

A Series of Photogrammetry for Protection of Syrian Cultural Heritage

Ancient Villages of Northern Syria Vol. 2

al-BARA



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Sari Jammo
Makoto Takizawa

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The Agency for Cultural Affairs of the Japanese Government

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1. Ancient Villages in Northern Syria Photogrammetry Project

Akira Tsuneki and Makoto Takizawa

The conflict that began in 2011 caused extensive damage not only to the Syrian population and their property, but also to the cultural heritage of Syria, which is extremely important in human history. Sponsorship from the Agency for Cultural Affairs of the Japanese Government was obtained in 2014 and various activities were undertaken to protect Syrian cultural heritage facing destruction. In 2014, an expert meeting in Beirut with Syrian, Lebanese, and UNESCO experts who deal with cultural heritage protection in Syria was held in order to determine what Japanese experts could do to facilitate the safeguarding of Syrian cultural heritage. These meetings and other activities indicated clearly that it was important, above all to cooperate with people undertaking the protection of cultural heritage in Syria. Both material and intangible support and encouragement are required and specifically it is more important to provide necessary equipment and techniques to safeguard cultural heritage. In addition, it is also very necessary to disseminate information to Syrian people and others throughout the world on the importance of Syrian archaeology and history.

The University of Tsukuba received support from the Agency for Cultural Affairs in 2016, and three basic strategies were implemented towards safeguarding Syrian cultural heritage: 1) Instruction of young Syrians on the importance of Syrian cultural heritage, 2) Documentation of endangered Syrian cultural heritage, and 3) Preparing manuals for people safeguarding cultural heritage in the field and museums.

This booklet is a result of the second strategy, i.e. 2) Documentation of endangered Syrian cultural heritage. For this project, we selected one of the World Heritage sites in Syria, i.e. Ancient Villages of Northern Syria. The limestone mountains in northwest Syria, consisting of Jabal Saiman in the north, Jabal Barish and Wastani in the middle, and Jabal Zawiye in the south, extend for about 2000 km², and there are over 700 villages from the Roman-Byzantine periods (1 to 7th centuries) (Figs. 1, 2). The combination of well preserved building remains and limestone mountains reflect a very impressive historical landscape. Archaeological investigation shows that these limestone mountains prospered as a result of olive oil production and trade (Challot 1984), and research on these villages indicate a local historical transition from the ancient Roman Empire to the early Byzantine Christian period. The remains of the early churches in the limestone mountains also provide a lot of information and material on how the early churches appeared and developed (Butler 1920).



Figure 1. Location of al-Bara (Source, Abdulkarim and Charpentier 2016)

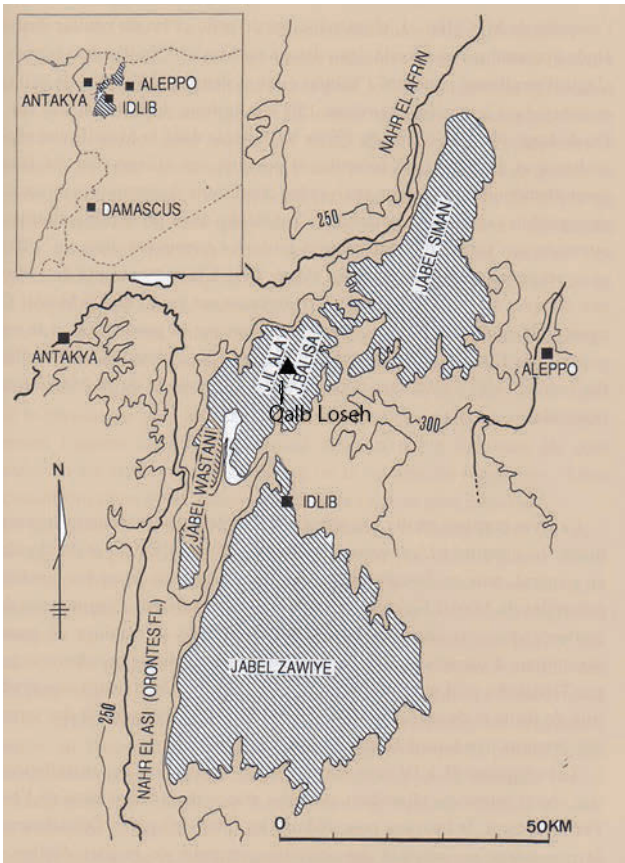


Figure 2. Limestone mountains of NW Syria

These limestone mountains are located in modern *Mohafaza* (governorate/district in Arabic) *Idlib* and *Mohafaza Aleppo*. Unfortunately, intense conflict recently occurred in these two *mohafaza*, and the destruction of many Ancient Villages of Northern Syria was reported. For example, severe damage to one of the most important churches in this World Heritage group, Saint Simeon in Jabal Saiman, was reported in May 2016. Al-Bara and Serjira, large trading centers in Jabal Zawiye, were also reported as having been severely damaged. Therefore, a project was initiated to document these important buildings, especially churches, in the World Heritage site using 3D images. Qalb Lozeh was our first target for documentation, and the results were published as *A Series of Photogrammetry for Protection of Syrian Cultural Heritage: Ancient Villages of Northern Syria Vol. 1 Qalb Lozeh* by Agency for Cultural Affairs and University of Tsukuba in March 2017. It is possible to see and use the 3D images of Qalb Lozeh via the following URL.

<http://rcwasia.hass.tsukuba.ac.jp/bunka/>

Al-Bara was selected as the second target for 3D documentation, because Syrian colleagues provided information that buildings at al-Bara were severely damaged by both bombing during the conflict and theft of building stones.

al-Bara بارّة 35° 41' 16" N, 36° 32' 21" E altitude: 673m

Al-Bara is one of the major sites among the World Heritage, "Ancient Villages of Northern Syria" proscribed by UNESCO in 2011. It was the largest settlement of the Roman-Byzantine ancient villages located on Jabal Zawiye, and west of modern al-Bara town. al-Bara is located in the lowlands between the valleys in the Zawiye Mountains and fertile lands with olive tree fields and vineyards surround the site itself. The size of the settlement is as large as a city, measuring ca 2 km x 1 km, and it acted as a center for the Zawiye mountains region during the Roman and Byzantine periods. The settlement seems to have survived after the Arab/Islamic conquest, and a medieval Mosque was excavated in the center of the site.

At least, five early churches were discovered (Figs. 3 and 4). The largest and well-preserved church is so-called al-Hoşn (horse) Church, which is located on the northern outskirts of the settlement. It is a typical Basilica style church dating to the 5th century. According to colleagues who visited recently, the church was completely destroyed by local people who used the stones for building (Figs. 5 and 6). E (Eglise) 2 is also a large church located to the south of al-Hoşn Church, and dates to the 5th century. Based on colleagues' information and Google Earth, it has also disappeared recently. The middle sized Churches 3 and 5 in the middle of the al-Bara village were heavily damaged and their foundations barely remain. The two churches are believed to belong to the 6th century (Tchalenko 1953). The smallest sized Church 4 (Petite église), which is located just north of Church 4, is the most well preserved church in al-Bara. It is said that the church dates to the 6th century. Therefore, it was decided to document the Church 4 using 3D images.



Figure 3. al-Bara ruins (Tchalenko 1953, Pl. 12)

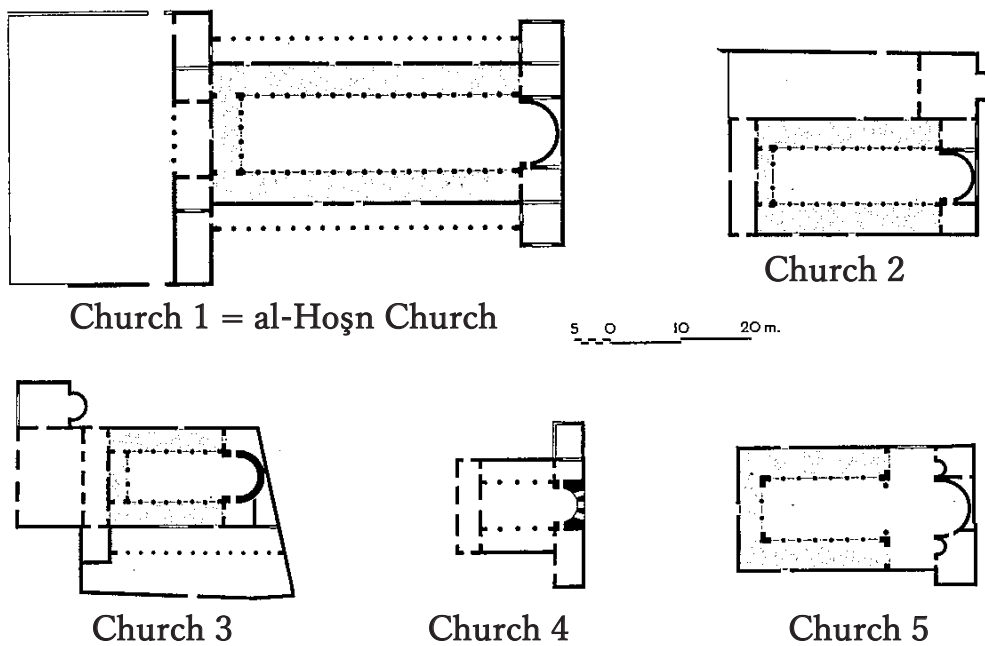


Figure 4. Five churches at al-Bara (Tchalenko 1953, Pl. 139)

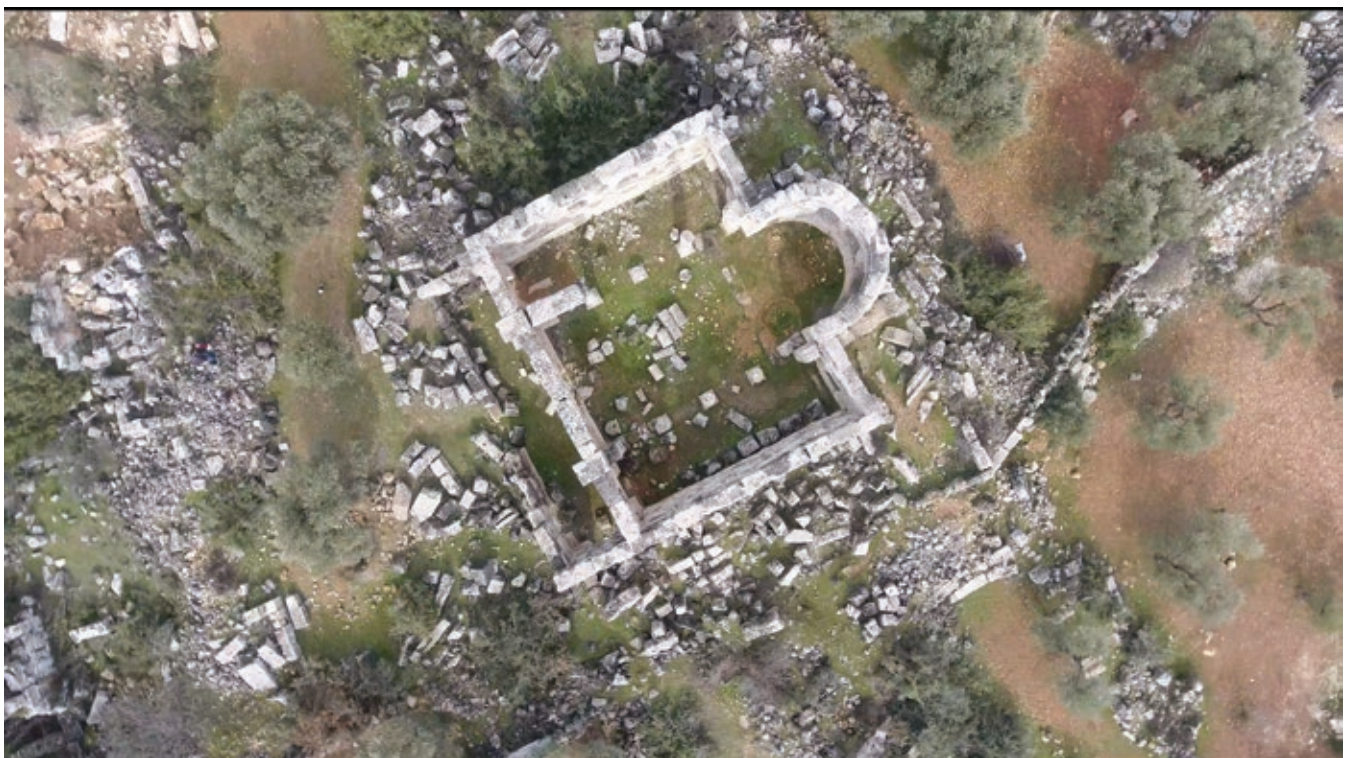


Figure 5. al-Bara, Church 1 June, 2010 (Google Earth)



