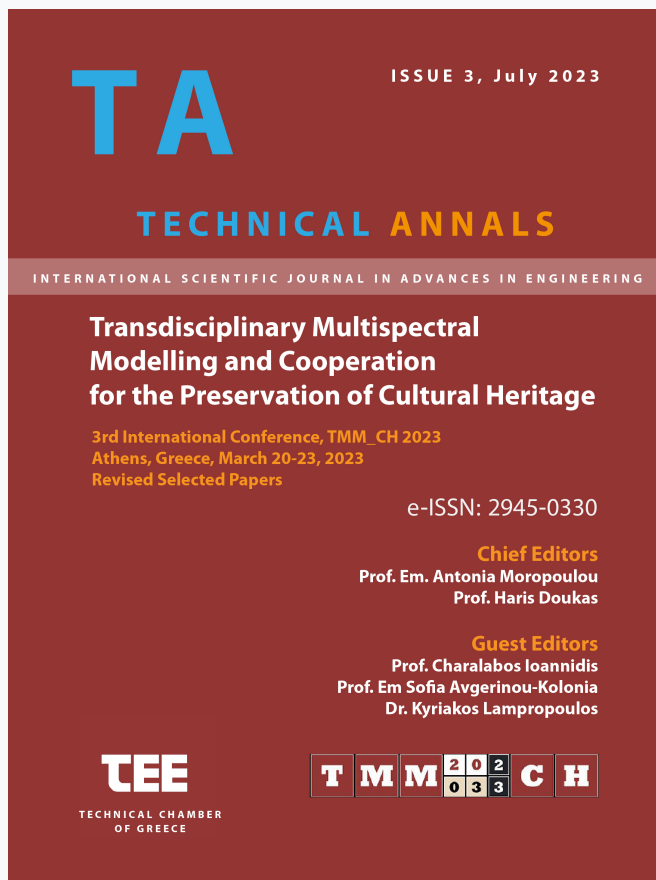


## Technical Annals

Vol 1, No 3 (2023)

Technical Annals



### Restoration and highlight of Agioi Theodoroi church in Nafplio with the use of CAD technologies

*Dimitris Psychogyios, Katerina Leptidou*

doi: [10.12681/ta.34881](https://doi.org/10.12681/ta.34881)

Copyright © 2023, Dimitris Psychogyios, Katerina Leptidou



This work is licensed under a [Creative Commons Attribution-NonCommercial-ShareAlike 4.0](https://creativecommons.org/licenses/by-nc-sa/4.0/).

### To cite this article:

Psychogyios, D., & Leptidou, K. (2023). Restoration and highlight of Agioi Theodoroi church in Nafplio with the use of CAD technologies. *Technical Annals*, 1(3). <https://doi.org/10.12681/ta.34881>

# Restoration and highlight of Agioi Theodoroi church in Nafplio with the use of CAD technologies

Dimitris Psychogyios<sup>1[0009-0009-5568-9064]</sup> and Katerina Leptidou<sup>1</sup>

<sup>1</sup>Department of Architecture, University of Thessaly, Pedion Areos, 38334, Volos, Greece  
dps@uth.gr

**Abstract.** The church of Agioi Theodoroi is located north of the new city of Nafplion in Greece. It is not proclaimed monument, but it constitutes important historical evidence of recent history of the city and of Greece in general, given that it is documented to be associated with one of the protagonists of the Revolution of 1821 Theodoros Kolokotronis and therefore it is inextricably linked to the collective historical memory.

This paper has a twofold objective. On the one hand, it describes the work of restoration and highlight of the church of Agioi Theodoroi, on the other hand, it presents the first results from the processing of the architectural, geometric, and historical data related to the building. The data resulted from both systematic interdisciplinary documentation and local community contribution, following an open invitation for relevant evidence. At the same time, the paper attempts to contribute to broader research related to the development of integrated data management methodologies at the scale of historic buildings and ensembles, in a single digital environment based on CAD technologies. Furthermore, this approach as well as the thematic maps developed, can facilitate, as a first and crucial step, the design and implementation of compatible conservation and enhancement interventions.

Since the beginning of building constructions to date, and the parallel systematic recording using CAD technologies, important data have emerged regarding the different construction phases of the monument. The results of the above allow the systematization and control of the ongoing restoration works. Finally, it is noted that this is the recording of a design documentation process that is implemented in parallel with the implementation of the project, a fact that will allow, within the completion of the project, to draw useful conclusions for the management of similar projects and for the contribution of digital technologies to the construction process.

**Keywords:** Cultural Heritage, CAD, Thematic maps, local communities, multi-disciplinary approach.

## **1 General project details**

### **1.1 Introduction**

As mentioned, the church of Agioi Theodoroi is located north of the new city of Nafplion, in the “Neo Byzantio” or “Kültepe” area, near the main road connecting Nafplion to Argos, on Kalamata Street. It is a small, simple construction, single aisled church with pitched tiled roof and a semi-circular sanctuary arch. The church is not proclaimed monument, but it constitutes important historical evidence of recent history of the city and of Greece in general, given that it is documented to be associated with one of the protagonists of the Revolution of 1821 Theodoros Kolokotronis and therefore it is inextricably linked to the collective historical memory. Today the church belongs to “Holy Church of Saint Constantine and Helen” in Nafplion. Due to celebrations for the 200 years anniversary of the Greek revolution, the committee “Greece 2021” has approved the financing of its restoration.

In recent years, scientific interest, and research towards the systematization of the scientific field of Architectural heritage and digital technologies has been increasing [1, 2]. In particular, research concerning religious monuments and churches appear and focus on issues such as the development of appropriate methodologies, protocols and guides for 3D digitization [3, 4, 5, 6], comparison of technologies and tools of digitization [8,9], development of integrated digital data recording and management solutions [10, 11], interconnection of geometric, architectural and historical data of the monuments with the aim of a holistic approach to the documentation and understanding of the monuments [12, 13, 14, 15, 16], development of accessible applications to end users with the aim of raising awareness of architectural heritage issues [17, 18, 19, 20]. Furthermore, of special interest for this presentation are research projects that focus on capturing, documenting, and highlighting small-scale historical temples with the use of digital technologies. We find research projects with emphasis on recording methodologies [21, 22, 23], database design and development [14], comparison of different technologies [24] and non-expert access to collected data [25].

This paper presents the initial diagnostic procedures as well as the first results from the plaster removals and the test sections in the construction field. The diagnostic procedures include the creation of multidisciplinary thematic maps in Computer Aided Design (CAD) environment, which incorporate: (a) data of historical and architectural documentation and (b) data of geometric documentation. It is about a work in progress and is proceeding with multidisciplinary collaboration between historians, architects, archeologists, material science engineers. Of particular interest is the involvement of the local community in support of the project and in archival/bibliographic research. Finally, the completion of the project will bring changes to the map of the city’s points of historical interest since it is located outside the historic city center. This event should have as its goal both the sustainable protection of the monument as well as the sustainable development of the wider area.

## **1.2 Description of the current condition of the building**

For this building there are no older studies, nor is it mentioned in the literature. The works on the restoration and enhancement of the church began in September 2022. An autopsy was carried out during which the following was established: Externally the temple was presented as a simple and unstructured building, with a prismatic volume and low proportions. The external surfaces of the walls were plastered with cement mortars. A semi-open space with a single-pitched tiled roof precedes the entrance to the church, and a newer metal door with glazing on the west façade leads inside. Internally, it is a single aisled, covered with a wooden roof carrier of newer construction, but originally it probably had a dome supported on the sufficiently thick masonry. A modern wooden iconostasis (templon) isolated the Sanctuary from the main temple. Regarding the form of the foundation of the monument, it was unknown and was not possible to be evaluated with certainty. The roof is formed on a wooden support of a newer construction, which is covered with a wooden layer (slim wooden boards). The trusses are placed at distances of about 90 cm and are located on the side walls of the temple. The covering is with Byzantine-style tiles with mortar. The roof of the niche of the sanctuary is covered with the same type of tiles. On the perimeter of the roof, a cornice is formed on the outside, which protrudes about 40 cm. All the exterior walls had been plastered (probably also grouted) with thrown cement mortar. All the exterior walls were additionally painted. The door of the church is newer, metal, single leaf, glazed and about 1m wide. Internally, the iconostasis was simple and isolated the sanctuary from the main temple. It extended across the entire width of the temple and had two doors, one of the Beautiful Gate and one to the north, which corresponded to the area of the Prothesis. It was found to consist of two sections, the lower section was a newer wooden structure while the higher section was an undated earlier wooden structure. The floor finish was ceramic tiles, and its layering was unknown. The inner surfaces of the walls were entirely covered in lime plaster. In the church there was an elementary electrical installation to cover lighting needs.

The surrounding area of the church was arranged in two levels, on the level of the west side where the entrance is and on the level of the north side of the temple. On the west side of the church, there was a platform with a floor of ceramic tiles. The roofed semi-open area/space on the west side is bound by two supporting walls. On these walls, along their entire length, were built later, linear benches. Moving further north, two large stair landings were formed, ending at the final level, 35 cm high from the western entrance. On the north side of the church, on its body, a linear bench, made of cement-bricks, had been built along its entire length, interrupted only by the north-ern opening of the church. The northern side of the surrounding area is bordered by a road, Kalamata Street. The whole surrounding area was paved with ceramic tiles. After visual inspection, no significant structural problems were found, and the building problems were limited. There was limited damage to the walls that was related to the descending and rising humidity and was manifested by spots mainly in the lower zone of the eastern wall and specifically in the niche of the sanctuary and in the nearby places. The church was facing several aesthetic problems, partly due to modern interventions. Initially, a small, crumbling warehouse built on the body of the church, at its northeast end, was

identified as a problem. Also, the newer coatings had altered the image of the monument and its historical and artistic value was not highlighted. Finally, it was found that there was a lack of design in the surrounding area and no information signs that would allow the visitor to understand the historical value of the church (see Fig.1).

Summarizing, four main objectives were set:

- Dealing with building and structural problems to eliminate the risks posed by their presence and to prevent further damage.
- The aesthetic upgrade of the church and its immediate surroundings.
- The highlighting of its degraded historical value.
- The use of the restored monument by the local community.



**Fig. 1.** North–West view of the church before the building works. (7/9/2021)

### **1.3 Building and structural works**

The following were defined as the basic principles of intervention: The preservation of the authenticity of the monument through the conservation, restoration and maintenance of the elements that have remained unchanged. The highlighting of those elements that have been damaged, but their restoration is possible. The use of traditional materials and building methods, with the commitment that, where these seem insufficient, the parallel use of modern methods and materials that have been tested in other similar interventions will be made. The distinct differentiation of the new materials from the original parts of the monument. The reversibility of interventions as far as possible. The clear morphological and construction separation of the new constructions that will be implemented.

Based on the above, the following works have been launched: Removal of newer surface coatings and mortars from the external faces. Grouting with compatible materials, local grouts in cracked areas if required. Disclosure of foundation and its possible reinforcement. Construction of a drainage ditch around the perimeter of the church. Test sections of internal coatings where necessary. Floor removal/ dismantling and

reconstruction with compatible materials. Remodeling of facades and construction of a belfry (bell tower). Configuration of the surrounding area, with care for access for the disabled, configuration of a parking area and placement of an information sign and supervisory material.

To date, the removal of plaster on the exterior masonry, the test cuts on the interior masonry, the excavation of the northern part of the surrounding area, the removal of interior floors and the detachment of the newest part of the iconostasis have been carried out (see Fig.2, Fig.3, Fig.4, Fig.5)



**Fig. 2.** North–West view of the church. Removal of plaster on the exterior masonry. Excavation of the northern part of the surrounding area. (24/9/2022)





**Fig. 3.** South–East view of the church. Removal of plaster on the exterior masonry. (24/9/2022)



**Fig. 4.** Interior of the church. Test cuts on the interior masonry. Removal of interior floors  
Detachment of the newest part of the iconostasis.



**Fig. 5.** Interior. Removal of plaster on the interior masonry. (23/6/2023)

#### **1.4 Scientific conference and invitation to the local community to participate.**

In parallel with the above, the Department of Architecture, University of Thessaly, in collaboration with the Municipality of Nafplio and the Holy Church of Agioi Konstantinos & Eleni in Nafplio, organized a scientific conference entitled "Restoration and Promotion of the Church of Agioi Theodoroi of Nafplio - Interdisciplinary Approaches" [26]. The purpose of the conference was to inform, exchange documented opinions and interact between different specialties of scientists and the local community on topical issues of restoration and promotion focusing on the specific project. At the same time, a student workshop was held at the construction site of Agioi Theodoroi (see Fig.6). The topics were related to:

- the post-Byzantine churches of Argolis and other regions of Greece.
- The Architecture, of the city of Nafplio in the Ottoman and Post-Revolutionary period.
- Theodoros Kolokotronis and his story.
- The history of the ownership status of the temple.
- The role of the church as a historical and religious place.

Also, historical evidence (photographs, contracts, documents, plans, etc.) of the temple that were granted to the research team by citizens was presented. Finally, the discussion included topics such as the role of cultural heritage monuments in urban development and the prospects that can be created for the city of Nafplio with the completion of the specific project.





**Fig. 6.** Student workshop on site (19/11/2022)

## **2 Project Methodology**

### **2.1 Process**

In order to make use of all the data and information obtained from the above actions, the methodology shown in the following diagram was followed (see Fig.7). This includes Geometric, Architectural and Historical Documentation. To date, the first three steps have been largely completed.

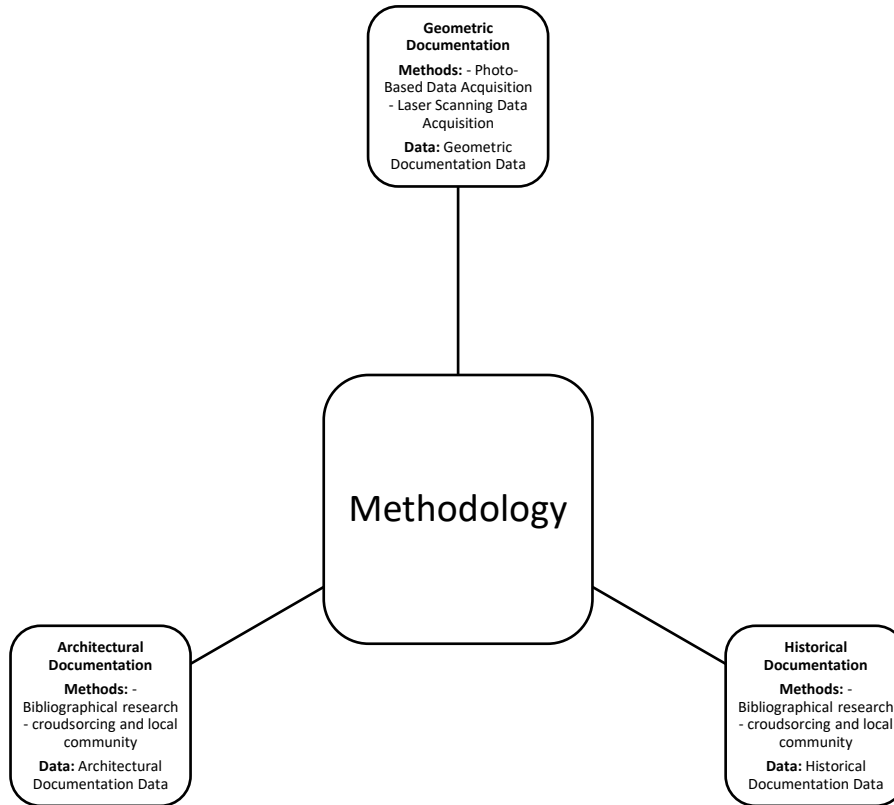


Fig. 7. Diagram of the process

## 2.2 Geometric Documentation

Technological developments in the field of geometric documentation offer many different combinations for the geometric documentation of monuments, depending on their size, the level of complexity, the desired and required accuracy of the developed outputs and equipment. In this paper, a combination of different methods was the ideal solution for geometric and architectural documentation to achieve the desired results.

**Geometric surveying in tape and laser.** Six hand-drawn sketches were made in which the detailed dimensions of the temple were marked. The sketches show the horizontal section (floor plan) at a height of 1m, the four elevations and the north-south axis section. Measurements were taken with a tape measure and verified with a Bosch PLR 40 C laser accelerometer, provided by the research unit "Architectural Design, Digital Construction and Building Technology" of the Department of Architecture, University of Thessaly, with an average spatial resolution of  $\pm 5-6$  mm. The accuracy of the measurements with the tape measure was two decimal places and with the laser

to three decimal places, information that was not considered worthwhile and was ignored. The external contour of the building was confirmed by a Trimble 5800 GPS topographic device which gives a deviation of 0.25m. The design material produced facilitated further processing of the architectural documentation of the church and allowed the design team to empirically observe and understand the details and particular parts of the structure on site.

**Photo-Based Data Acquisition.** A database of photographs was created which provided the necessary information of the facades and surface details of the structure as well as the necessary information for the development of the building material maps. A Canon PowerShot SX50 HS digital camera with a 12.1 Megapixel sensor (1/2.3" CMOS) with a 24 - 1200 mm (50X) lens was used for the acquisition of data based on photographs. A Parrot Anafi unmanned aerial vehicle (UAV) with an HDR: 4K 30fps camera provided by the research unit "Architectural Design, Digital Construction and Building Technology" of the Department of Architecture of the University of Thessaly was also used. These cameras were used for photorealistic texture mapping and for the quality of the images produced. A specific number of digital images were taken depending on the difficulties encountered in each case. In addition, the tree trunks, almost in contact with the south façade, added difficulties to the data collection process. Therefore, images were taken at close range (in many cases, less than 1.5 m). Digital images were taken from different angles and distances. In the case of the western façade, documentation was very difficult in the highest part due to the proximity to the semi-conservatory. In total, about 20 images were taken for each façade from different distances and multiple angles, covering the exterior facades of the church. In addition, all exterior walls incorporating texture, surface variation, material variation and alterations were obtained in the developed model of the church. two levels of headings should be numbered.

### 2.3 Architectural and Historical Documentation

As mentioned above, a preliminary survey was carried out to collect all available information on the architectural analysis of the monument since there was no previous documentation for this particular building. Also, a scientific conference [26] was organized with invited speakers from different scientific fields (history, archaeology, architecture, law) directly or indirectly related to the temple. In addition, in the context of the conference, an open invitation was made to institutions and citizens of the local community to contribute evidence related to the temple. Finally, a survey was carried out on previous interventions in the temple. All interrelated information regarding the documentation and investigation of the current state of preservation of the temple consists of various elements. Beginning with the historical documentation, a complete and in-depth understanding of the structure and history was achieved through a thorough literature search, including past photographs, drawings and plans of the historical documentation (see Fig.8, Fig.9, Fig.10).

At this point it should be noted that it is important to complement the project with the on-site application of the non-destructive techniques of digital microscopy, infrared thermography, and ground penetrating radar to generate data for material characterization and deterioration diagnosis of building materials.



**Fig.8.** Photographic documentation of the west façade (adopted from [14]).



**Fig. 9.** Photographic documentation of south-west view (Adopted from [14]).



**Fig.10.** Photographic documentation of north facade (Adopted from [14]).

### **3 Results**

#### **3.1 Geometric Documentation Data**

The next step was to process the sketches and photographs of each facade and convert them into drawings using CAD technologies. Initially, each façade was worked out as a different project using masks of edited images. After processing the data for all facades, a 3D model of the Catholic Church was constructed. Selected images were used to process the orthoimages of each facade to ensure quality texture. To advance the interdisciplinary process, four orthoimages were created, one for each facade of the church. These orthoimages served as blueprints for further processing of thematic maps incorporating not only qualitative information but also quantitative data. (See Fig.11, Fig.12)

Various methods were used to develop two-dimensional drawings (plans and sections). The required resolution was  $\pm 1.5$  cm. In addition to the architectural documentation of the structure, the survey aimed to identify various deformations and alterations compared to the original condition of the structure. First, the planes of the sections were determined in two sections that constitute the main axes of symmetry of the monument. In addition, a horizontal section at +2.10 m elevation was defined to cross most of the temple openings.





**Fig. 11.** Orthoimage of the north façade.



**Fig. 12.** Orthoimage of the south façade.

### **3.2 Historical Documentation Data**

The reason for the in-depth historical research, financing and implementation of the project was the change in its ownership status. The building was donated in 2015 by the Retalis family to the legal entity of the Holy Church of Saints Constantine and Helen. In order to proceed with the transfer process, an inspection of the ownership documents was carried out, which revealed the systematic and documented link between the building and Theodoros Kolokotronis.

According to data provided by the Retalis family and based on the research of the notary Nikolaos Tobras [27-30], the documents concerning of the ownership of the wider area, in which the church is located, are as follows:

- Law 10/23-05-1839 entry 18<sup>th</sup>, Theodoros Kolokotronis, Land and place Nafplion" (see Fig. 13).
- The will of Theodoros Kolokotronis of 3 May 1841, where he invites Charalambos Papadopoulos Mnemonas - Notary Public of Nafplio to his estate near "Kioulutepe" on the outskirts of Nafplio, to prepare and write it.
- The publication by the Athens District Court of 25 May 1868 of the secret will of Lieutenant General Ioannis Gennaios Th. Kolokotronis, which had been submitted to the notary of Athens St. Tavanakis. In this document, the land in Nafplio, as in other places, is not mentioned in detail, but is left to his heirs as common. (See Fig. 14)
- The contract number 15.987/02-08-1871 of the notary of Athens Vasileios Lambrolis where it is mentioned that in September 1869 a distribution report had been issued by the Magistrate of Nafplio.<sup>7</sup> In this contract it is mentioned that relevant

drawings depicting the fields were attached to the relevant report. Also, that the land that had passed to the grandfather of the parties to the contract, General Theodoros Kolokotronis, constituted National Lands.

- In 1898 Angeliki, widow of Theodoros Ioann. Kolokotronis (or Falez) declares that under the 14.529/1890 contract of the notary Tasos N. Economou and in conjunction with the secret will of Ioannis Gennaios Th. Kolokotronis, i.e., her father-in-law, which had been filed with the notary of Athens St. Tavana, who had been a trustee of the estate, occupied a land in the location "Kioulu Tepe" of Nafplio of about forty-five acres. It also contains a church honored in the name of Agioi Theodoroi and is bordered on the east by the old Argos Street, on the north by the fields of the heirs of Constantine Th. Kolokotronis formerly and already owned by K. Retalis, west with the new Argos Street, south with river and the fields of P. M. Iatrou and Michael Damoulou. He sells the above land to the brothers Konstantinos D. Retalis, Gregorios D. Retalis, farmers, residents of Aria, Nafplion and Georgios D. Retalis, wine seller, resident of Nafplion by shares. It excludes from the above land the holy church of Agioi Theodoroi, which he retains, and which will pass to the buyers after its death, but from now on it appoints them as managers and responsible for the maintenance of the church.
- In 1900, on the 29.184 contract of the notary Tasos N. Economou, some of the heirs of Ioannis Kolokotronis promise and undertake the obligation towards the Retalis brothers that if the heirs of Panagiotakis Th. Kolokotronis, with whom, as mentioned above, they were in conflict, ask for a percentage of the above major land, they will assume this financial obligation and the Retalis brothers will not be liable.
- Subsequently, in the course of time, the Retalis brothers divided the central undivided land among themselves and George D. Retalis received the part that included the holy church of Agioi Theodoroi, of fifteen acres. His children inherited it when he passed and they in turn distributed his property by a relevant contract of 1932 of the notary of Nafplion, Panagiotis An. Perrakis.
- The new land that was created and which included the church, was given to Michael Georg Retalis. His heirs Penelope Arvanitis née Retalis, Niki Chiotakakakou née Retalis and George M. Retalis, in 2015 donated the Holy Church of Agioi Theodoroi to the Holy Church of St. Constantine and Helen of Nafplio.

Moreover, G. Chorras [28], refers to the property of Theodoros Kolokotronis in Nafplio and gives another dimension to the issue. He wrote that "the victors, worn out by the struggles, looked to Nafplio, in Kolokotronis' words, 'as the anchor of Greece". In addition to Theodoros Kolokotronis, G Chora mentions the property of Bouboulina in Agia Moni, Miaoulis at the Prophet Elias and Manto Mavrogenous next to Agios Spyridon and essentially claims that Nafplio was an attractive destination for important personalities of the revolution.

The church of Agioi Theodoroi is neither mentioned nor analyzed by researchers of Byzantine architecture, besides, it is not a listed monument until today. In its present form, it is a small, mono-spatial, runic church with a gable roof and semicircular sanctuary arch. Ioannis D. Varalis, Associate Professor of Byzantine Archaeology at the

University of Thessaly, Department of History, Archaeology and Social Anthropology, in his presentation [26], attempting to link the temple with similar cases, mentions the following characteristic buildings of post-Byzantine temple architecture in Argolida.

- Ligurio, monastery of Agios Mercurion, late 17th and early 18th century (single-aisle basilica)
- Prosymni, church of St. John, 18th century (?) (Single-aisle Basilica)
- Asini, church of Agios Dimitrios, 18th - 19th century (single-aisled basilica)
- Argos, Agios Charalambos in Trikoupis property, approx. 1830 (Single-aisled basilica)
- Asini, Transfiguration of the Saviour, 14th - 15th century and wall. 1569 by Theodosius Kakavas (single-aisle basilica)
- Epidaurus, monastery of Panagia Polemarcha, 15th and early 18th century (Triclinic Basilica)
- Argos, church of St. John, 1829 (Triclinic Basilica)
- Nafplio, church of St. George, addition of western portico and narthex, 1834 (triple-aisled basilica)
- Ligurio, Assumption of the Virgin Mary, 1701 (Cruciform inscribed)
- Ligorio, Agia Marina, 1713 ("Cruciform inscribed")
- Argos, Agios Vasilios, late 17th century (Cruciform)
- Plataniti, Assumption of the Virgin Mary, late 17th century (Cruciform)
- Argos, Agios Nikolaos, late 15th c. and ca. 1700 (Cruciform)
- Arachneio (Heli), complex of the churches of Agios Nikolaos (Assumption of the Virgin Mary) and Agia Marina, late 15th - early 16th century (Cruciform churches)

Based on the above and on the evidence that has emerged so far from the external plaster removals in the project, the church of Agioi Theodoroi represents a typical example of post-Byzantine church architecture in Argolida, following the type of the single-aisle basilica with a gabled roof with a tiled roof that we find in Lygourio and Asini. The masonry is for the most part with rough or semi-worked stones, bonded with mortar and is differentiated on the eastern side where the niche of the sanctuary is located. The sanctuary consists of a three-sided niche and is one of the places where the masonry layers are built of many large, squared stones, with very small joints and almost no mortar. Most of the interventions are on the west side of the church and around the upper layers of the masonry, which proves the multiple interventions on the roof. Of particular interest is the corner connecting the eastern and western sides of the church. Before the work was started, all the walls were plastered and painted. During the external plaster removal of the walls, different building phases gradually appear. Inside, the temple is single aisled (mono-spatial) and there seems to have been a large arch supporting the roof, starting from the floor, and forming a semicircle. Today there is only part of the arch as shown in the section AA drawing (see Fig. 15).

It should be noted that the only drawing documentation in which the temple building appears are two. The topographical diagram for Nafplio of the French scientific expedition of the Moria (1828-1836) [29] and the attached drawings of the contract number 15.987/02-08-1871 of the notary of Athens Vasileios Lambroulis. In it Theodoros (or Falez) of Konstantinos Kolokotronis and Rallou Karatzas (grandson) sells to his

daughter's husband (his son-in-law) various parts of the original inheritance both located in Dalamanara Argolida, and in the location "Kipos Kiouloutepes" which he held ex-dividedly with his sisters from their father (see Fig. 14).

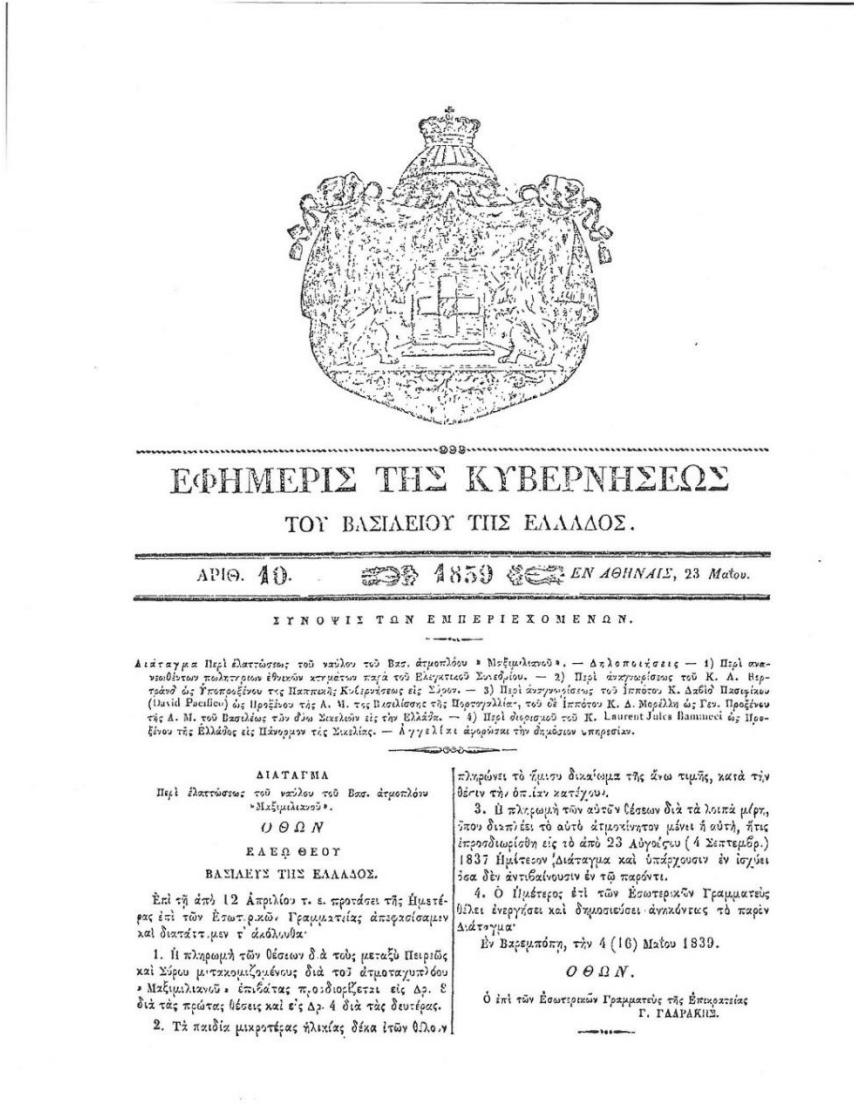


Fig.13. Documentation Law (FEK) 10 / 23-05-1839 (Adopted from [13]).



Fig. 14. Documentation publication by the Athens District Court of 25 May 1868 of the secret will of Lieutenant General Ioannis Gennaios Th. Kolokotronis (Adopted from [13]).





**Fig. 15.** Documentation of the attached drawings of the contract number 15.987 / 02-08-1871 of the notary of Athens Vasileios Lambroulis (Adopted from [14]).

### 3.3 Architectural Documentation Data

For the needs of the project, floor plan, section and elevation drawings were prepared to date (see Fig. 16, Fig. 17). The architectural documentation drawings (derived from the geometric documentation) provided information on the state of preservation of the structure. The construction phases of the project were observed and validated as well as individual alterations to the surface of the structures. In addition, the developed orthophotos from the geometric documentation process were digitized for each façade, contributing to the interdisciplinary process as presented in this paper. Each element is to be classified in terms of building material, deterioration, architectural and artistic details (see Fig. 18, Fig. 19). During the process of mapping the classified data, several layers of information were created, forming a database.

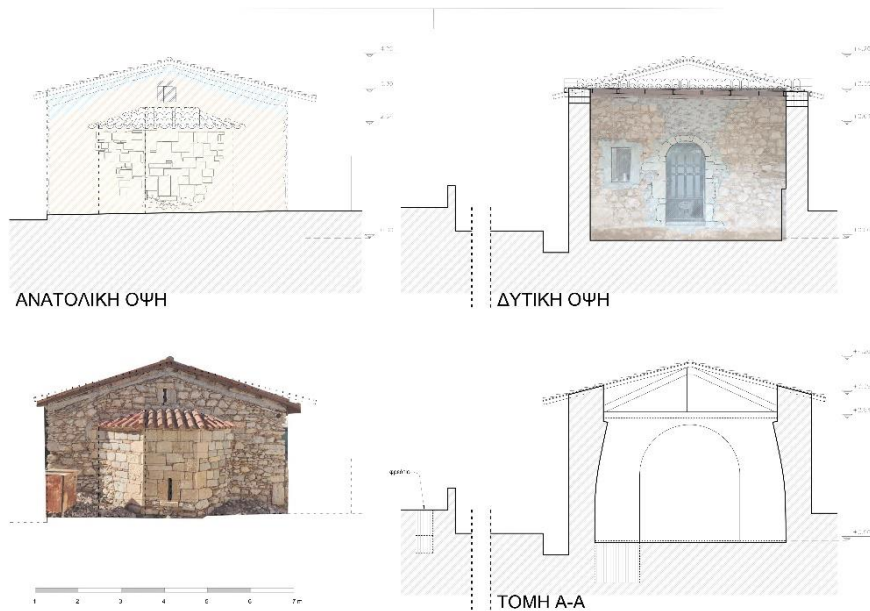
The external dimensions of the main temple are 5.60 m × 9.90 m, and the dimensions of the basic rectangular plan are 3.90 m × 8.30 m. To the west, the frontage is extended by 3.50 m. The thickness of the wall construction varies due to the semicircular section of the masonry. At the height of the present road the thickness of the north wall is about 83cm, on the south frontage 83, 75 cm, on the east frontage 85, on the sanctuary niche 50cm and on the west 73cm.

From the data of the project so far, two large construction units have been identified, the main single-space temple (Construction Unit A - KEA) and the portico on the west side of the temple (Construction Unit B - KEB). The main temple comprises the following building units:

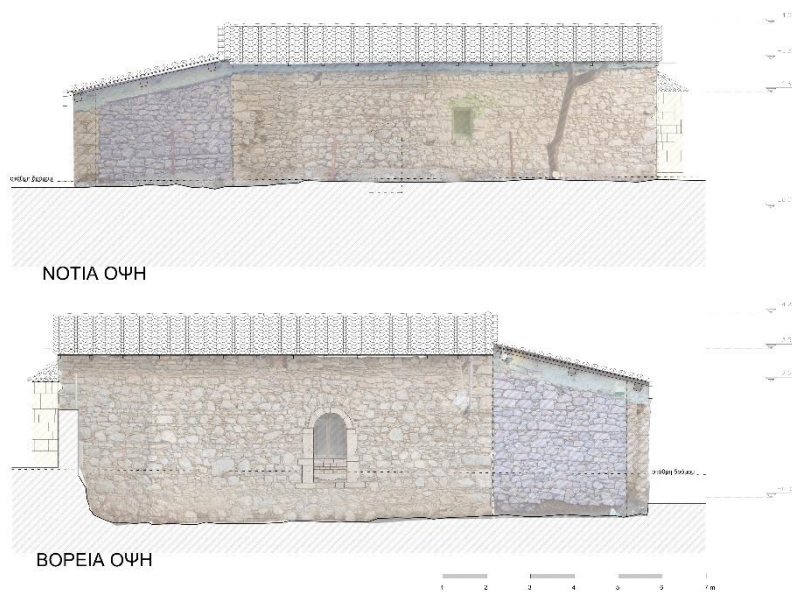
1. The construction sub-unit 1 (KEA1) includes the pitched roof, consisting of a main truss on which the ridge beam is supported and four smaller trusses with

different slope on which are supported the rafters, the thin wooden layer, and the Byzantine-type tiles.

2. The construction sub-unit (KEA2) includes a small perimeter zone at the top of the masonry. A large section of the western masonry has also been included in this sub-unit. The upper part of the western masonry remains undetermined due to the non-completion of plaster removal works.
3. The construction sub-concept (KEA3) includes most of the masonry of the main temple. It is rough or semi-worked stones (combination of small and large sized stones), bonded with mortar. Large stones are used in the corners and carved material has been used in the opening on the north side.
4. The construction sub-unit (KEA4) appears exclusively in the polygonal niche of the sanctuary (eastern side) and consists of carved stones. Of particular interest is the fact that this type of masonry is found starting about 15-30 cm above the present ground level. Further work will be needed to identify and study the foundations of both the eastern and southern sides.
5. Construction sub-units (KEA5) and (KEA6) are located on the south side in limited locations. In particular, a double section of masonry has been identified in (KEA5) and a construction discontinuity has been identified in (KEA6) above the current opening.
6. The portico on the west side of the temple includes the construction units (KEB1) and (KEB2)
7. The construction sub-unit (KEB1) includes the two rough or semi-worked stone walls of the portico while (KEB2) includes the two piles. From the excavations in the northern part, it has been established that the foundations of the two sub-units are at a higher level. It has also been established, from photographs taken in the 1950s and 1970s, that the portico has undergone various alterations.



**Fig. 16.** Clockwise Architectural drawing of the East Façade, Architectural drawing of the West Façade, Cross Section A-A drawing, Orthoimage of the East Façade



**Fig. 17.** Up Architectural drawing of the South Façade, Down Architectural drawing of the North Façade.

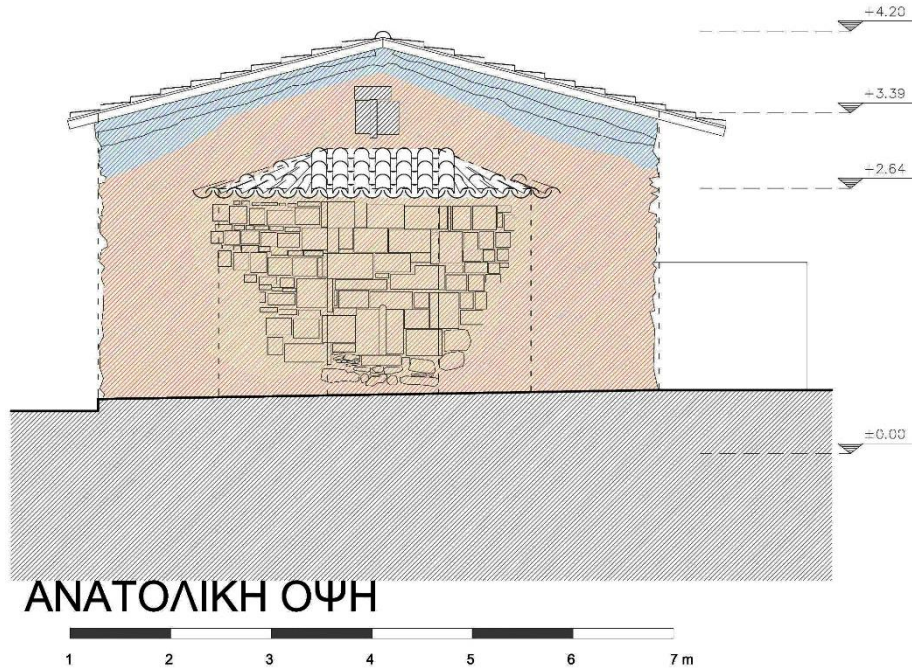


Fig. 18. Construction phases thematic map-east façade.

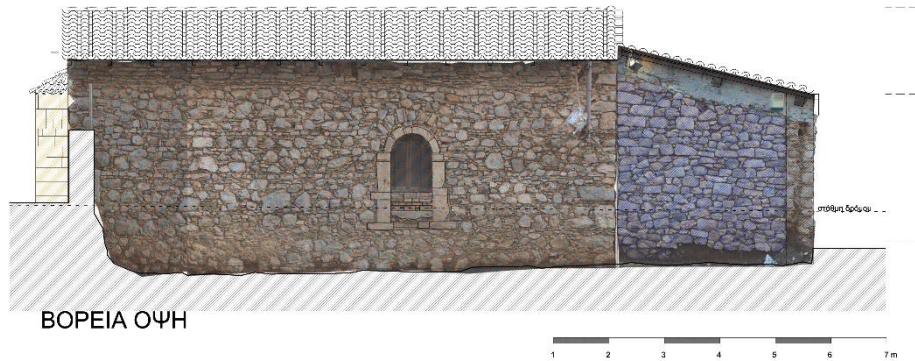


Fig. 19. Construction phases thematic map – north façade

#### 4 Conclusion

As shown in the construction phases of the monument (images), the main church retains the original building materials except for the roof, a large part of the west façade and the window of the south façade, where there is an undocumented restoration that took place in the 1950s. In addition, older and more recent building interventions have taken place on the portico and are probably related to the interventions on the west elevation and the double masonry that appears on the corner of the west and south



elevations. The eastern side has suffered the least interventions but the part of the masonry of the polygonal niche of the sanctuary remains unclear.

Besides the thematic maps of building phases, it is important to develop thematic maps of building material and decay in order to be able to perform a combined (historical / architectural / decay of materials) qualitative and quantitative assessment of the state of the monument.

This paper describes the progress of restoration and enhancement of the Church and the first results from the introduction of a specific interdisciplinary data representation methodology using CAD technologies. The data is derived from historical, architectural, geometric, structural and deterioration documentation (Figure 21).

The representations relate to the state of preservation in terms of pathology of building materials in combination with the geometric and architectural documentation data. The construction phases of the monument are also depicted, ensuring sustainability in terms of planning and implementation of conservation and restoration interventions. Each documentation process contributes equally to the illustrated diagram to create the multi-thematic thematic maps.

## References

1. Mansuri, Lukman & Patel, Dilip & Udeaja, Chika & Ncube, Chiko & Trillo, Claudia & Kwasi, Gyau & Jha, Kumar. (2021). A systematic mapping of BIM and digital technologies for architectural heritage. *Smart and Sustainable Built Environment*. 11. 1060-1080. 10.1108/SASBE-11-2020-0171
2. Khalil, A., Stravoravdis, S. & Backes, D. Categorisation of building data in the digital documentation of heritage buildings. *Appl Geomat* 13, 29–54 (2021). <https://doi.org/10.1007/s12518-020-00322-7>
3. Barsanti, S. G., Remondino, F., Fernández-Palacios, B. J., & Visintini, D. (2014). Critical Factors and Guidelines for 3D Surveying and Modelling in Cultural Heritage. *International Journal of Heritage in the Digital Era*, 3(1), 141–158. <https://doi.org/10.1260/2047-4970.3.1.141>
4. Masciotta, Maria & Sánchez-Aparicio, Luis & Bishara, S. & Oliveira, Daniel & González-Aguilera, Diego & García-Alvarez, J.. (2021). Digitization of Cultural Heritage Buildings for Preventive Conservation Purposes. 10.23967/sahc.2021.081.
5. Adamopoulos, E.; Tsilimantou, E.; Keramidas, V.; Apostolopoulou, M.; Karoglou, M.; Tapaki, S.; Ioannidis, C.; Georgopoulos, A.; Moropoulou, A. Multi-sensor documentation of metric and qualitative information of historic stone structures. In *Proceedings of the 26th International CIPA Symposium, IV-2/W2 Ottawa, ON, Canada, 28 August–1 September 2017*; pp. 1–8
6. Raisa Mammoli, Chiara Mariotti, Ramona Quattrini.: Modeling the Fourth Dimension of Architectural Heritage: Enabling Processes for a Sustainable Conservation. *Sustainability* 2021,13,5173 (2021).
7. Juan Moyano, Ángel Justo-Estebanz, Juan E. Nieto-Julián, Alfonso Ojeda Barrera, María Fernández-Alconchel,
8. Evaluation of records using terrestrial laser scanner in architectural heritage for information modeling in HBIM construction: The case study of the La Anunciación church (Seville), *Journal of Building Engineering*, Volume 62, 2022, 105190, ISSN 2352-7102,



- <https://doi.org/10.1016/j.jobe.2022.105190>. (<https://www.sciencedirect.com/science/article/pii/S2352710222011962>)
9. Pierre Smars.: Documenting Architectural Heritage, Looking for balance between automation and control. *Conservation Science in Cultural Heritage* (2007).
  10. Wei Wang, Mengmeng Hei, Fan Peng, Jing Li, Shaobin Chen, Yuanyuan Huang, Zhuangbo Feng, Development of “air-ground data fusion” based LiDAR method: Towards sustainable preservation and utilization of multiple-scaled historical blocks and buildings, *Sustainable Cities and Society*, Volume 91, 2023, 104414, ISSN 2210-6707, <https://doi.org/10.1016/j.scs.2023.104414>. (<https://www.sciencedirect.com/science/article/pii/S2210670723000252>)
  11. Rocío Mora, Luis Javier Sanchez-Aparicio, Miguel Angel Mate-Gonzalez, Joaquín García-Alvarez, María Sanchez-Aparicio, Diego Gonzalez-Aguilera.: An historical building information modelling approach for the preventive conservation of historical constructions: Application to the Historical Library of Salamanca. *Automation in Construction* 121(2021), 103449 (2021).
  12. Francesca Noardo, Architectural heritage semantic 3D documentation in multi-scale standard maps, *Journal of Cultural Heritage*, Volume 32, 2018, Pages 156-165, ISSN 1296-2074, <https://doi.org/10.1016/j.culher.2018.02.009>. (<https://www.sciencedirect.com/science/article/pii/S1296207417303710>)
  13. Bruno, N.; Roncella, R. HBIM for Conservation: A New Proposal for Information Modeling. *Remote Sens.* 2019, 11, 1751. <https://doi.org/10.3390/rs11151751>
  14. Themistocleous, Kyriacos & Mettas, Christodoulos & Evagorou, Evagoras & Hadjimitsis, Diofantos. (2019). The use of UAVs and photogrammetry for the documentation of cultural heritage monuments: the case study of the churches in Cyprus. 18. 10.1117/12.2533056.
  15. Aricò, M.; Lo Brutto, M.; Maltese, A. A Scan-to-BIM Approach for the Management of Two Arab-Norman Churches in Palermo (Italy). *Heritage* 2023, 6, 1622-1644. <https://doi.org/10.3390/heritage6020087>
  16. Giuffrida, D.; Mollica Nardo, V.; Neri, D.; Cucinotta, G.; Calabrò, I.V.; Pace, L.; Ponterio, R.C. A Multi-Analytical Study for the Enhancement and Accessibility of Archaeological Heritage: The Churches of San Nicola and San Basilio in Motta Sant’Agata (RC, Italy). *Remote Sens.* 2021, 13, 3738. <https://doi.org/10.3390/rs13183738>
  17. Patricia Hernandez-Lamas, Beatriz Cabau-Anchuelo, Oscar de Castro-Cuartero, Jorge Bernabeu-Larena: Mobile Application, Geolocation and Information Technologies for the Study and Communication of the Heritage Value of Public Works. *Sustainability* 2021,13,5173 (2021).
  18. Banfi, F. The Evolution of Interactivity, Immersion and Interoperability in HBIM: Digital Model Uses, VR and AR for Built Cultural Heritage. *ISPRS Int. J. Geo-Inf.* 2021, 10, 685. <https://doi.org/10.3390/ijgi10100685>
  19. Giuffrida, D.; Bonanno, S.; Parrotta, F.; Mollica Nardo, V.; Anastasio, G.; Saladino, M.L.; Armetta, F.; Ponterio, R.C. The Church of S. Maria Delle Palate in Tusa (Messina, Italy): Digitization and Diagnostics for a New Model of Enjoyment. *Remote Sens.* 2022, 14, 1490. <https://doi.org/10.3390/rs14061490>
  20. Bolognesi, C.M.; Fiorillo, F. Virtual Representations of Cultural Heritage: Sharable and Implementable Case Study to Be Enjoyed and Maintained by the Community. *Buildings* 2023, 13, 410. <https://doi.org/10.3390/buildings13020410>
  21. Delegou, E, Mourgi, G., Tsilimantou, E., Ioannidis, C., Moropoulou, A.: A Multidisciplinary Approach for Historic Buildings Diagnosis: The Case Study of the Kaisiariani Monastery. *Heritage* 2(2019), 1211–1232 (2019).

22. Masciotta, Maria & Sánchez-Aparicio, Luis & Bishara, S. & Oliveira, Daniel & González-Aguilera, Diego & García-Alvarez, J.. (2021). Digitization of Cultural Heritage Buildings for Preventive Conservation Purposes. 10.23967/sahc.2021.081.
23. Pavlidis, & George, & Tsiafakis, & Tsiafaki, