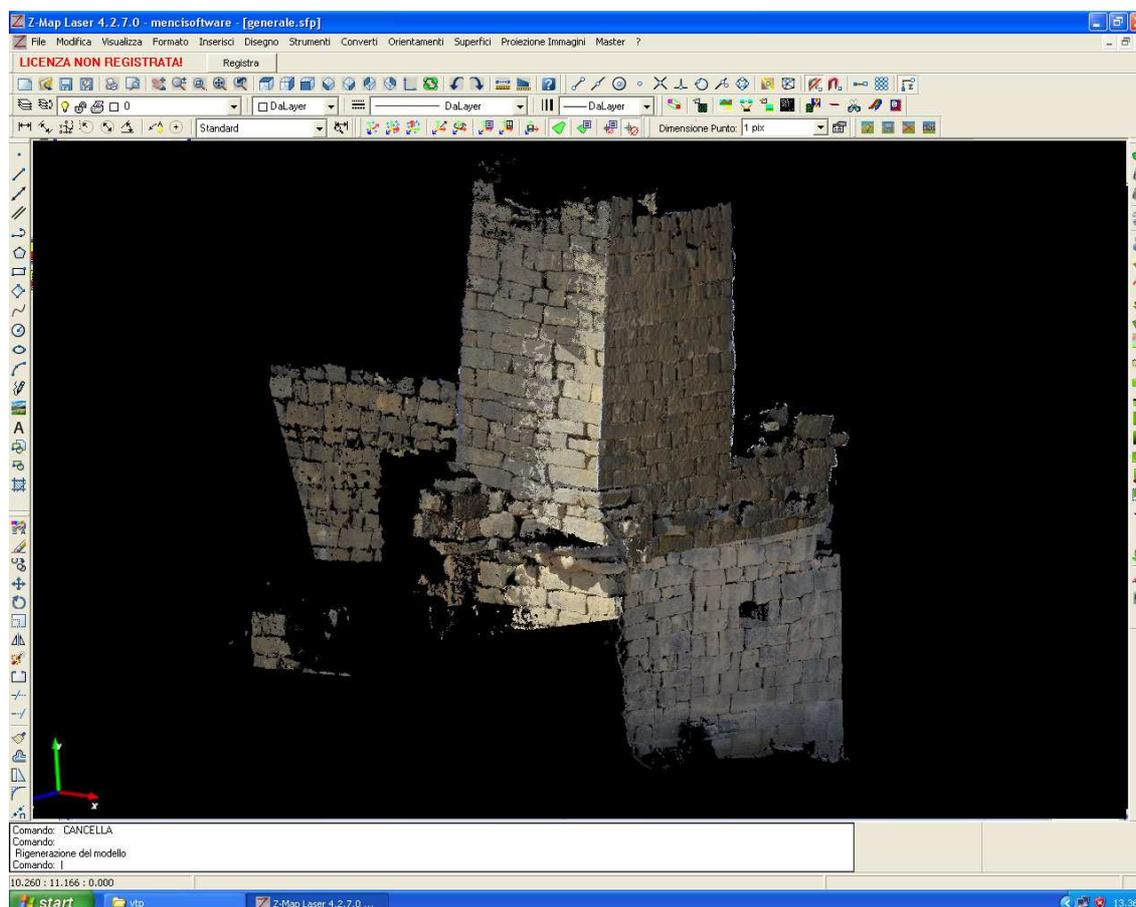


Fig. 12 – A Zmap pointscld screenshot of the north-west external angle of the tower, and a part of the north external church wall.

South size of room B: This side includes the external north Church wall as well as the north wall of the tower. The north wall of the Church never touched the west wall of room A, since the original Church wall ended one meter and half before the west side of room A, and the filling actually linking them together was built in order to support the tower. There are three building techniques; the original church includes the lowest eight rows and the little window: carefully squared cut stones, detailed smoothed surface, slim joints and straight rows; the “filling” sustaining the tower: stones and diatoni alternated in a display that recalls very much the tower’s one; a corbels' row and the upper part of the wall: it fits with the last phase of the other sides.

