SCIentific RESearch and Information Technology
Ricerca Scientifica e Tecnologie dell'Informazione
Vol 15, Issue 2 (2025), 53-70
e-ISSN 2239-4303, DOI 10.2423/i22394303v15n2p53

CASPUR-CIBER Publishing, http://www.sciresit.it

THEORETICAL RECONSTRUCTION OF THE 5TH CENTURY COMPOSITION OF THE TEMPLE OF TEKOR

*Areg Hasratyan**

*National Academy of Sciences of the Republic of Armenia – Yerevan, Armenia.

Abstract

This study was carried out at the Department of Architecture of the Institute of Arts of the National Academy of Sciences of the Republic of Armenia as an annual thematic work. The theoretical reconstruction was carried out based on archival materials provided by the Research on Armenian Architecture Foundation. The subject of the study is the Tekor temple (it is also often found in literature under the name of the Holy Trinity). It was built in 478-490. The temple is located 20 kilometers southwest of Ani, near Mount Arjarich. The Tekor temple is of exceptional importance for the development of Armenian early medieval architecture. Built in the 5th century, it remained standing for 15 centuries, during which it underwent some reconstructions. The dome of the temple was one of the first domes built by Armenian architecture, which collapsed in 1912. We have made an attempt to reconstruct the original appearance of the Tekor Temple based on archival materials using three-dimensional computer programs.

Keywords

Tekor Temple, three-dimensional reconstruction, stratification of the monument, Early Middle Ages, Armenian architecture

1. *Introduction*

We carried out the collection and study of source materials as well as literature. The Tekor temple has always been the subject of study by scholars engaged in the theory of architecture, such as Toros Toramanyan, Nikoghayos Mar, Josef Strzygowski, Charles Texier and others.

The study of Tekor Temple (Fig. 1) can be conditionally divided into two stages: before 1920 and after. This is due to the deterioration and collapse of the monument in the period 1912-1920. In fact, the older generation of researchers had the opportunity to measure, photograph and study it on site.

These source materials served as the basis for further works, which were carried out both during the Soviet Union period and after the independence of Armenia. It should be noted that the works belonging to this period were already carried out without on-site studies. The reason is that only ruins remained. However, taking into account the given period, naturally, modern digital technologies were not available to scientists.

This work is perhaps the first attempt to recreate the original appearance of the Tekor temple with the help of modern technologies. We have made an attempt to perform a virtual

Fig. 1: Archive photo of the Tekor temple, view from the southwest. Photo Credit: RAA Archives

Fig. 2: Theoretical reconstruction of the Tekor temple, according to Toramanyan

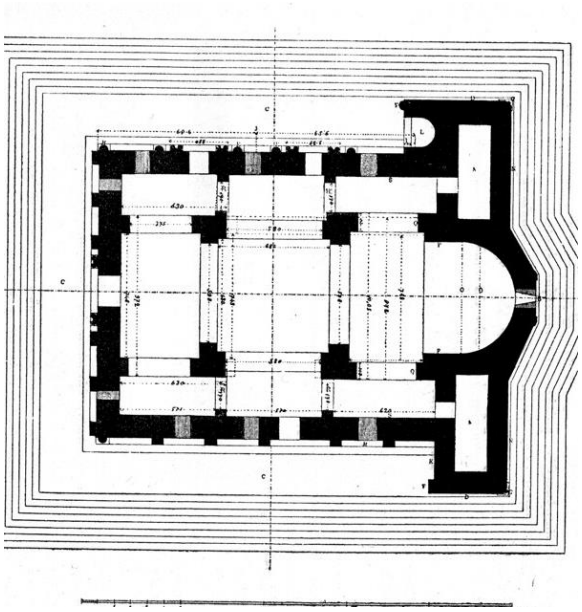

Fig. 3: Plan of the temple of Tekor

reconstruction of the monument based on archival materials - floor plans (Fig. 3), sections, measurements of the facades, as well as the theoretical reconstruction carried out by T. Toramanyan (Fig. 2), etc. For certain facades, archival photos were also used, which were brought to the frontal position and scale using specialized computer programs. Taking into account the fact that the temple has undergone numerous reconstructions over the centuries, stratification was also carried out. The views of researchers regarding the origin of the monument differ sharply and in some cases even contradict each other. According to some scientists, the temple had different construction phases. Built as a three-nave basilica, it was later rebuilt as a domed three-nave basilica. However, this view was refuted by some researchers. Contradictions also refer to some reconstructed parts of the monument. Considering all possible versions and

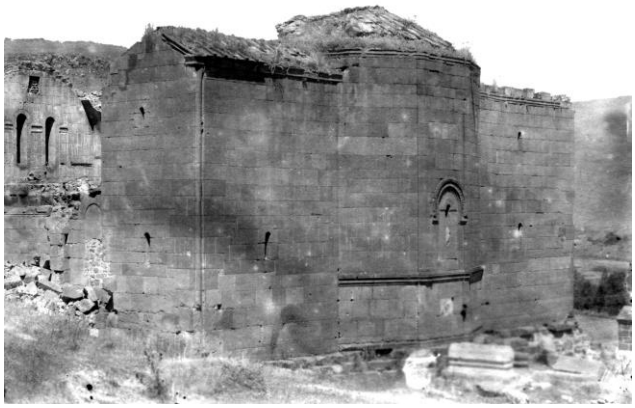

Fig. 4: Archive photo of Tekor temple, view from the southeast. Photo Credit: RAA Archives

Fig. 5: Archive photo of Tekor temple, view from the northwest. Photo Credit: RAA Archives

conflicting viewpoints, we will also try to carry out a stratigraphy of the monument, and using modern computer technologies, to reconstruct its original appearance in as much detail as possible through various three-dimensional modeling programs.

2. *Research aim*

The temple of Tekor is one of the few monuments from the Early Middle Ages preserved with minor changes until the beginning of the 20th century, and provides valuable insights into the architecture of the monuments of that period.

Thanks to archival photos and measurements, it is possible to reveal the peculiarities of the spatial composition, structural solutions, and the stylization of the decoration (Fig. 4-5). Additionally, lithographic inscriptions on the monument's walls, created over different centuries, allow us to recreate the development and transformations of the letters of the Armenian alphabet from the oldest initial type to the developed Middle Ages.

The temple is considered, if not the first domed three-nave basilica, then certainly one of the

Fig. 6: The current appearance of the ruins of the temple of Tekor

Fig. 7: The interior of the Tekor temple after its demolition. Photo Credit: RAA Archives

earliest examples. However, as previously mentioned, the monument is now completely destroyed, with its fragments missing on-site (Fig. 6). Therefore, the Tekor temple is not subject to restoration. In this case, a virtual reconstruction becomes particularly significant.

3. *Bibliographic documentation and description of the monument*

The Tekor Temple is considered one of the cornerstones of the development of Armenian architecture. It is located 20 kilometers southwest of Ani, near Mount Arjarich.

This monument is particularly significant to researchers of Armenian architecture due to its dome, which was the oldest known example to have survived with minor changes until the early 20th century. Unfortunately, the Tekor temple is now completely destroyed. Only archival photos and measurements remain as records. Before the collapse of the monument, the site was first examined by the French scientist Charles Texier in 1839 (Texier, Ch., 1842, p. 120). However, the most detailed study belongs to Toros Toramanyan, who visited the Tekor temple in May 1909, took measurements and photographed it (Թորամանյան, Թ. 1911, pp. 5-6). The dome of the temple collapsed in 1912 (Стржиговский, Й. 2018, p. 126) and, in fact, Toramanyan was the last researcher to study the monument in its fully preserved state. All subsequent studies were largely based on the measurements and research of Toramanyan, the results of which were published in a separate brochure in 1911 (Թորամանյան, Թ. 1911).

In 1912, the Austrian historian Josef Strzygowski visited the already dilapidated monument (Стржиговский, Й. 2018, p. 163). In 1920, the temple completely collapsed (Հասրաթյան, Մ., 2002, p. 47).

On the walls of the Tekor temple there are numerous inscriptions indicating the dates of construction and reconstruction of the church, as well as the name of the builder. According to this inscriptions, the temple is called the Cathedral of St. Sarkis. It was built by Sahak Kamsarakan during the reign of Catholicos Hovhannes Mandakuni (478-490) (Ղաֆադարյան, Կ., ՊԲՀ, № 2, 1962, p. 45). The records contain a lot of historical information, such as exemption of Tekor from taxes, receipt of donations, etc. However, the most important for our study is the record of the reconstruction of Tekor in 1014 (Հասրաթյան, Մ., 2002, p. 46).