Figure 6. al-Bara, Church 1 Feb. 2017 (Google Earth)

- Abdulkarim, M. and Charpentier G. 2016 Sergilla, Rywuga abd El-Bâra (Idlib), in Kanjou, Y. and Tsuneki, A. *A History of Syria in One Hundred Sites :393-400*, Archaeopress Archaeology, Oxford.
- Butler, H. C. 1920 *Early Churches in Syria, Fourth to Seventh Centuries*, Department of Art and Archaeology, Princeton University.
- Callot, O. 1984 *Huileries Antiques de Syrie du Nord*, Bibliothèque Archéologique et Historique, t. 118 P. Geuthner, Paris
- Tchalenko, G. 1953 *Villages Anitiquities de la Syrie du Nord: Le Massif de Bélus à l'Époque Romaine*, Paris.
- Vogüé, M. de 1865-1877 *Syrie Centrale, Architecture Civil et Religieuse*, du 1er au Ve sicles, Paris.



Figures 7, 8. Church 4 (Photographs by UAV.)

2. Preliminary Survey in al-Bara Ancient City and Making 3D Images of the Church 4

Sari Jammo

1. Abstract

The Ancient Villages of Northern Syria are a large cluster of archaeological sites in northwestern Syria. The cultural landscape in this region is marked by an abundance of significant archaeological ruins that date to the Byzantine periods. These sites were inscribed on UNESCO's World Heritage List in 2011. The cultural heritage site is comprised of eight assemblages (Jabel al A'la, Jabel Barisha, Jabel Saiman, Jabel Wastani, Jabel Zawiye), and these include forty individual village sites ¹.

Since 2011, most of the archaeology sites, standing ruins, and museums in the region have suffered from an excessive level of vandalism and destruction, mainly due to military action and looting. Furthermore, some of the sites seem to have been intentionally and systematically destroyed to the extent that they may eventually disappear. Recently, the most common pressing phenomena is dismantling of the archaeological ruins, recycling the stones into carved or hewn blocks and their sale to local people for use in new houses (Fig. 1-3).



Figure 1. al-Bara ancient city

¹ <http://whc.unesco.org/en/list/1348/>

Most, if not all the archaeological sites in this region have been subjected to this kind of vandalism. The ruins become quarries and the main stone sources for modern building, and people freely access and extract the stones they need.



Figure 2. Modern building built using heritage site stones



Figure 3. Carved blocks

2. Preliminary survey

Due to the extent of vandalism in the cultural and archaeological sites of al-Bara ancient city a documentation project in this region was undertaken. The goal of this project is not only estimating the damage and reviewing the preservation status of the ruins on the ground in this region, but also selecting a site for 3D modeling.



Figure 4. Deir Sobat, traces of munitions fire

The team began a survey in the ancient city of al-Bara starting from the northern part of the city. Lack of a map or plan for the ancient city was one of the main obstacles at the beginning of the work. Therefore, the drawing and maps published by G. Tchalenko (1953)² who researched the Roman and Byzantine remains in this region were utilized. The starting point was the northern side of the ancient city from Qalat abu Safian, Church 1 (al-Hoşn Church), Church 2, Pyramidal-roofed tomb, Church 4, 5 and Dier Sobat. Most of these sites were subjected to varying degrees of damage and vandalism. Specifically, loss of wall sections, traces of shelling on the walls, use of the walls for target practice and recycling building stones were observed as the major cause of damage (Fig. 4, 5).

Notably, the degree of damage and vandalism increased and is more visible at sites furthest from the modern village of al-Bara. Locals extensively raided the archaeological sites, and systematically dismantled the building stones. A heavy machine driller likely used for digging the foundation of a modern house was observed bulldozing the remains of a former archaeological site.

Five churches numbered from 1 to 5 are present in a small area³. One of the worst manifestations of destruction and intentional vandalism is the case of the Church 1 (al-Hoşn Church). The building landmarks have almost disappeared and are difficult to recognize. However, through the remains and a plan of the building, it was possible to identify and confirm that a building was the al-Hoşn church.

The building was turned into the personal property of a local inhabitant. The interior part of the building was turned into a field for planting fruit trees such as



Figure 5. Deir Sobat, collapsed part of interior wall



Figure 6. Eastern part of al-Hoşn church (apse)

² Tchalenko, G. 1953 Villages Antiquities de la Syrie du Nord: Le Massif de Bélus à l'Époque Romaine, Paris.

³ ibid.

figs. The size of the small trees indicates that they have been newly planted. The entire building has been destroyed or bulldozed. The arched-shape remnants left standing in the eastern section, is likely an apse (Fig. 6, 7). The survey and photos suggest that the stones from the building were recycled and re-located. The recycled stones were used to construct a stone base (terrace) where later a new modern building was built (Fig. 8). The remnants of the standing walls, and the remains of broken and unshaped stones were pushed aside to define the field boundary (Fig. 9).



Figure 7. Remains of the eastern walls of al-Hoşn church

Within this massive chaos and systemic destruction, a small beautiful church building stands intact. Thus, this building has been selected for 3D modeling. The reason for its selection is to enable the documentation of its details because of the systematic destruction of the surroundings very close to the building and there is concern that the building will be damaged (Fig. 10-12).

3. Building description

The Church 4 building has a T-shape. Its axis is aligned east–west (apse-entrance), and the structure is not very tall. Even though the building size is small, it has several access doors in the east and west.

Before entering the church main building or “sanctuary” there is an attached aisle which extended north south. The entrance wall of the aisle has three doors, on the right, left and in the center. Only the right door is still intact, whereas the central and left doors were already collapsed. There are window-openings above the lintel of the right door. Likely the other collapsed doors have the same design. The aisle also has two doors in the north and south side.

The western wall of the church sanctuary likely has the same design as the western wall of the aisle. Three doors (on the right, center and left), and a window opening above the lintel of each door existed. The church sanctuary is divided into three aisles (right, central, left) by a row of five stone columns. On the right side, the columns which



Figure 8. Turning the al-Hoşn church into a field and the construction of a modern house

were attached to the east and west sidewalls were intact, however, three others were collapsed and their stone fragments found on the ground. On the left side, four columns were still standing, only one was collapsed. The right and left aisles have the same plan, and end with a door in the east parallel to the one in the south. There are four window openings along the southern side wall and another parallel four window openings on the northern side wall. The central aisle ends at the church apse, which has three window-openings and there are two doors on the north and south sides.



Figure 9. The remnant of al-Hoşn Church used in field boundary

4. Photogrammetric process

Being a small relatively low building allowed photos to be taken freely from all sides and directions. The tools were simple, a camera, handmade pole and drone. Most of the work was undertaken using the ground photos. The camera pole was enough to reach the higher elevation and to take photos from above. The work was successfully accomplished, step by step, wall by wall, layer by layer, comprising more than 70% horizontal and vertical photos overlapping, appropriate timing, dead spots, shadow and utilizing all the written instruction in the photogrammetry for cultural heritage brochure⁴. To cover all the internal and



Figure 10. Church 4

external facades required more than 3,500 photographs, in addition to about 200 aerial photos and some videos. It is the second cultural heritage-documentation project undertaken by this civil organization group. The measuring and photographing skills of the photographers gradually improved throughout the process of recording the church.

⁴ Watanabe, N. 2017. Photogrammetry for Cultural Heritage. Booklets for Protection of Syrian Cultural Heritage, Vol. 1. Research Center for West Asian Civilization, University of Tsukuba.



Figure 11. Church 4, illegal excavations and destruction near by



Figure 12. Illegal excavation and destruction in the Church 5

5. Conclusion

Archaeological sites and cultural properties in Syria are part of people's national identity. However, local people in Syria essentially have assumed the responsibility for safeguarding heritage regardless of whether they receive support from concerned authorities or not. Unfortunately, many people do not share the same sense, and the result can be seen clearly on the ground. The perceptions and attitudes of local people surrounding the archaeological sites strongly influences their behavior in relation to protecting heritage and promoting public awareness. Hence, in identifying the principal factors that influence local people's cooperation in heritage protection, an "education paradox" is shown to be the critical factor. Syrian people did not receive cultural education in their youth or via the

promotion of activities by archaeological missions. Thus, as a result, it is possible to clearly see the negative consequences of this prior inaction in recent years.

Violations against archaeological sites will not stop soon as most locals did not receive any kind of cultural education, awareness or knowledge about the importance of these sites. They are not aware that their actions are hurting the country, but rather are just looking for financial benefits in the first instance.

Whilst strongly rejecting these actions heritage professionals often do not know what to say or how to react against this vandalism. In contrast, it is possible to understand to some degree that the vandalism is a consequence of a lack of education since childhood, reinforcing the fact that, education is critical for a nation's development.

The wish is that these documentation projects working in cooperation with civil organization groups will contribute towards safeguarding Syrian cultural heritage. It is also hoped that these projects will pay significant attention to better knowledge provision and building awareness for locals in relation to Syrian cultural heritage.

External sections



Western facade and aisle



General view from the west



Western facade



General view from the southeast showing the apse and the southern facade



General view from the northwest showing northern facade



General view from the northeast

Interior sections



3. 3D Reconstruction of al-Bara Church 4

Nobuya Watanabe

1. Background

1.1. Method and Limitations

The 3D model of Church 4 in al-Bara, illustrated in this brochure was processed using Photoscan Pro (Agisoft), based on photographs collected by local colleagues in Syria. More than 3,600 photographs were used for the processing, including photographs collected by a UAV (drone). The overlap of the photographs was sufficient in most cases, which enabled the creation of a comparatively consistent 3D model. All of the photographs were processed in a single calculation, which generated a single model of the whole church (i.e. processing with one “chunk” in Photoscan). However, the model may include skewness or errors, since control points to aid accurate rectification were not available in this case. Several points to set scale and orientation were collected and the associated information is attached to the model. Thus, the 3D model provides a capable measurement using 3D point cloud processing software (e.g. Cloud Compare, Meshlab, etc.).