Butler and King (KING 1988) were right to be doubtful on dating the whole complex at 624 a.C., and in stating the the Church had to be more ancient than the once many rooms (cloister?) leaning on it. Actually three observations can be stated on the dating epigraph:

- The epigraph's date may refer only to the room it has been preserved in, or to partial restoration of the whole complex.
- Even under Persian, (and later Islamic), domination Christians were allowed to restore, if not freshly build churches and cloisters. Searching for economic and material resources may have not been easy during war time, but in Rihab too, a site near Mafraq, villagers were dedicating and building churches in the same years.
- Building techniques show that the church is older than the two leaning rooms that are left: this could testify the hypothesis that the epigraph refers to the building or to the restoration of the church only.

Later changes of the church's structures are similar in every aspect to Umm al Surab ones: the closing of the cancel arch and the tower's construction, to be related with a change of the cult. The building history of S. Sergio church of Samah can be therefore so rebuilt:

- A rectangular church without apse or diaconicon, with a single apse ending the central aisle. Actually there are no clues to determine the number or shape of the aisles.
- A room, called A, leaning on the apse, built or restored in 624 a.C.
- The apse's closure, the tower's construction and the building of a room leaning on the north church wall and on the room A west one.

Photogrammetry in the black desert

To analyse thoroughly extended and still standing sites, the research needed a quick, low cost, flexible, user friendly and depending methodology, In order to get reliable results, we needed to single out and record the different building phases of many elements. The data recording had to be carried out with very precise systems and a consistent workflow; moreover, the processed data had to be very detailed and easy to share among different platforms and suitable for traditional publication and on-line and multimedia products.

Taking all those considerations into account, we adopted a data recording system that acquires the walls' features through rapid photogrammetry and produces processed data that is compatible with a large set of DataBase Management Systems and GIS. The computer aided methodology we use allows for a composite survey:

1. a marker-based system by using total station;
2. a visual system that produces orthophotos, 3D Models and photographic renderings, thanks to an Italian innovative technology based on point clouds (Z-Scan, Z-Map, and Evo developed and released by MenciSoftware, Italy). This system has virtually the same resolution as a laser scanner, but with lower costs.

This type of search offers particularly the following advantages:

1. different protocols can be applied to different contexts, with inexpensiveness of the interventions, calibrated on the real demands but also on the concrete availabilities; it allows, altogether, a great sustainability of the projects themselves;
2. work through "not destructive" interventions;
3. it allows to calculate brief times for the work on the field, even if with a longer job to be developed in a second time in the laboratory.

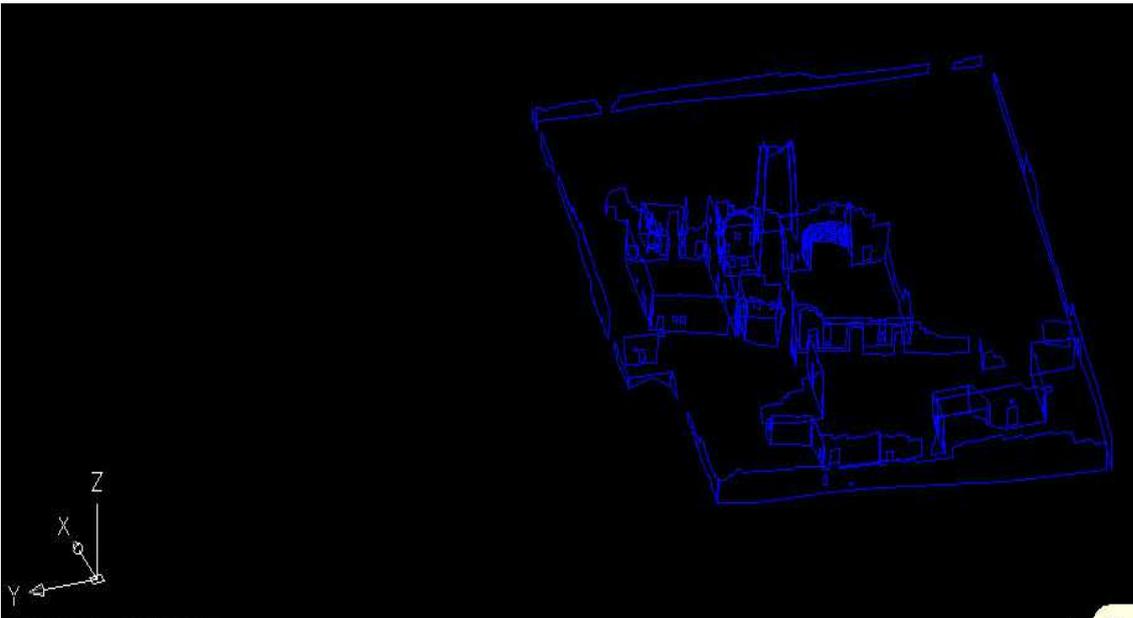


Fig. 13 – The CAD 3D partial plan of the Ss.Sergius and Bacchus church with some of the cloisters' rooms.