The Tekor Temple is a domed, four-aisled basilica in plan. The main altar on the eastern side has a trapezoidal volume protruding beyond the plane of the wall. On both sides of the altar are rectangular, vaulted, two-story sacristies, which are oriented from north to south. The temple was surrounded by a colonnade on the northern, southern and western sides, of which only traces remain. The northern colonnade ends on the eastern side with an altar.

As is typical for churches of the 4th-5th centuries, it rises on a multi-stage stylobate. Two of the four entrances to the Tekor temple are on the northern facade, while the western and southern facades each have one entrance. Unlike the southern facade, the northern facade is quite richly decorated with carvings. This can perhaps be considered an exception for Armenian architecture, since the southern facades of most churches are more solemn than the northern ones.

This circumstance is most clearly seen in the Yereruyk Cathedral, which is geographically, chronologically and stylistically close to Tekor. The northern facade of Yereruyk, for instance, has no entrances or windows at all. Instead, the southern and western facades have entrances, windows and are richly decorated. Something similar can be seen in a number of other monuments built in the Early Middle Ages. For example, in the Kasakh basilica, which dates from approximately the same period, the northern wall is completely blank, while the southern and western walls have open entrances and windows. A similar pattern can also be seen in the Tsiranavor basilica in Ashtarak. In Yeghvard basilica, although there are entrances on the northern wall, there is no decoration here.

The richer decoration of the southern facades is due to their illumination by the sun's rays, which creates a dynamic interplay of light and shadow on the ornamental sculptures. In the Tekor temple, semicircular pilasters are attached to the northern wall, crowned at the top with capitals; they resemble the Corinthian type common in Greco-Roman architecture. However, these pilasters differ from one another in the style of their ornamental carving, with acanthus leaves and grape clusters predominating (Հասրաթյան, Մ., 2002, p. 43). Only three of the five capitals have survived. And the capitals of the porticoes were later widely used in Soviet-Armenian architecture (Токарский, И., 1961, p. 83).

The more important and solemn character of the northern facade of the Tekor temple is determined, first of all, by its location. Situated on the slope of a hill, the most convenient approach to the monument is from the northern and western sides. Additionally, the northern facade is visible from a nearby settlement, further emphasizing its significance. (Мнацаканян С., 1989, p. 58).

4. *Design features*

The Tekor temple deserves special attention in terms of construction techniques. In professional literature, it is considered if not the first domed basilica, then one of the first. As such, the builders approached the issue of the strength of the church with particular scrupulousness. It is built with masonry called midis, which is widespread in Armenian architecture. The walls are notably thick, measuring 1.35 meters. Although Toramanyan considers this circumstance unprecedented (Թորամանյան, Թ. 1911, p. 25),

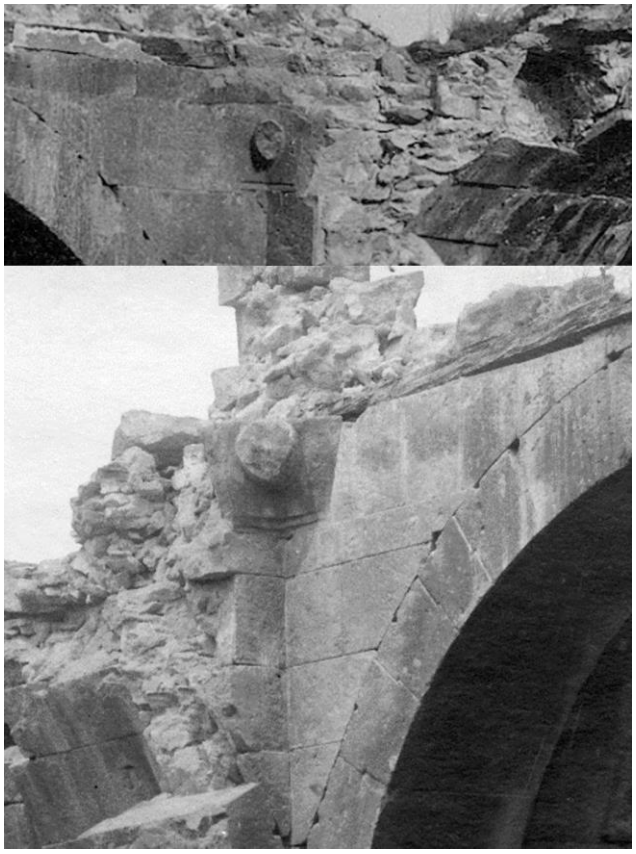

Fig. 8: The trumpets of the temple of Tekor. Photo Credit: RAA Archives

Armenian basilica-type churches dating back to the same period also have walls of similar thickness, for example, in the Kasakh basilica it is 1.35 m (Հասրաթյան, Մ., 2002, p. 48).

The load of the dome is carried by four irregular columns. Horseshoe-shaped arches span between them, which is typical for Armenian architecture of the 4th-5th centuries. The stones of the arches are connected to each other by jagged projections. Thanks to this design solution, the connection of the stones to each other is more reliable (Թորամանյան, Թ. 1911, p. 98).

In the Tekor temple, the walls inside, have anti-seismic belts at different levels, which are made of wooden boards (Fig. 7). Such belts are also present on all longitudinal arches, at the base of the altar conch, and within the sub-dome square. The use of wooden boards in the construction of the walls not only creates connections in the horizontal direction, but also the load falling from the upper rows of the walls is distributed more evenly both on the rows of masonry walls and on the arches. Such measures of strength and seismic resistance can explain the fact that the temple has stood for fifteen centuries.

The dome is distinguished by its archaism, both in spatial composition and in design solutions. Internally, it is an unequal octagon at the base. When erecting the dome, the architect managed to combine various design solutions. The transition from the sub-dome square to the octagonal volume of the dome is carried out by tromps (Fig. 8). Due to the extremely small size of the latter, in the literature they are more often considered as a purely decorative element, rather than a constructive one. However, we believe that, taking into account the builders' intention to increase the strength of the structure, it also played a constructive role in addition to their decorative purpose. In the upper part, the trompe is combined with a sail transition.

Another constructive solution is used inside in the drum of the dome, the origins of which lie in the roof of the Armenian folk dwelling hazarashen. As already mentioned, it has an unequal octagonal shape in the lower part, which is transformed into an equilateral octagonal volume at the top. The builders achieved this transformation by inclining the internal walls, facing each other diagonally, to obtain the hazarashen roof (Мнацаканян С., 1989, p. 74). This was the oldest surviving dome of Armenian architecture before its destruction in 1912.

The construction of the Tekor Cathedral coincides with the period of reconstruction of the Main Cathedral of Echmiadzin (1913. Պատմութիւն Սեբէոսի Եպիսկոպոսի, p. 38).