Figure 1. Overview of al-Bara Church 4

1.2. The illustrated figures

Basically two types of figures are introduced here. One is the shaded-relief model and the other is the textured model. The color difference in the shaded-relief model shows the difference of point-cloud density for the corresponding meshes. Thus, more red indicates the point-clouds are scarce or “noisy” because of the errors. The shaded relief model shows the comprehensive surface asperity, while the textured model gives realistic visualization.

1.3. Bird’s-eye view of the church

Several bird’s-eye view figures are illustrated in this section. Besides several noises due to miss-matching of pixels, most of the sections turned out to be successful. Although the focus is on the building the collapsed building stones were intentionally left around the church in the model. This is because the spread of the related material may help the safeguarding or reconstruction of the church to some extent.

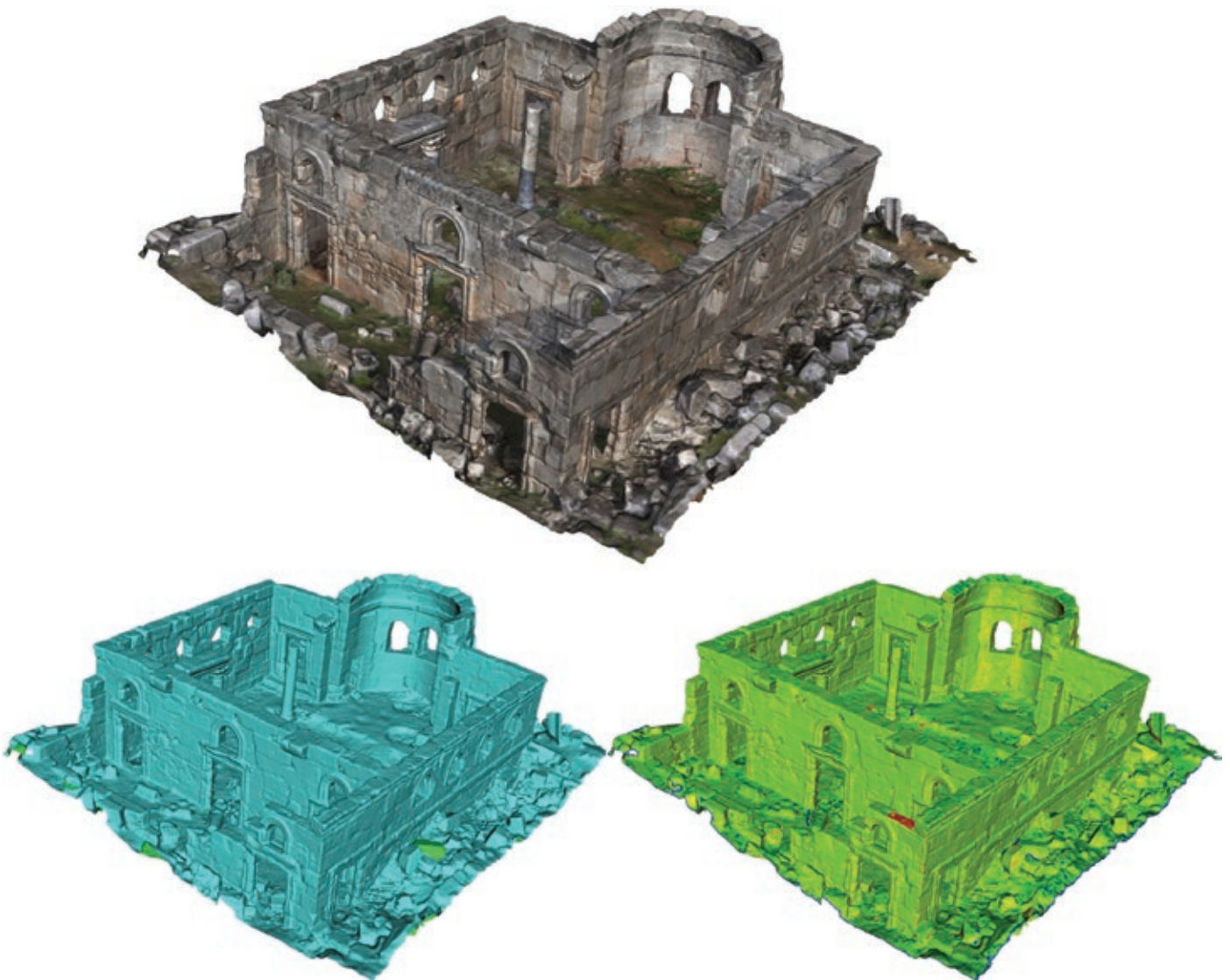


Figure 2. Bird’s-eye view from the south-west

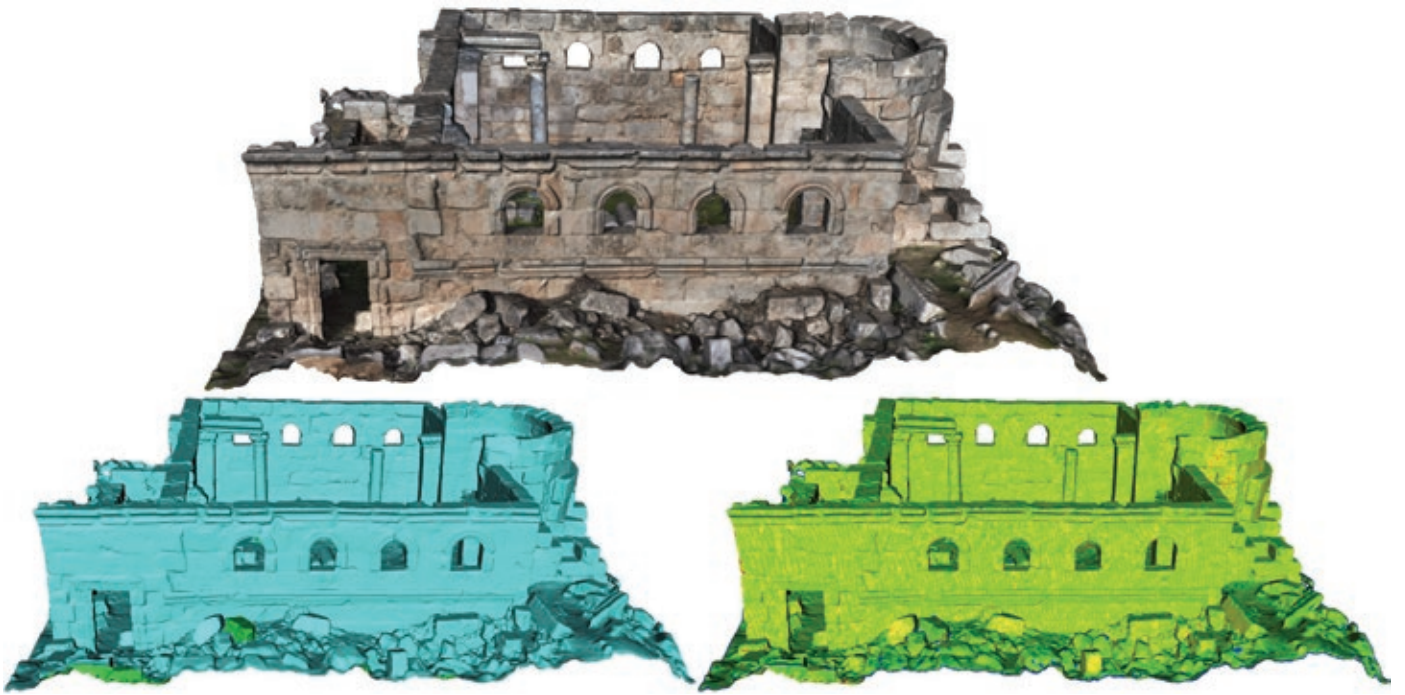


Figure 3. Bird's-eye view from the south

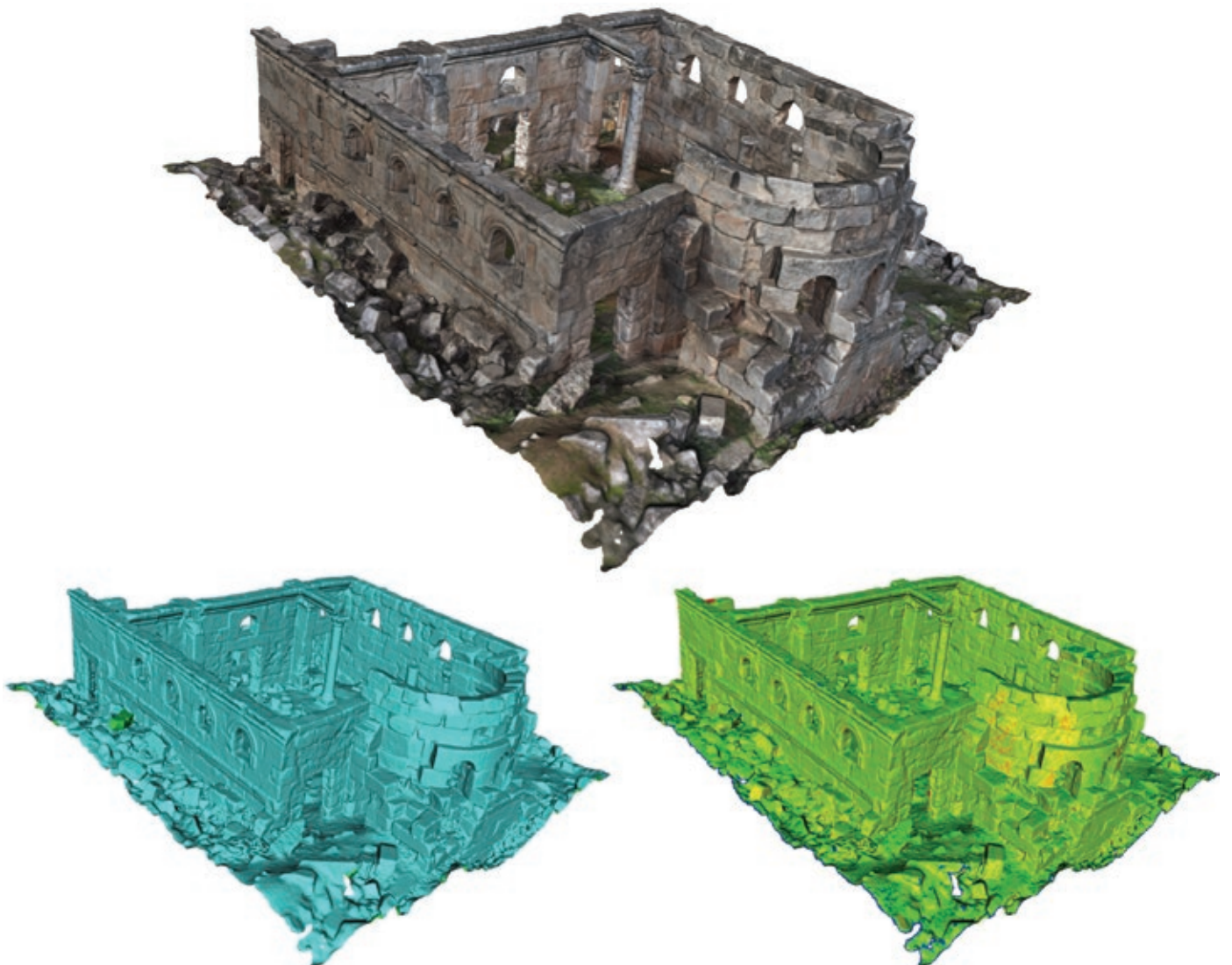


Figure 4. Bird's-eye view from the south-east

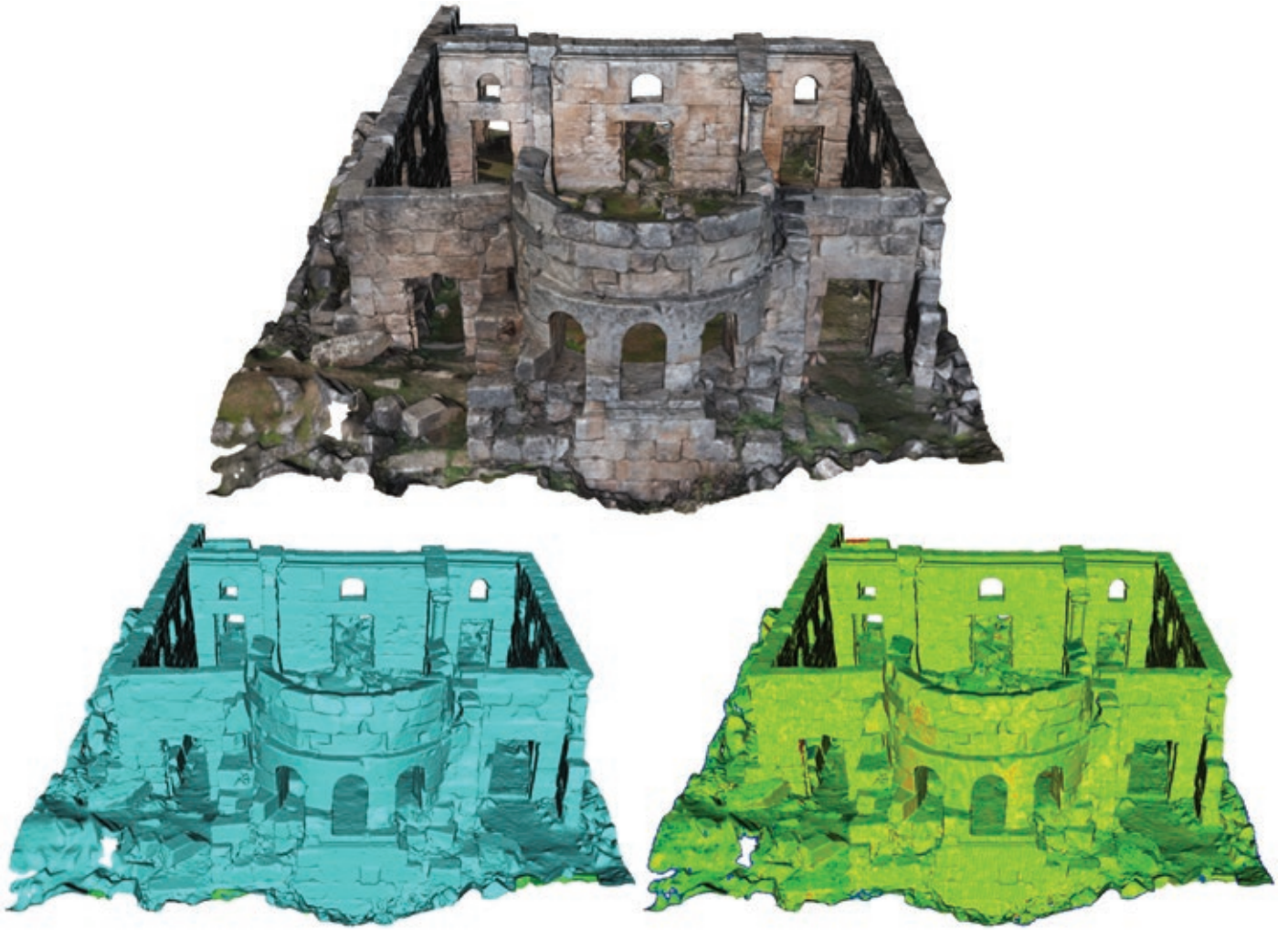


Figure 5. Bird's-eye view from the east

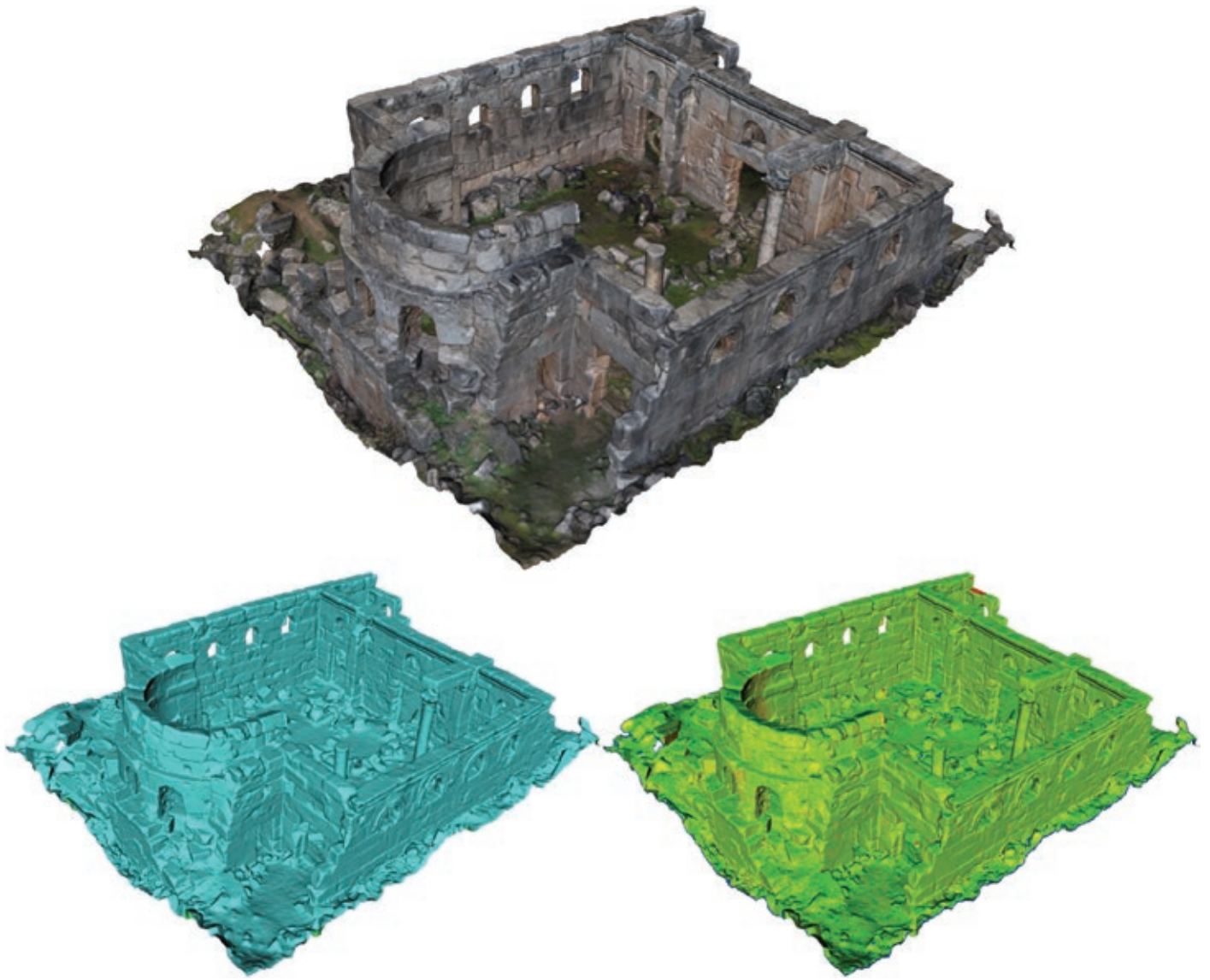


Figure 6. Bird's-eye view from the north-east

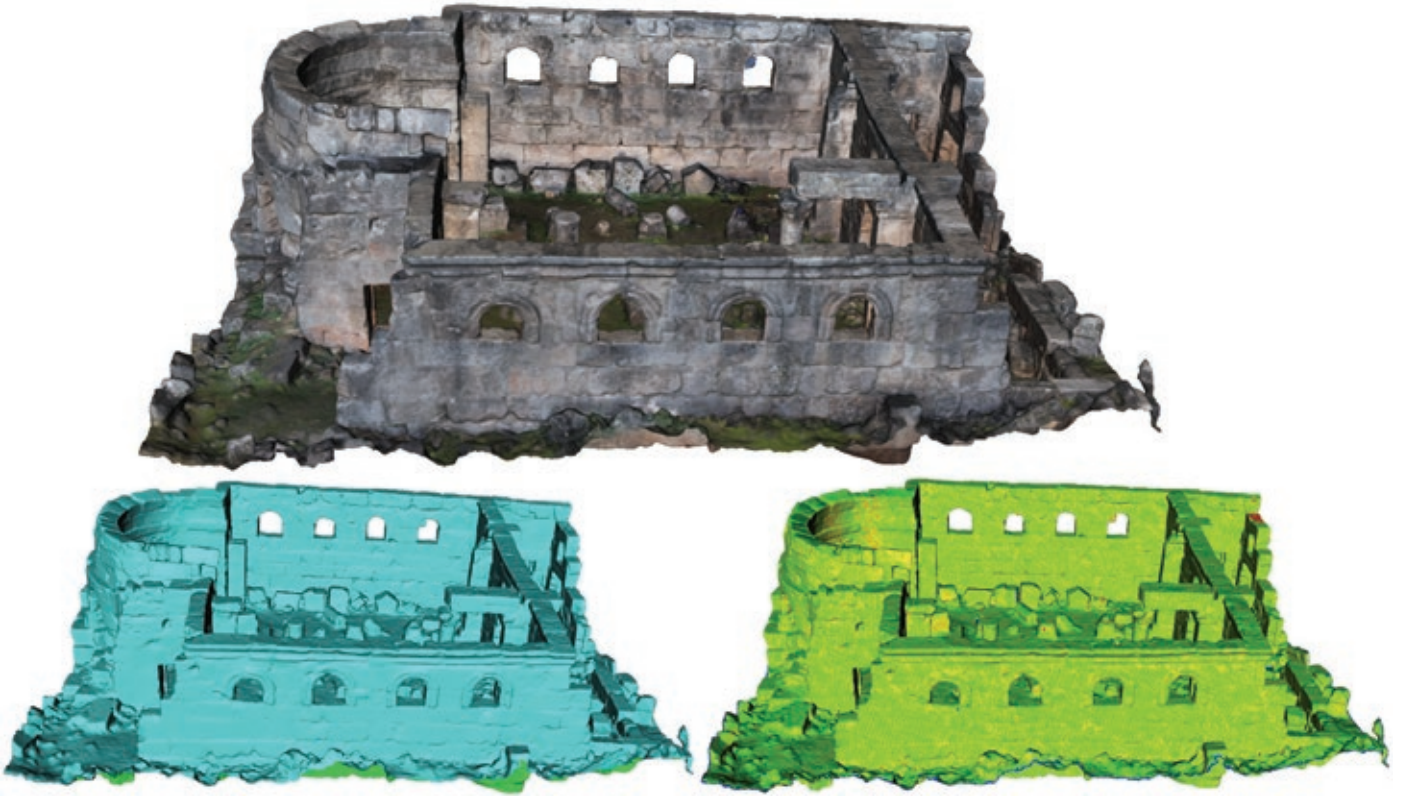


Figure 7. Bird's-eye view from the north

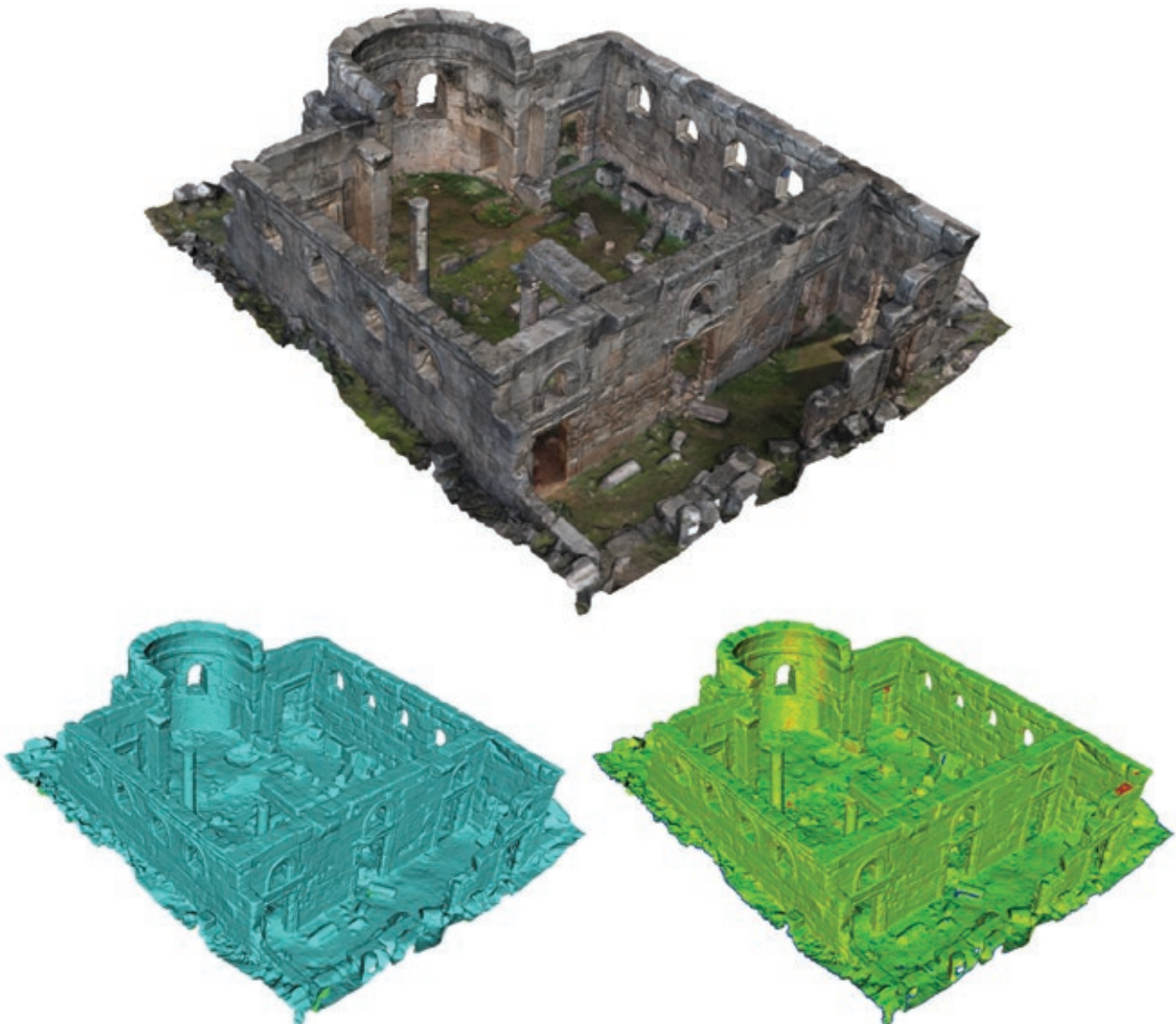


Figure 8. Bird's-eye view from the north-west

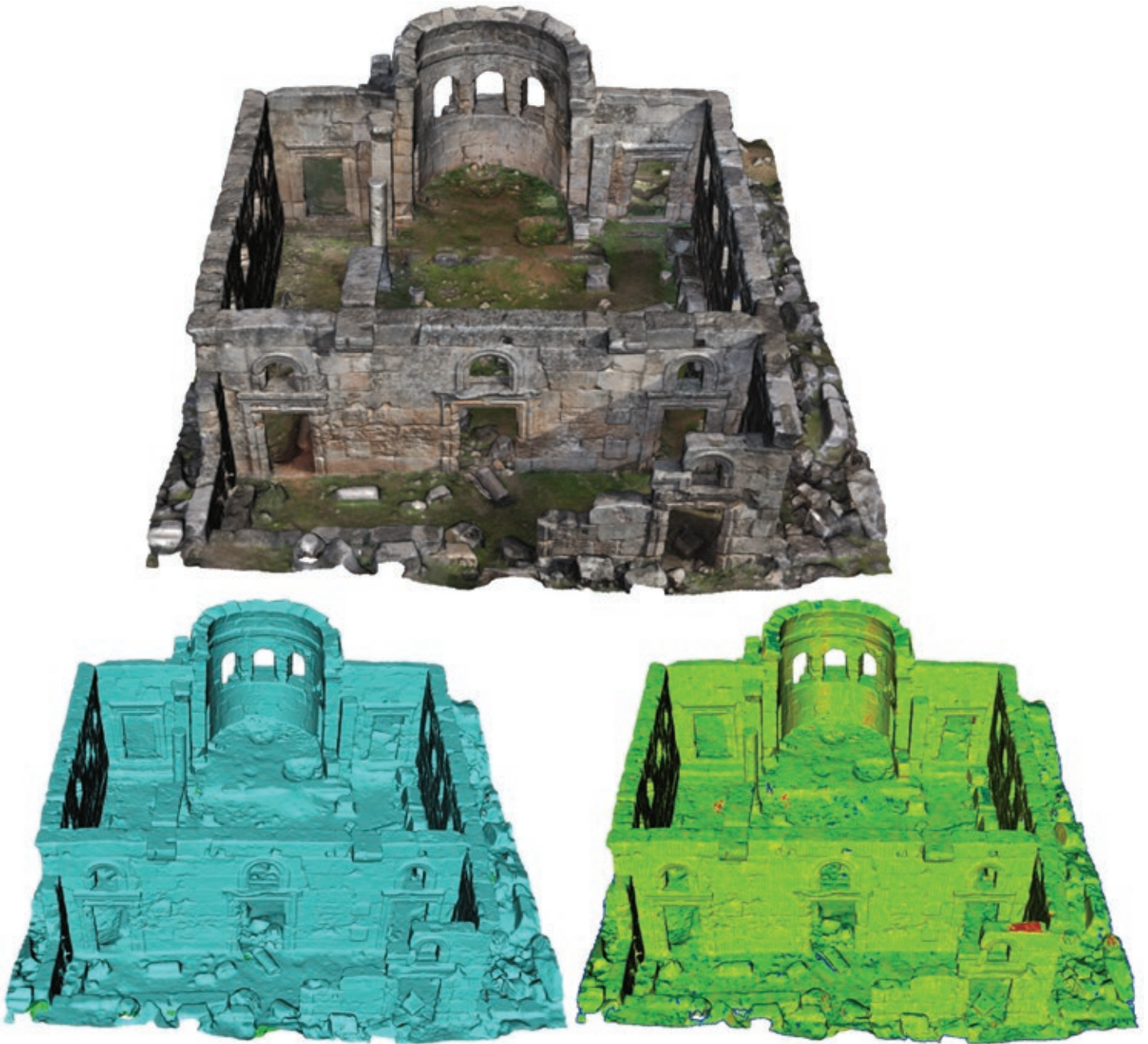


Figure 9. Bird's-eye view from the west

2. Sections of Church 4

Several section plans (i.e. ortho-photographs with scale) of the church are introduced here. The missing parts in the plans are the places covered by ground or surrounding the dislocated stones.

2.1. Sections of outside walls

There is a line of decorated stones under the window in the southern wall that does not exist for the northern wall. Perhaps this difference should be considered from the viewpoint of its relation with the surrounding buildings (e.g. facing the main street), if the stones are in their original location.

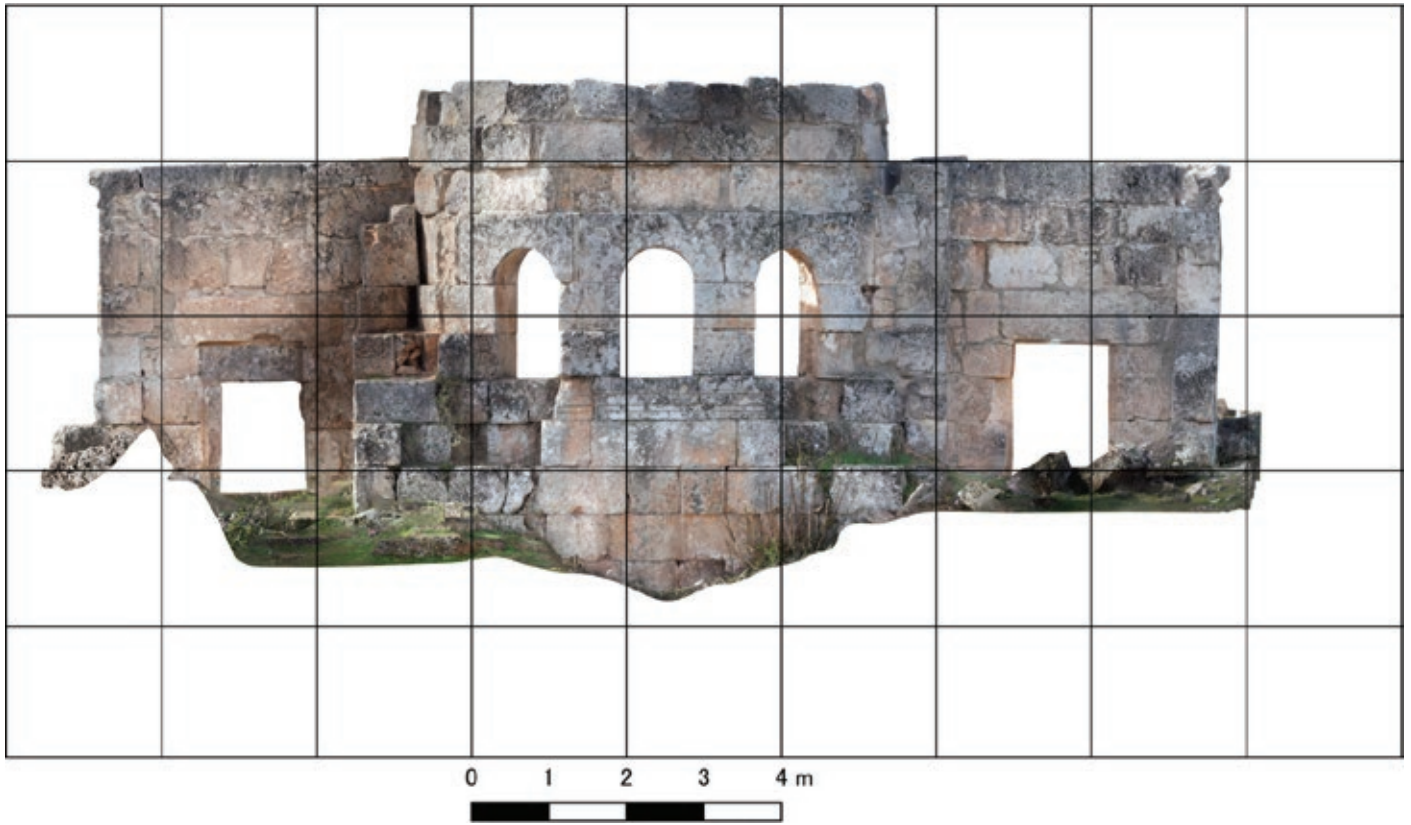


Figure 10. Section of eastern wall (outside of the apse)



Figure 11. Section of northern wall

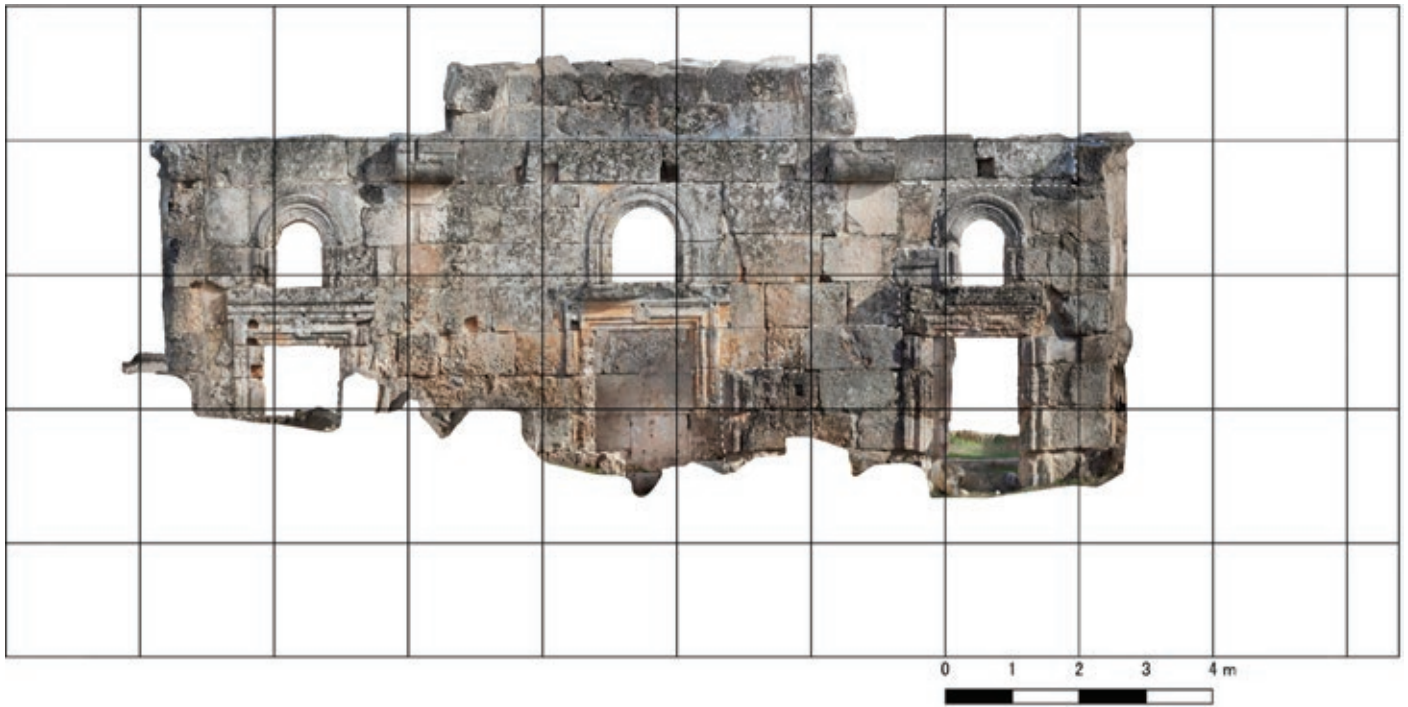


Figure 12. Plan of the western wall (the inner wall is hidden by the remaining outer side wall: white dotted line)



Figure 13. Section of southern wall

2.2. Sections of inside walls

Plans of inside walls are illustrated here. The inside walls are revealed by cutting the 3D model in half showing some of the transections.

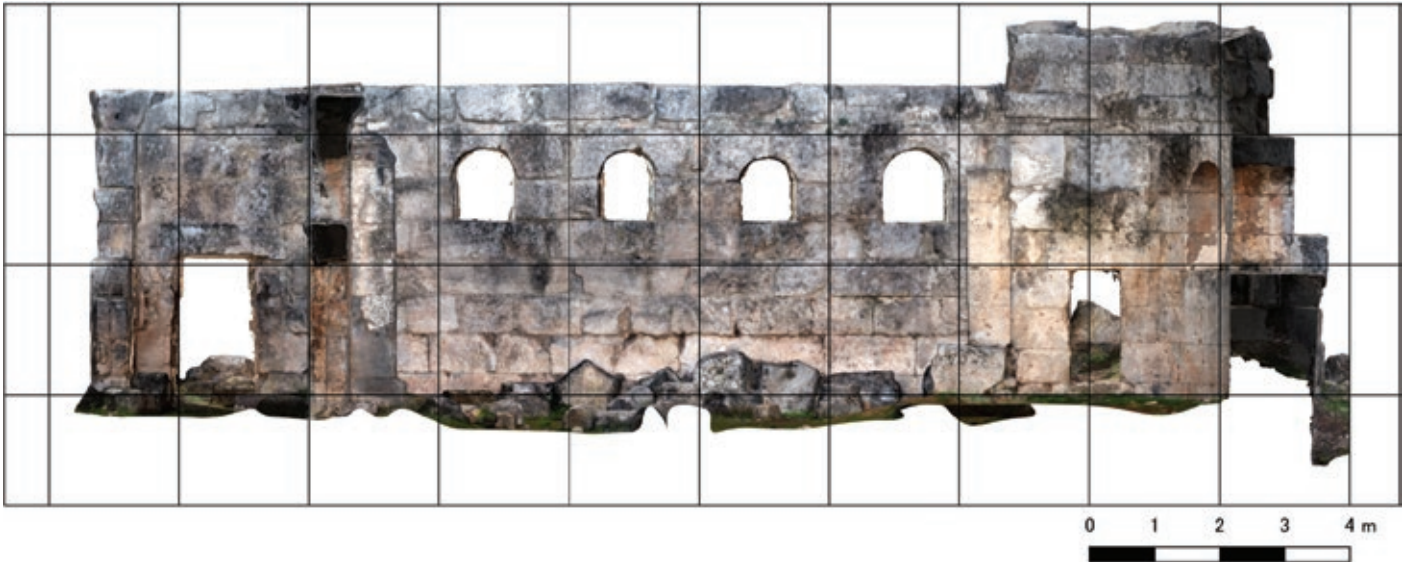


Figure 14. Section of inside wall (southern wall)

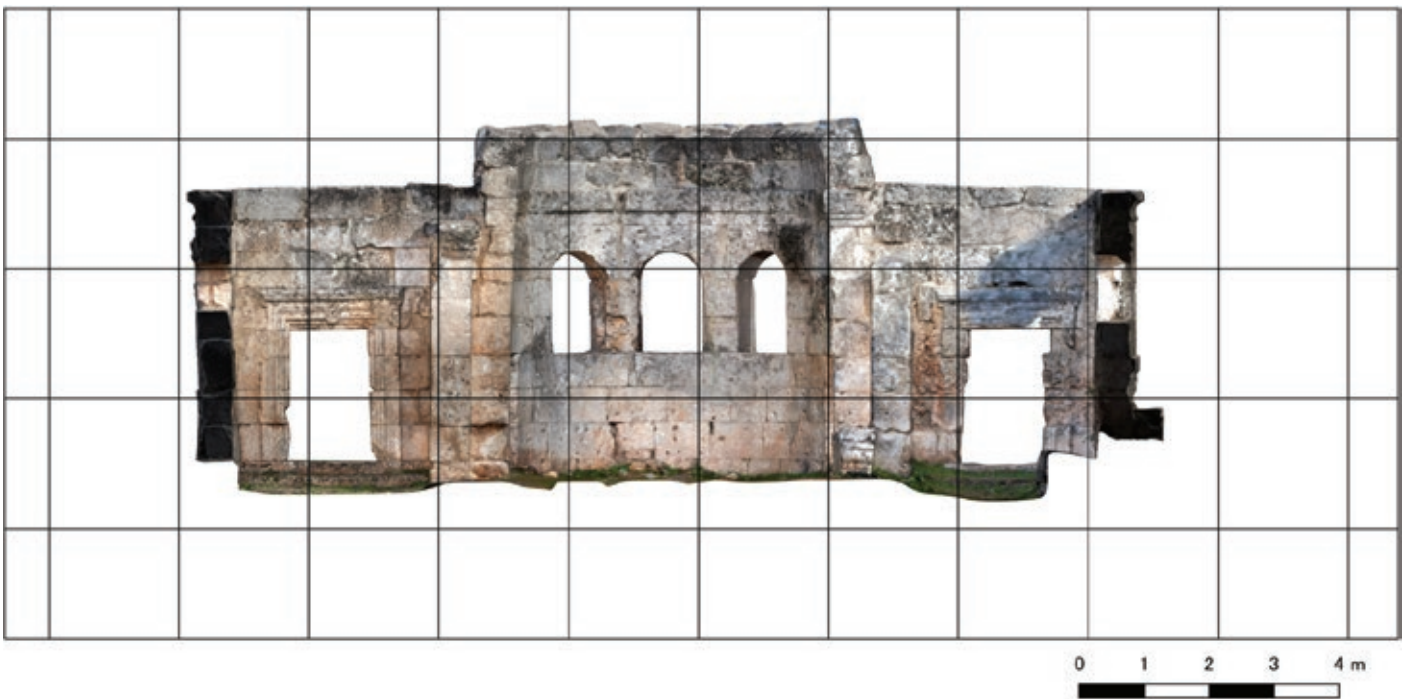


Figure 15. Front section of the apse (east)

3. Top views and plan

The top view ortho-photograph, point cloud data, and a plan generated from the ortho-photograph are illustrated here. The ortho-photograph shows that many dislocated stones are scattered around the church. The orientation of the church is given from the GPS values tagged to the photographs collected from the UAV (Since the GPS device utilized is not high-precision, its orientation can vary slightly from the actual one).



Figure 16. Ortho-photograph from above (Top view)

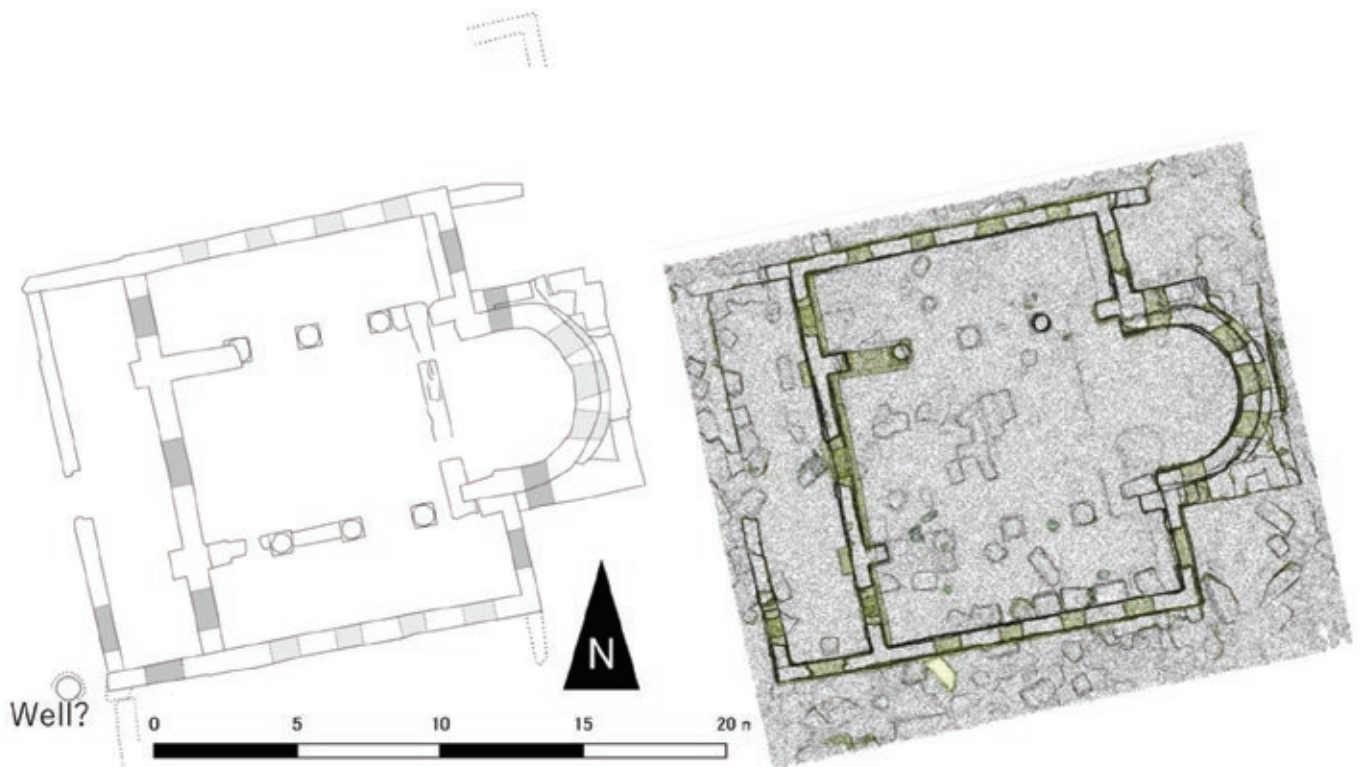


Figure 17. left. Top plan (Derived from the ortho-photograph.) , right. point cloud data

4. Comparing the components

The components (e.g. entrances, masonry, symbols) of the church are listed and compared here.

4.1. Entrances

Decoration of the entrances is seen only on the western side with the outer side of entrance C showing “no decoration”. Perhaps decoration is more specific to the main entrance (west) than the outer views.

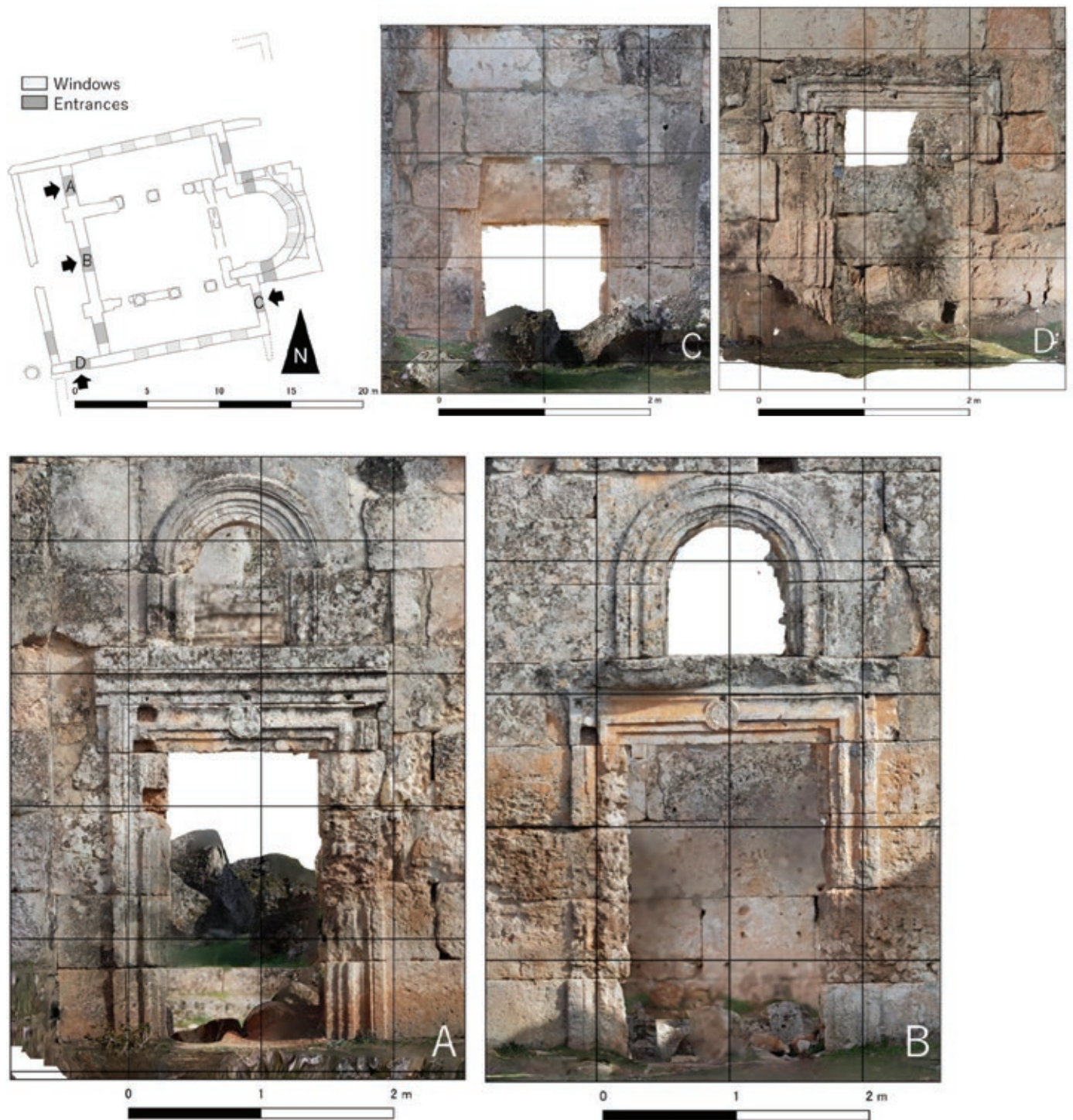


Figure 18. Comparison of the entrances

4.2. Masonry

Not much “special” masonry was observed. However, the protruding stones observed in Figure 19 “C” seem to be stones from the attached walls (also see Figure 2).

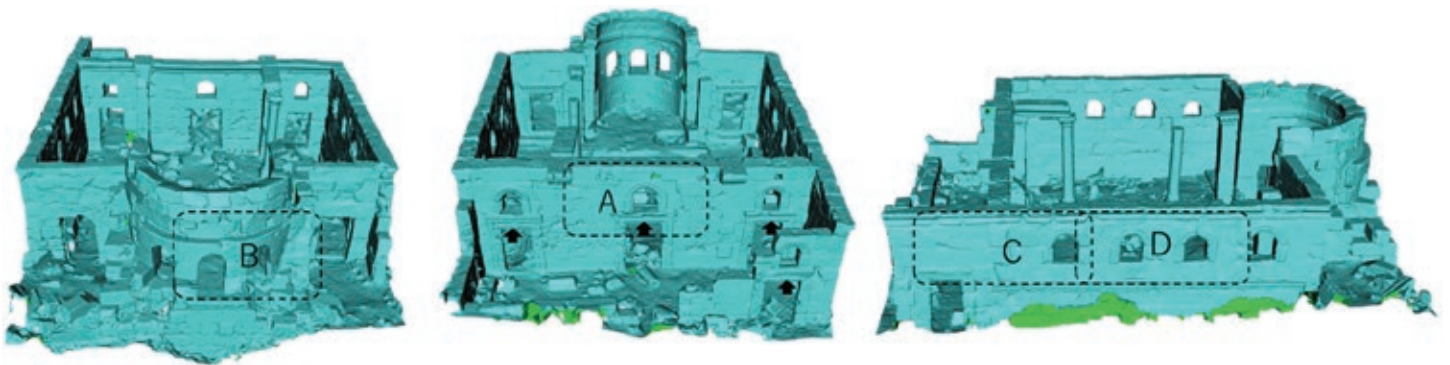


Figure 19. Masonries observed in the church

4.3. Symbols

Six symbols on the lintel stones of the entrances are observed in this church, comprising four on the outer side, two in the inner space. The four symbols of the outer side are illustrated here.



Figure 20. The symbols observed on the church

5. Other visualization

Transparent perspectives and a 3D-model including the surrounding environment are illustrated here.

5.1. Half transparent view

The point-cloud models are used to show half transparent views from different angles. This may help further understanding of the positional relationship between the structures.

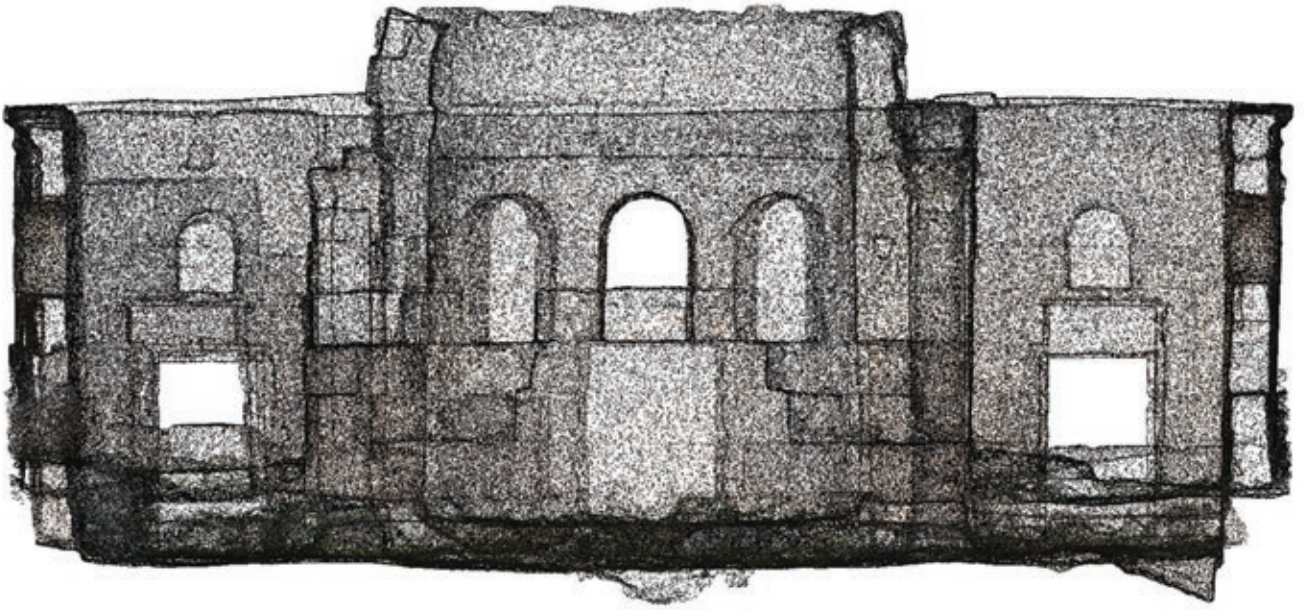


Figure 21. Half transparent view from the east

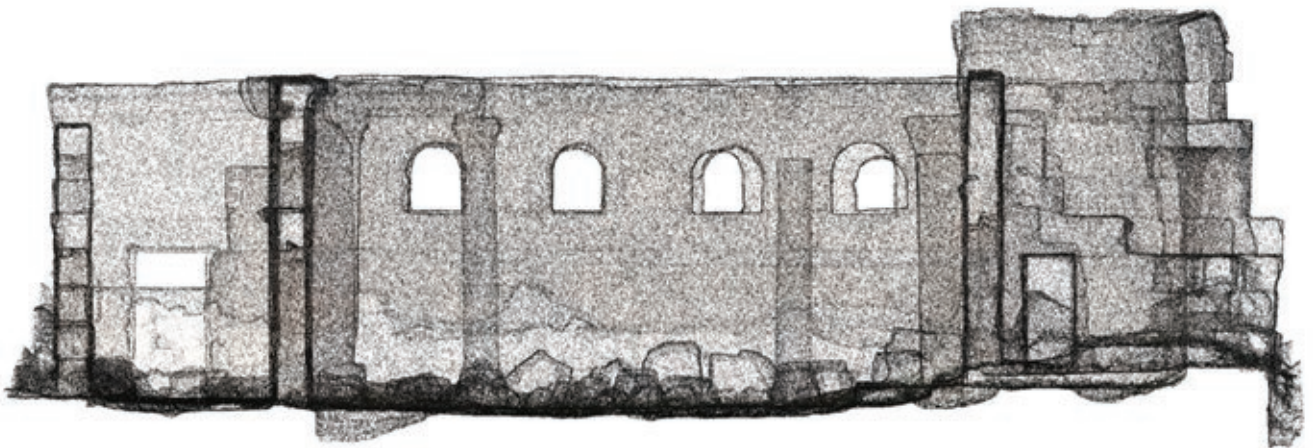


Figure 22. Half transparent view from the south

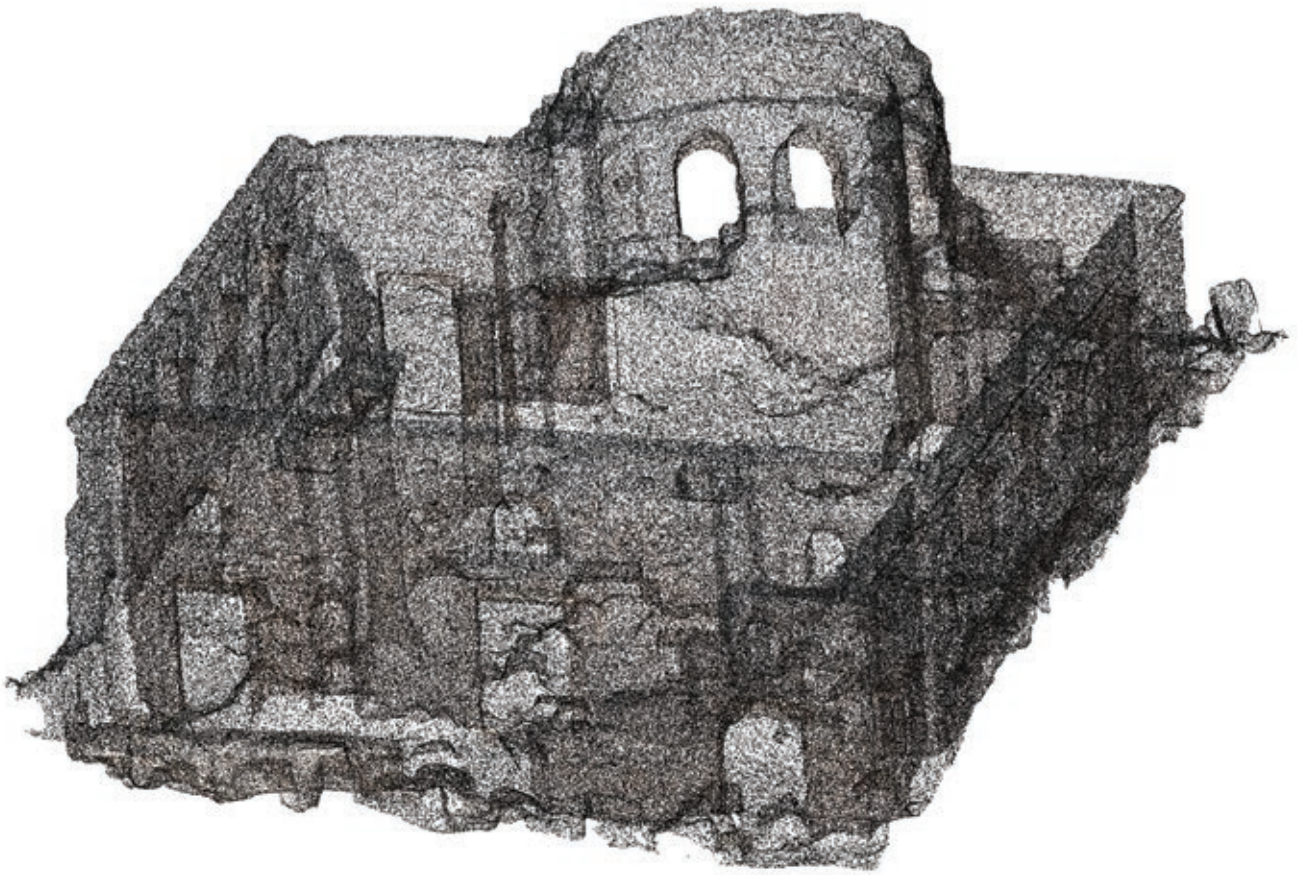


Figure 23. Half transparent view from the south-west

5.2. Combining the model with Google Earth

The 3D model is combined with Google Earth images and the surrounding landscape can be determined from this result. As such, the geographical context can be understood.

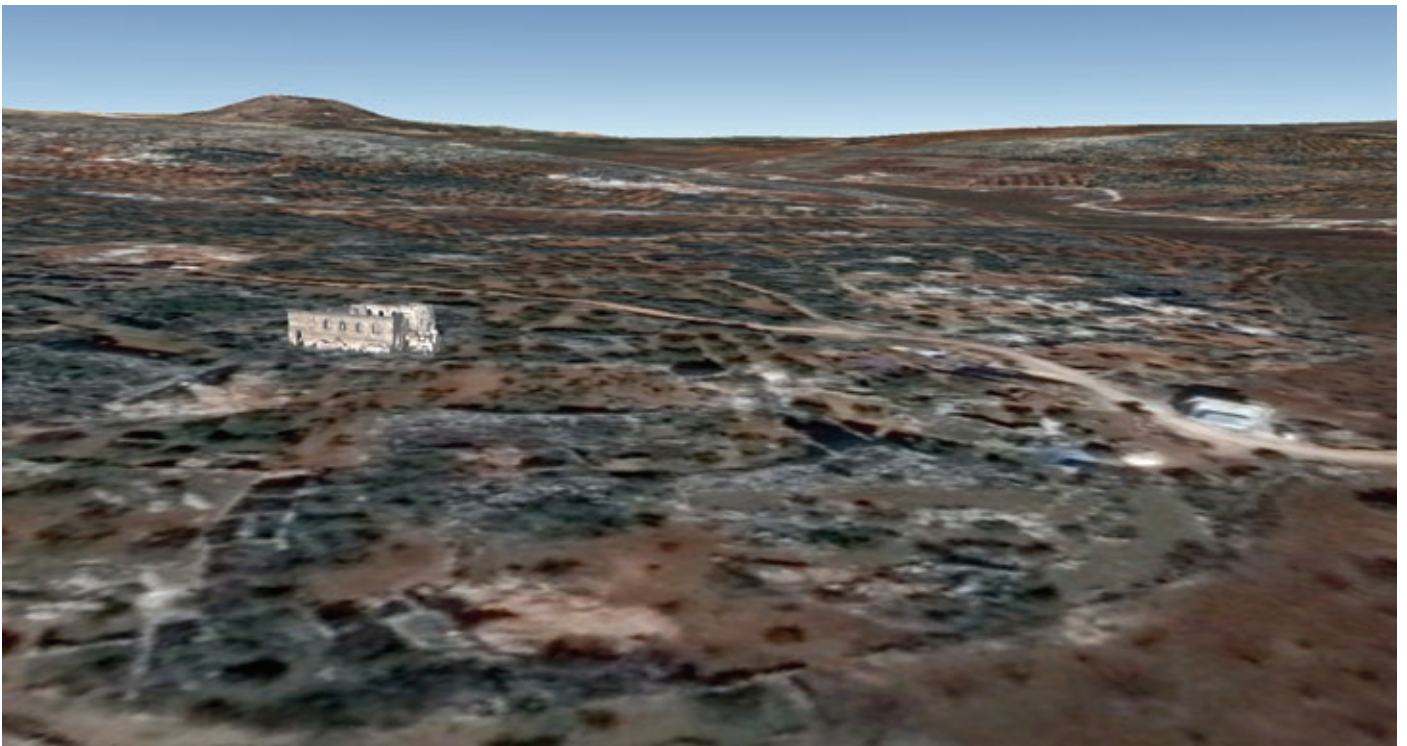


Figure 24. Model combined with Google Earth (facing north-west)



Figure 25. Model combined with Google Earth (facing south)



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