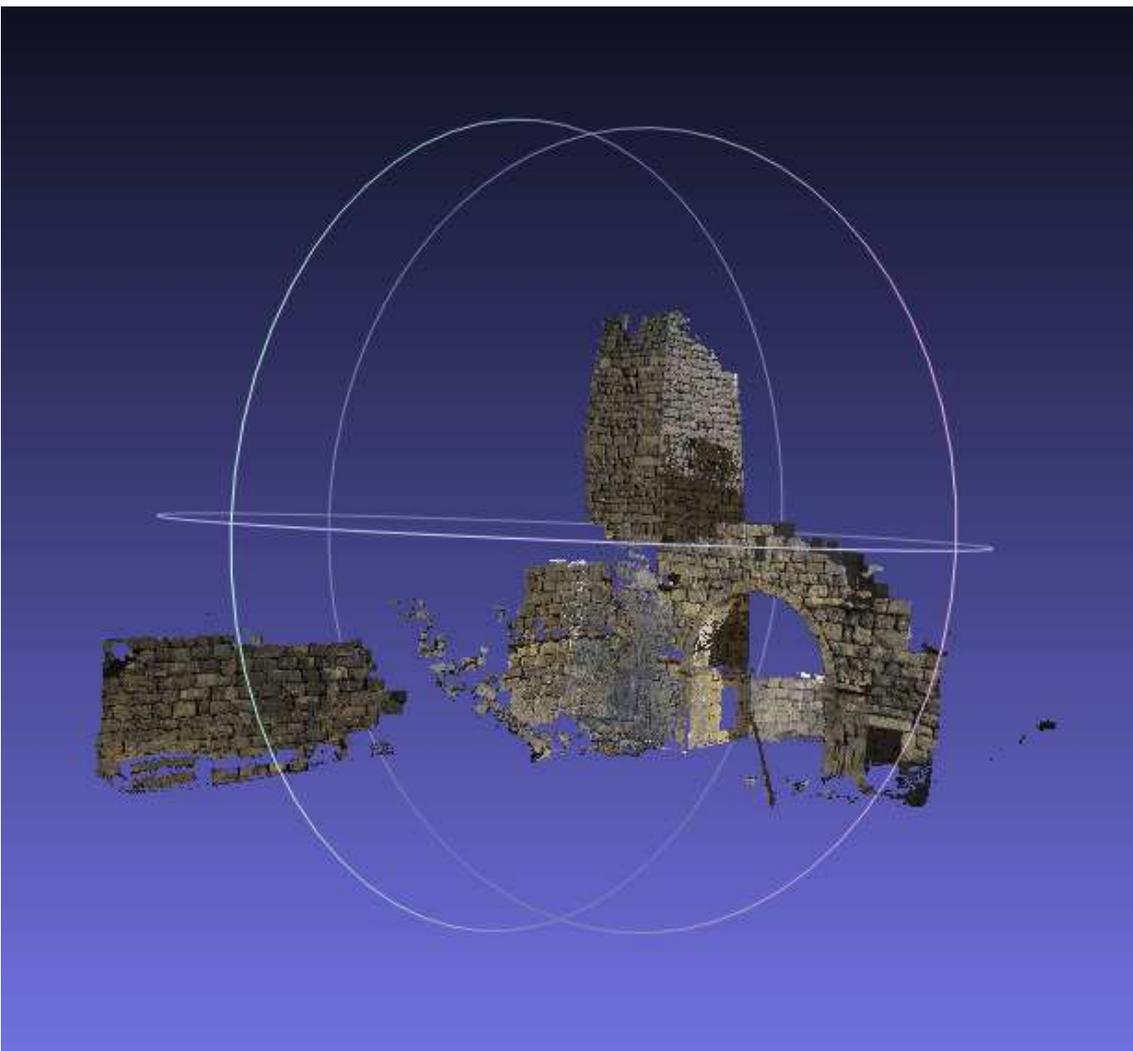


Fig. 14 – The 3D cloud point from Meshlab of the cancel arch and minaret at Umm al Surab, Ss.Sergius and Bacchus.

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