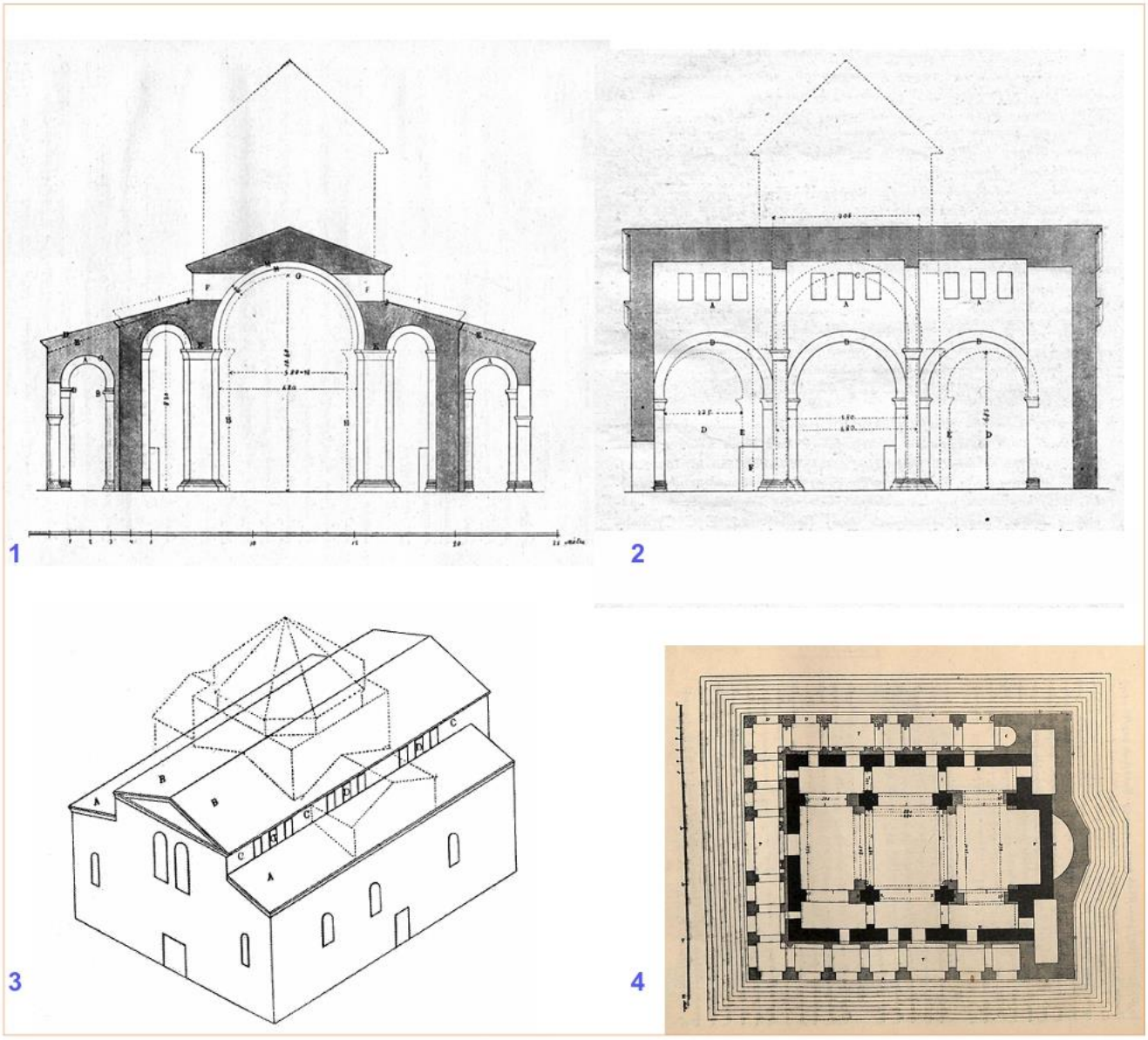

Fig. 9: Theoretical reconstruction of the Tekor temple, according to Toramanyan: 1. cross-section; 2. longitudinal section; 3. axonometric view; 4. plan

Therefore, the dome of the Tekor Temple provides a valuable reference for understanding the original appearance of the Main Cathedral's dome.

The dilapidated temple was completely destroyed in the 1920s, when the Turkish and Kurdish residents of the nearby villages used the stones of the church as building material (Հասրաթյան, Ս., 2002, p. 47). Currently, only traces remain on the site, and it is no longer possible to conduct any research.

5. *Theories about the construction of the Temple of Tecor*

Toramanyan in his research expressed the opinion that the composition of the Tekor Temple resulted from the reconstruction of an earlier building that once stood at the same location. It had a three-aisled basilica plan with a rectangular main altar, without a dome, sacristies and a gallery (Fig. 9). According to this point of view, the supports of the three-aisled basilica were rebuilt and strengthened to withstand the load of the dome, and the walls were thickened on the northern, southern and western sides, and a gallery and a colonnade were added (Թորամանյան, Թ. 1911, p. 15).

Later, this point of view was refuted by a number of Armenian and foreign researchers (Հասրաթյան, Ս., 2002, p. 51). Strzhigovsky, who was on site and studied the monument, expressed his doubts about this point of view of Toramanyan (Стржиговский, Й. 2018, pp. 128-129). According to Stepan Mnatsakanyan, the construction was carried out in two stages. Initially, up to the 10th-11th rows of walls, the structure was built as a three-aisled basilica without a dome. However, after construction resumed, it was rebuilt and transformed into a domed three-aisled basilica. (Мнацаканян С., 1989, p. 59).

6. *Proportional analysis of the plan of the Tekor temple*

The first fundamental question we aim to address is whether the composition of the Tekor temple is a result of reconstruction. A proportional analysis of the plans of three-nave basilica churches of Early Middle Ages shows that the ratio of the width and length of the prayer hall is close to 1:2. For example: in the basilicas of Tsiranavor, Tsitsernavank, Kasakh, Yeghvard, Ashtarak. In Yereruyk and Dvin basilicas this ratio even reaches 1:2.3.

The results of a similar analysis of the plans of three-nave domed basilicas show that the prayer halls are close to a square in terms of the ratio of width and length. For example, in the churches of

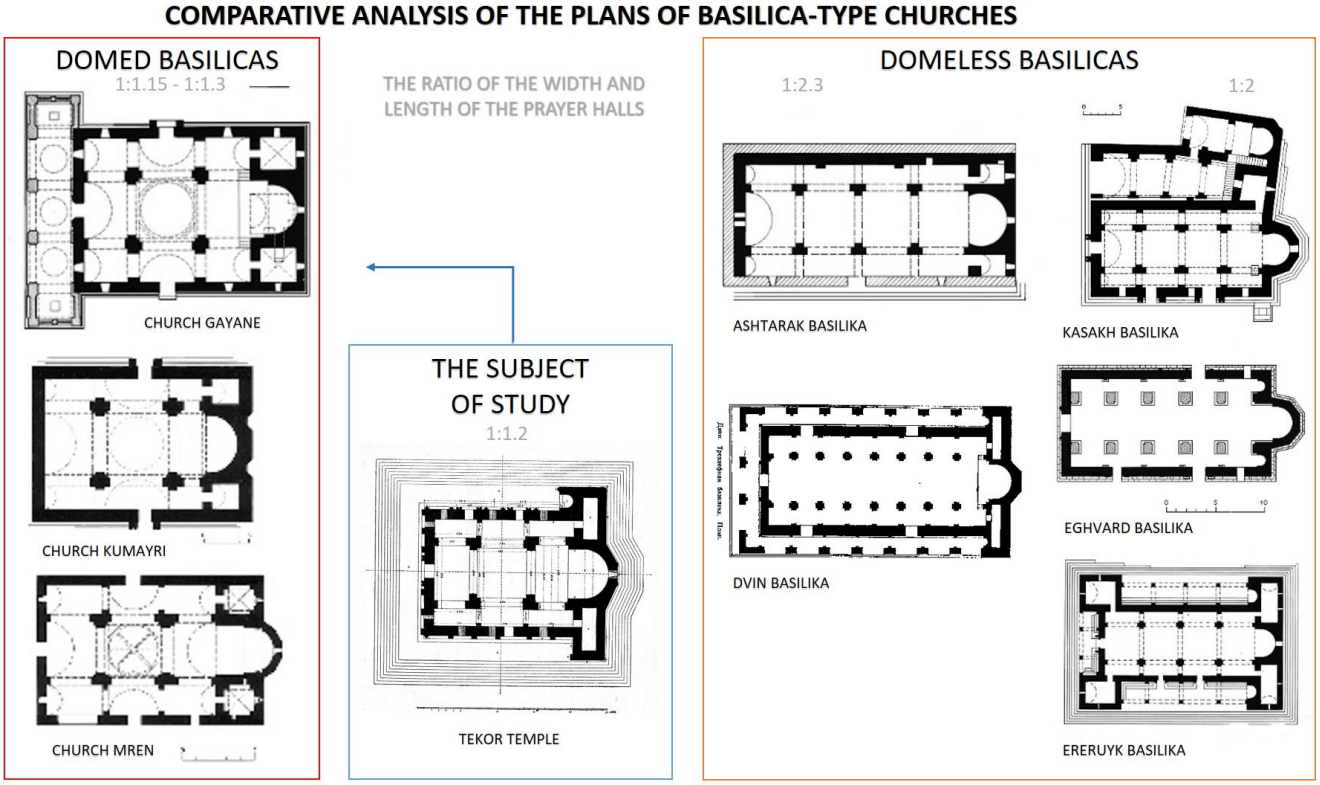

Fig. 10: Comparison of the plans of domed and domeless basilicas

St. Gayane, Kumayri and Mren, the ratio ranges 1:1.15 to 1:1.3 (Fig. 10). We excluded the three-nave domed basilica of Odzun from this analysis because it features 3 pairs of columns. The reduction in length in basilicas is primarily due to the reduced number of columns. In the case of domeless basilicas, their number varies from 3 to 7 pairs.

In the object of our study, for the Tekor temple, the ratio of width to length is 1:1.2, which aligns with the symmetry of four-pylon domed basilicas. In addition, the stylobate of the temple identically repeats the external contours of the walls of the building. Therefore, it can be concluded that the Tekor temple was originally designed and built as a four-pylon domed basilica.

7. *Stratification of the monument*

Archival photos (Fig. 4-5) clearly show that the stonework in the galleries, the altar on the eastern facade, the colonnade are uniform and there are no traces of any reconstructions or additions. The destroyed sections of the walls indicate that the outer stone layer of the midis masonry is structurally uniform with the layer of lime concrete.

However, the church bears traces of numerous reconstructions and renovations that have been carried out over the centuries.

These reconstructions are notable not only for the differences in the shape and color of the stonework, but also in style.

The window frames of the Tekor temple are horseshoe-shaped and are located right at the edge of the windows. This is typical for the 4th-6th centuries, such as the Avan temple, Kasakh basilica, Yereruyk basilica, the Cathedral of Echmiadzin etc. (Fig. 11).

However, since the 7th century, the window parapets are no longer located right at the edge of the windows, but are located at some distance from them. This is evident in structures such as the Aruch Cathedral, the Cathedral of Talin, the temple of St. Hripsime and other similar objects.

The eastern window of the northern wall of the Tekor temple differs from the others in this regard. Although the profile of the window parapet is similar to the other windows, there is a space between the window and the parapet equal to the thickness of one row of masonry, and the parapet

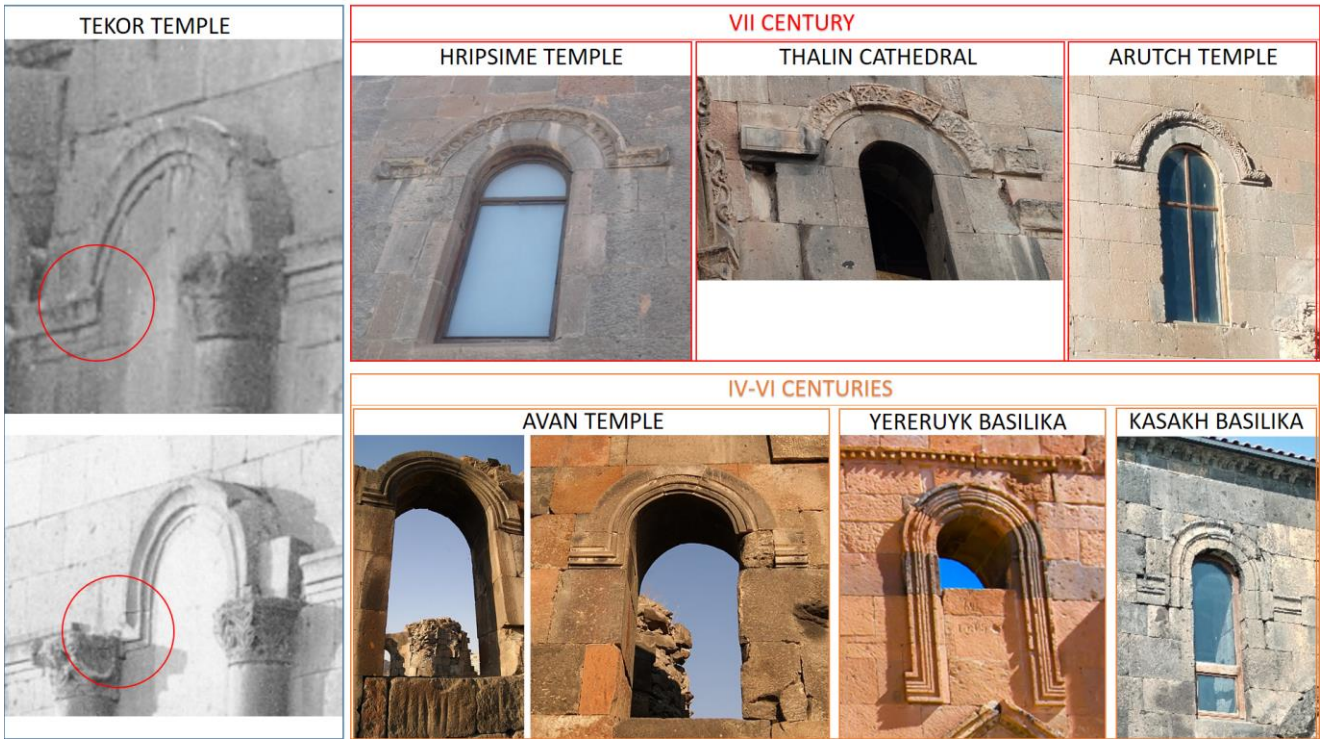

Fig. 11: Comparison of window arches from the IV-VI and VII centuries

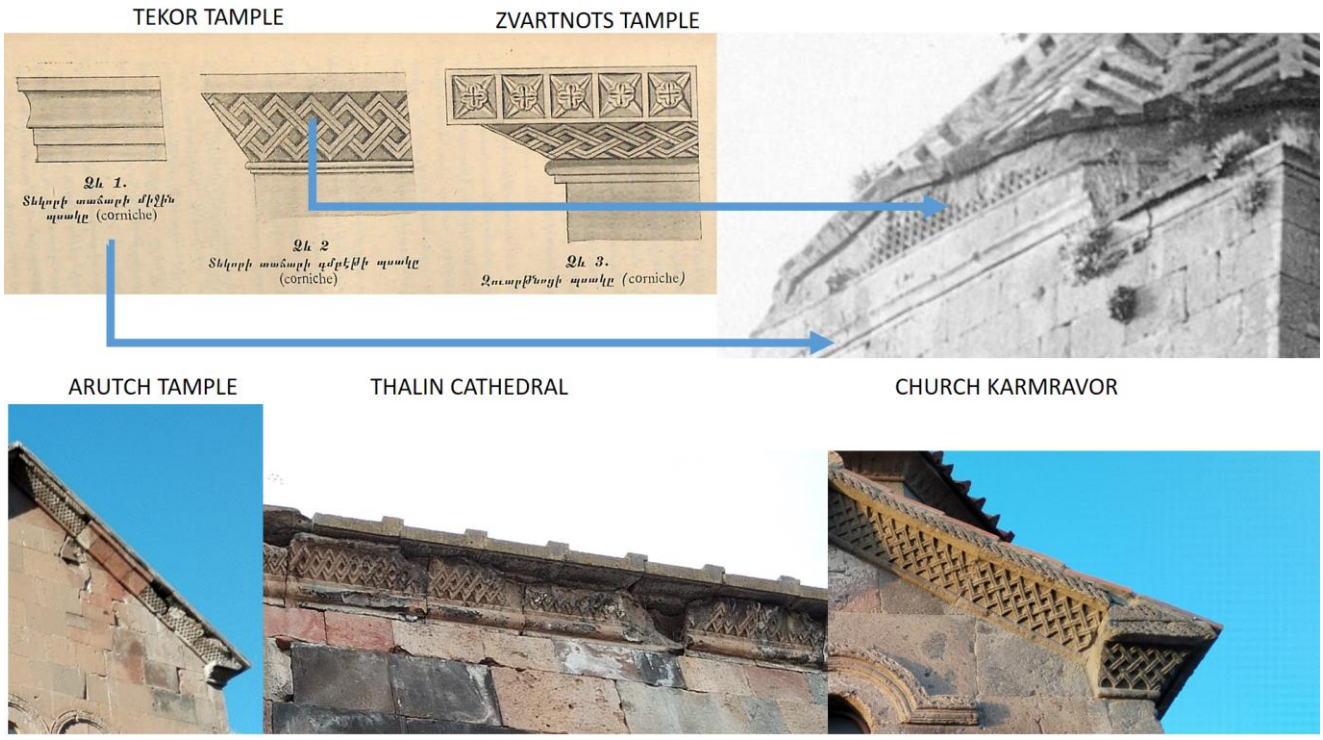

Fig. 12: Comparison of cornices from the 5th and 7th centuries

itself is interrupted at the corner between the curved and straight sections. This indicates that this section of the wall, like the window, was reconstructed.

The eastern window of the southern wall has also undergone a similar reconstruction, with traces of it being more clearly visible in this case. In Tekor temple, as in other churches of the same period, the interior was quite abundantly illuminated by large and numerous windows.

The number of windows cut into the walls reaches 15, to which should be added 4 windows in the drum of the tetrahedral dome and 8 windows opened in the vaults of the prayer hall.

In contrast to the Early Middle Ages, in the High Middle Ages, approaches to the lighting of the prayer hall changed. The interiors of churches built in this period became more dimly lit, the number of windows decreased, and their sizes became smaller. The windows of some early medieval churches were also reconstructed, they were either completely covered with stonework or their sizes were reduced.

In this regard, Tekor temple is no exception. The lower windows of the northern, southern and western facades were closed with stone blocks, and the windows of the upper part, as well as the dome and the altar, were reduced in size.

In our view, the windows of the Tekor temple reflect two stages of reconstruction. The north and south windows on the east side were first rebuilt with openings of the same size, therefore they are the result of a 7th century intervention. Those were then covered with a light stone lining during the 1014 reconstruction.

The cornices in the Tekor temple do not differ much from each other in size and shape. The only exception is the cornice of the dome drum. It has a carving in the form of a wicker basket and stylistically differs sharply not only from the other cornices of the Tekor temple, but also from the cornices of monuments dating back to the 4th-6th centuries in general. Toramanyan in his work compared it with the cornice of the Zvartnots Cathedral, built in the 7th century (Թորամանյան, Թ. 1911, p. 97). Similar cornices were widespread in early medieval Armenia and are found in a number of monuments, such as the Karmravor Church in Ashtarak, St. Gregory Cathedral in Arutch, Cathedral in Talin, etc. (Fig. 12).

The dome was also reconstructed. The shape of the veghar, is not typical for Armenian church architecture of the 4th-6th centuries in style, design and use of building materials. It is made of stone lintels and in its composition resembles fan-shaped domes common in the High Middle Ages (Мнацаканян С., 1989, p. 74). Thus, the dome has

layers of two reconstruction periods: the cornice of the dome was renewed in the 7th century, and the spire reconstructed (already mentioned in the inscription) in 1014.

8. *Initial appearance detection and three-dimensional reconstruction*

The archival photos of the Tekor Cathedral are black and white, so we get an idea of the color and tone of the stone facing the walls of the church mainly from the watercolor painting of Arshak Fetvadjian from 1906 (Չոլքասզյան, Գ., 2001, p. 59), (Fig. 13), as well as the written descriptions of Nikoghayos Mar. He writes: "The stone is of two types, both are most likely tuff, one is pinkish in color, it is close in color to the Yereruyk, but there can be no doubt about its identity, the other with its light, whitish hue it reminds us of the old Smbatashen sections of the walls of Ani." (Мнацаканян С., 1989, p. 60).

Fig. 13: Watercolor of Tekor temple by Arshak Fetvadjian, 1906

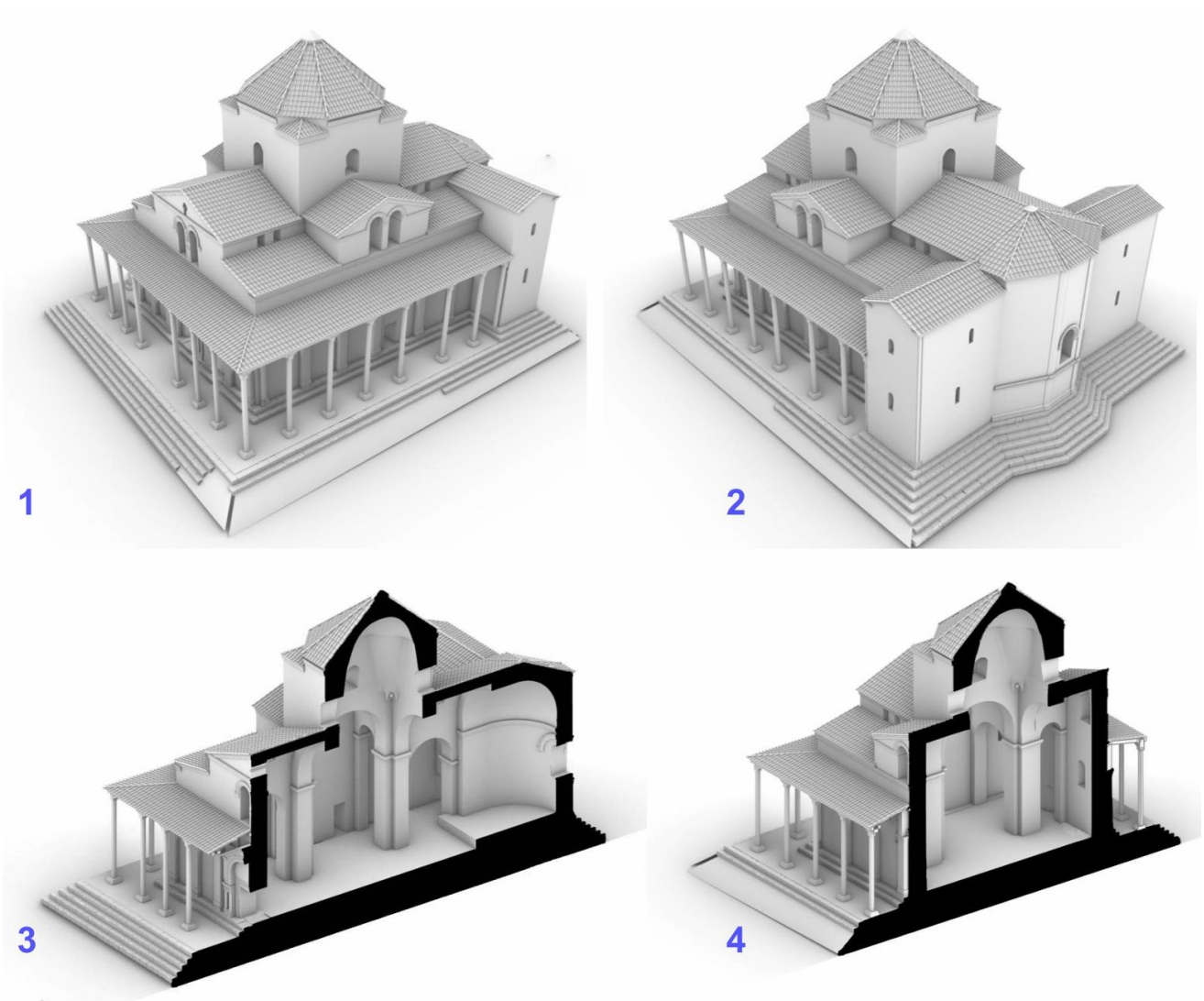

Fig. 14: Theoretical reconstruction of the Tekor temple according to the author: 1. view from the northwest; 2. view from southeast; 3. longitudinal section; 4. cross-section

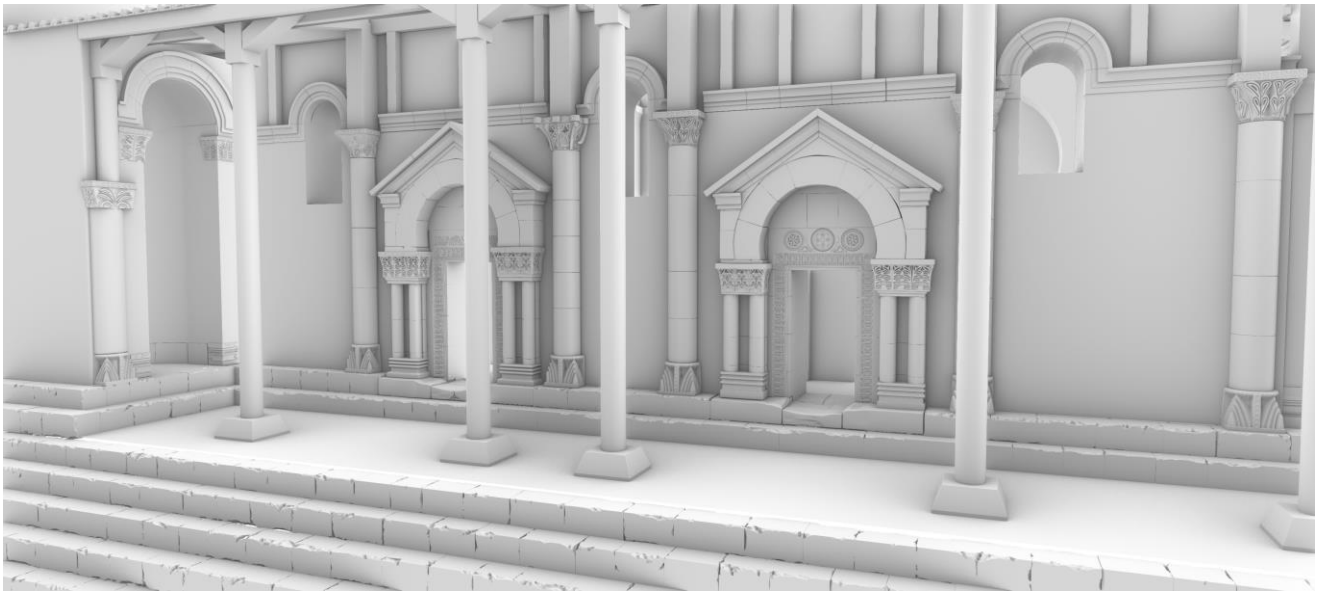

Fig. 15: Northern facade

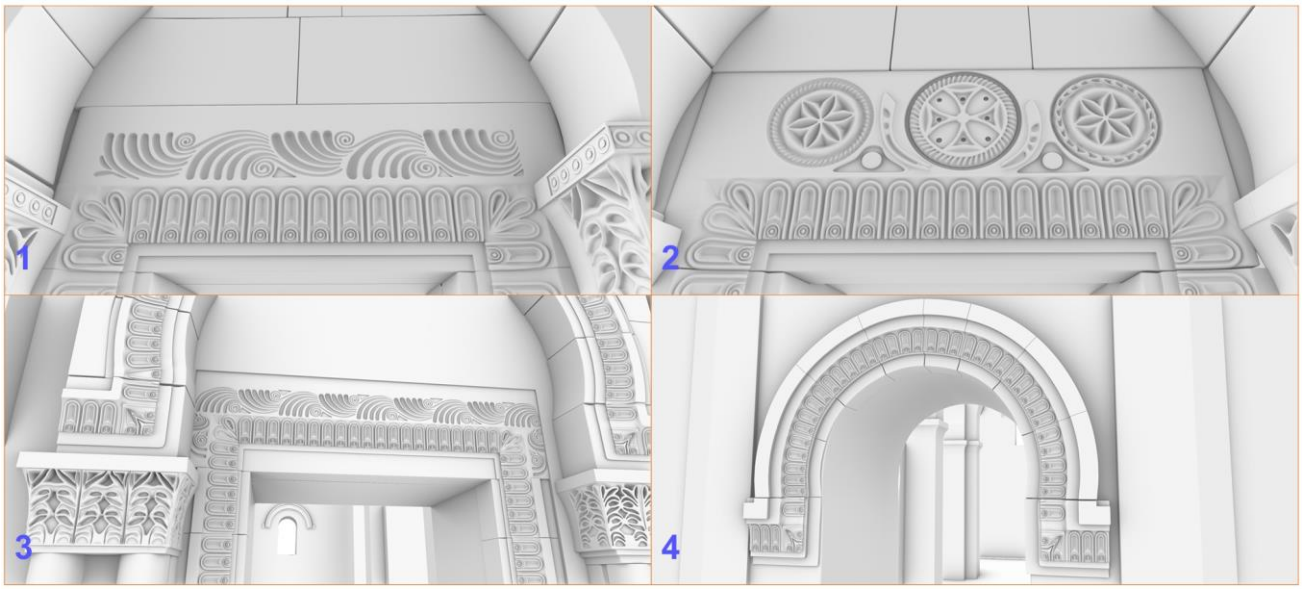

Fig. 16: Bas-reliefs: 1. northeast entrance; 2. northwest entrance; 3. west entrance; 4. east window

The stonework of the lower part of the walls of the Tekor temple, up to the 10th-11th row, differs in colour from the upper part. In this regard, the opinions of researchers of the monument differ. It is known that the construction of the temple was suspended for some time due to the uprising, and after the construction was resumed, the colour of the stonework was deliberately changed. As has been mentioned many times, unfortunately, today the monument is completely destroyed, and it is no longer possible to conduct any research on the site.

Therefore, one can only assume that the change in the colour of the stone was probably caused by structural considerations, not aesthetic ones. Most likely, a lighter stone was used above the 11th row of the wall to reduce the mass of the structure.

The temple was surrounded by an open gallery on three sides (Fig. 14 -17). And if the main volume of the structure survived with some distortions until the beginning of the 20th century, then only traces of the colonnade in the form of wall panels remained. In professional literature, opinions on the original composition of the colonnade differ. Among the monuments of this period, one can note the Yereruyk temple, although the galleries have not survived here either. And the Odzun temple, which was built later, in the 6th century (Мнацаканян С., 1989, p. 94), cannot be considered as an example from a typological point

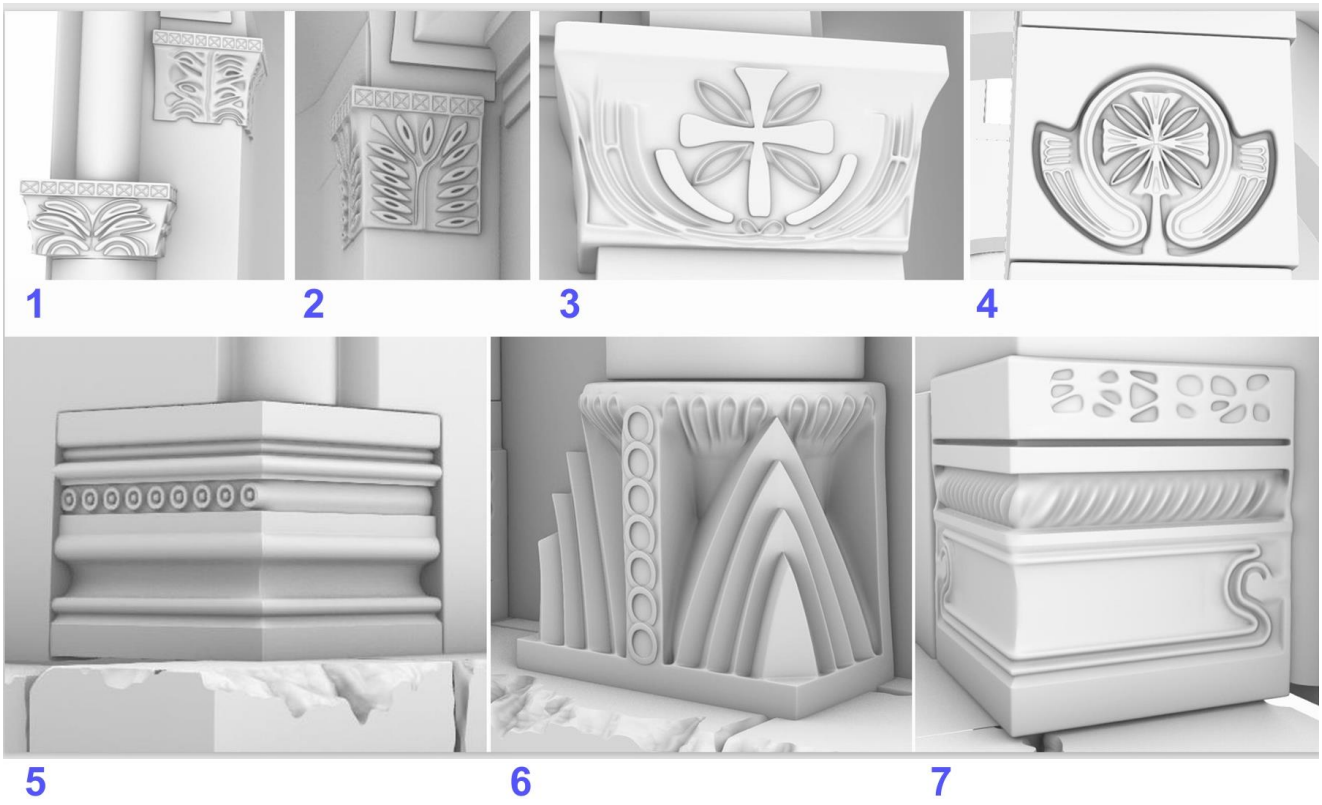

Fig. 17: Details.: 1., 2. The capitals of the eastern altar of the north façade; 3. the capital of the west façade; 4. the bas-relief located between the pair of windows on the west façade; 5. base of the southeast corner of the temple; 6. the base of the pilasters of the north façade; 7. the base of the eastern altar of the north façade

of view, but it gives an idea of the structure of early medieval vaulted galleries. Determining the form of the colonnade composition in this case is quite a difficult task. The columns of the latter have not survived, there are practically no analogues, opinions differ, etc. The most important question is to determine the structural system, whether the hall had a stone vault or a wooden roof, whether there were arches or wooden beams between the columns, whether the columns were made of wood or stone, how high was the roof, etc.

In the Tekor temple, the walls are thicker at the bottom, the masonry up to the capitals is 135-145 cm. thick (Թորամանյան, Թ. 1911, p. 25), and above they narrow by about 20-25 cm (Fig. 14). The thick part of the wall ends with a cornice, which is at the same height as the lower parts of the window frames. In our opinion, the hall in the Tekor temple could not have been covered with a stone vault, firstly, a 25 cm. projection is too small to serve as a support for a stone vault. For example, in the Odzun temple, the gallery vault rests from the inside on a wall about 40 cm. thick. Secondly, the cornice, which serves as a support, is interrupted by window frames, the presence of which already excludes the possibility that the gallery was closed with a stone vault. Thirdly, after the vault was demolished, numerous traces of limestone concrete would have remained on the walls, at least one to one and a half rows high, and this is clearly visible in the photos, that such traces are absent. In the Yereruyk temple, the halls had arches extending in the longitudinal direction, traces of which have been preserved in the form of a stone ledge on the wall of the south-eastern sacristy. There are no traces of longitudinal arches in the Tekor temple either. Therefore, it should be concluded that the roof of the halls, as well as the supporting columns, were entirely wooden (Fig. 21-23). We took the lowest point of the gallery roof as the minimum mark of the roof of the north-eastern altar (Fig. 21), and the highest point should not be higher than the lower part of the pair of windows on the western facade (Fig. 20).

The portals of the temple are reconstructed according to the traces of limestone concrete on the walls, as well as by analogies with the portals of the Yereruyk temple, with arches and gable pediments placed on pillars protruding from the plane of the wall (Fig. 24-27).

In conclusion, it should be emphasized the exceptional significance of this monument not only for the development of Armenian early medieval architecture. In fact, the Tekor temple laid the foundation for the creation of a new type of church architecture: a domed three-nave basilica.

Fig. 18: The north facade of the Tekor temple, theoretical three-dimensional reconstruction carried out by the author

Fig. 19: The east facade of the Tekor temple

Fig. 20: The west facade of the Tekor temple and the roof tiling

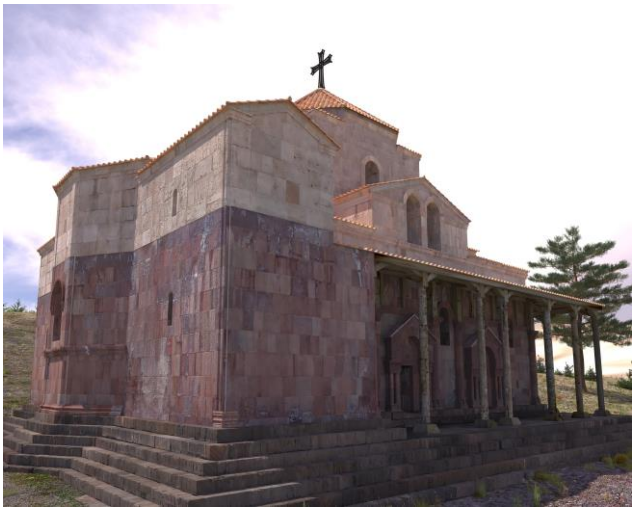

Fig. 21: Tekor temple, view from the northeast

Fig. 22: Tekor temple, view from the northwest

Fig. 23: Tekor temple, view from the southeast

Fig. 24: The northwest entrance to the Tekor temple

Fig. 25: The northeast entrance of the Tekor temple

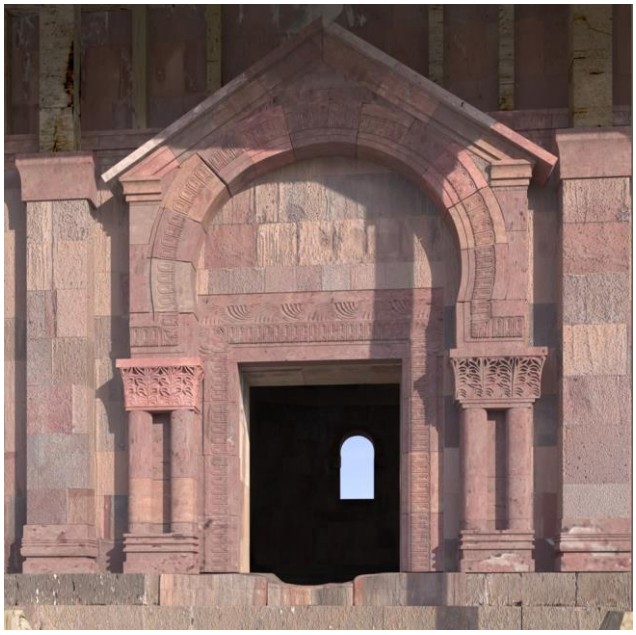

Fig. 26: The west entrance of the Tekor temple






Fig. 27: Details and capitals of the Tekor Temple

9. *Methodology*

The Tekor Temple is now located in Turkey. It is completely destroyed and it is impossible to make any metrology of the monument on site. Only the measurements and photos taken by Toros Toramanyan, the watercolour painting by Arshak Fetvadjian, as well as the photos taken by Josef Strzygowski and Garegin Hovsepyan have been preserved.

In the first stage, two-dimensional drawings of the building were made (Fig. 28.1) for which the measurements of facades, plans and archival photos served as a basis. For removing perspective distortion of archival photos we used Cigraph plugin of Graphisoft Archicad 16 software. For this purpose we have selected photos of facades that were taken from a frontal position. The real coordinates of four points of the structure (measurements taken on-site) are indicated on the photo. Then, on the same plane, two points are extended from the end points of the segment to apply the triangulation technique.

In the second stage, based on the obtained results, three-dimensional modelling of the structure was carried out (Fig. 28.2). We used Rhinoceros 8 computer software. The interior and exterior have been modelled by the NURBS modelling toolkit. During the reconstruction, special attention was paid to the temple's ornamental carvings, the basis for which was archival photos and drawings made by Arshak Fetfvdjian. For this purpose was used the Subd toolset of the mentioned software.

The roof tiles are also three-dimensional objects (Fig. 28.3), no displacement map was used. The modelling of the roof tiles was based on preserved examples from the given period. They mostly correspond to each other in both size and shape. The tiles were grouped randomly so that the colour play would be close to natural and the texture would not be repeated. For this purpose, an algorithm was created using the Grasshopper application of the Rhinoceros software, with the help of which it was possible to quickly and easily select, group and attach material to thousands of objects with the principle of randomness.

In the third stage, texture search and processing was carried out (Fig. 28.7, 28.8). Finding a suitable texture for the stonework of the Tekor temple proved challenging. The monuments preserved from this period are few, and the shape and colour of their arrangement did not correspond to the Tekor Temple arrangement.

The difficulty was compounded by the fact that the Tekor temple was built with two-coloured stones. To this should be added the stylobate with five steps. Therefore, not finding a corresponding texture among the monuments of the same period, we had to look for it in monuments built later.

For the reddish texture of the Tekor temple, we chose the stone texture of the gavit of the Harichavank monastery, built in the middle ages, located in the Shirak region of Armenia, and for the stylobate of the Tekor temple, the stylobate of the church of the same monastery. For the yellowish stone arrangement of the Tekor, we chose the stone arrangement of the gavit of the Kecharis monastery, built in the High Middle Ages, in the Kotayk region of Armenia.

The choice of the gavites for the texture was also due to the fact that the latter have few and small windows, and are outwardly restrained from the point of view of decoration, this circumstance significantly speeds up and facilitates the creation of a homogeneous texture.

For this purpose, three-dimensional scanning of the corresponding facades was carried out with photogrammetry method, using the Agisoft Metashape software. Then the obtained result in the form of an orthophoto image was imported into the Adobe Photoshop software for further processing (Fig. 28.9).

In the fourth stage, the creation of a real accurate environment of the Tekor temple was carried out, for which geolocation data was corrected and the landscape of the given location was exported using the Google Earth application, both in the form of a texture and a three-dimensional model. For this purpose, the RenderDoc computer program was used (Fig. 28.4). The obtained result was imported into the Blender program using the Maps Models Importer plug-in (Fig. 28.5).

In the fifth stage, all results were collected and imported into the Autodesk 3ds Max 2024 software and processed. In this program, the creation and organization of the environment was carried out, green cover and vegetation were scattered over the landscape using the Multiscatter plug-in (Fig. 28.10).

In the sixth stage, texture mapping, creation and attachment of materials, camera position selection, rendering was carried out using the V-Ray 3 plug-in of the given program.

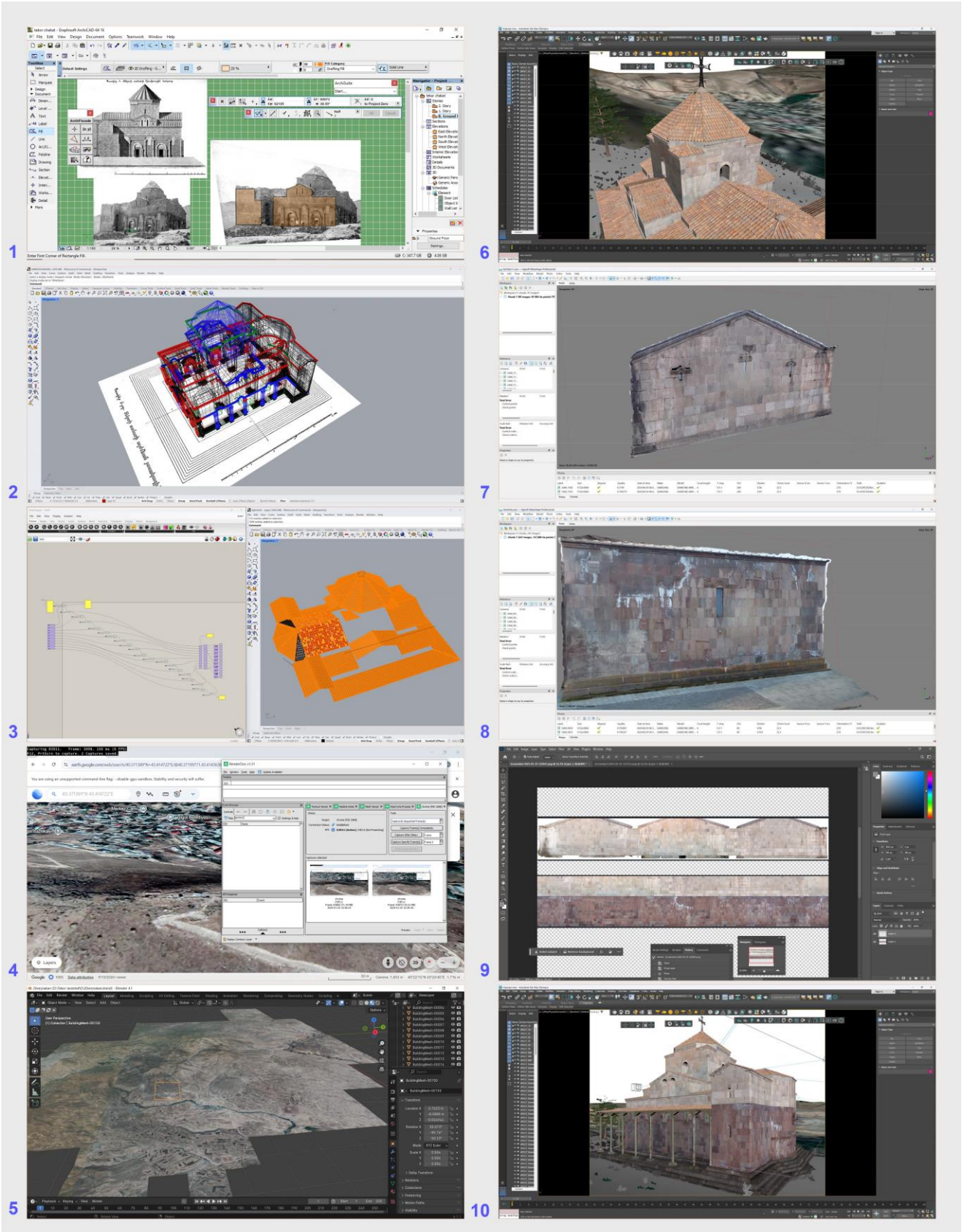

Fig. 28: Screenshots of used software: 1. Archicad 16; 2. Rhinocerros 8; 3. Grasshopper; 4. RenderDoc; 5. Blender 4.1; 6. 3ds Max 2024 (with the environment from the Google Earth); 7-8. Agisoft Metashape; 9. Adobe Photoshop; 10. 3ds Max 2024 (with a fully assembled scene)

10. Conclusion

As already mentioned, opinions on the Tekor temple differ. To better understand its architectural composition and subsequent modifications, we must first consider whether the monument was originally built as a three-nave basilica and later rebuilt as a domed basilica.

- A proportional analysis of similar monuments shows that the ratio of width to length of three-nave domeless basilicas corresponds to 1:2 to 1:2.5. In the case of domed basilicas, it is close to a square. The ratio of width to length of the Tekor temple is 1:15, therefore it corresponds to domed basilicas.
- The unprecedented thickness of the wall is not unusual for churches of this period. Photos of the destroyed sections of the walls clearly show that they are homogeneous and were built in the same construction stage.
- The transition from the domed square is made by trumpets, which, due to their small size, have often been considered purely decorative in the literature. However, taking into account the meticulousness of the builders in relation to the constructive details, we believe that they also have a structural significance.
- The eastern windows of the northern and southern facades of the Tekor temple show two stages of reconstruction. The latter were destroyed, and rebuilt in the 7th century with windows of the same size. Then in 1014 were closed with a stone layer.
- There are also two stages of reconstruction on the dome. The cornice of the pediment corresponds to the 7th century and the pediment to the 10th-11th centuries. Therefore, the top of the dome should be assumed to have been rebuilt at the same time as the windows in 1014.
- The lower and upper parts of the temple differ in the colour of the stone. In this regard, there are also conflicting points of view. However, in our opinion, the change in the colour of the stone was not due to aesthetic reasons but rather structural considerations. A lighter stone was used in the upper part.
- The galleries could not have been covered with a stone vault, as a 25 cm is not enough for a stone vault as a support, the distances between the columns are uneven, and there are no traces of concrete in the corresponding places of the walls. Therefore, the galleries were covered with wooden coverings.
- The entrances to the temple had gabled pediments, the traces of which are visible in the form of concrete on the walls on.
- The Tekor Cathedral was the first attempt by Armenian architects to build a three-nave domed basilica. It was planned and originally built as a three-nave four-aisled domed basilica. Therefore, it laid the foundation for the creation of a new type of church building.

REFERENCES

Texier, Ch., (1842). *Description de l'Armenie, la Perse et la Mesopotamie.* (p. 120). Paris

Թորամանյան, Թ. (1911). *Պատմական հայ ճարտարապետության, Ա, Տեկորի տաճարը.* (p. 5,6,15,25,97,98). Թիֆլիս

Стржиговский, Й. (2018). *Архитектура Армян и Европа. т I, книга вторая.* (pp. 126,163,128-129). Ереван

Հասրաթյան, Մ., (2002). Տեկորի Ս. Սարգիս վկայարանը, *Սուրբ Սարգիս, նստաշրջանի նյութեր.* (pp. 43,46-48,51). Երևան

Ղաֆադարյան, Կ., (1962). ՊԲՀ, № 2. Տեկորի տաճարի V դարի հայերեն արձանագրությունը և մեսրոպատառ այբուբենի առաջին տառաձևերը. (p. 45). Երևան

Токарский, И., (1961). *Архитектура Армении IV-XIV вв.* (p. 83). Ереван

Мнацаканян С., (1989). *Крестовокупольные Композиции Армении и Византии V-VII веков,* (pp. 58-60,94). Ереван

Мнацаканян, С., Оганесян, К., Саинян, А., (1978). *Очерки по истории архитектуры древней и средневековой Армении.* (p. 74). Ереван

Չուքասզյան, Գ., (2001). *Արշակ Ֆետֆաճյան,* Երևան (p. 59).

(1913). *Պատմութիւն Սեբէոսի Եպիսկոպոսի ի Հերակլն.* (p. 38).Թիֆլիս

Web Sources

https://www.europeana.eu/en/item/22/_37611

https://shnorhali.com/kars/

https://www.panorama.am/en/news/2016/04/24/Cultural-Genocide/1567927

https://raa-am.org/en/home/

https://www.rhino3d.com/learn/?query=kind:%20nurbs&modal=null

http://www.cigraph.it/en/node/286

https://www.rhino3d.com/learn/?query=kind:%20grasshopper&modal=null

https://www.sci.am/index.php?langid=2

https://www.rhino3d.com/learn/?query=kind:%20subd

https://www.asor.org/wp-content/uploads/2022/05/ASOR_Tutorial_04-13_Photogrammetry-Agisoft-Orthomosaic.pdf

https://www.labora.polimi.it/wp-content/uploads/2023/07/Guida-Maps-Blender.pdf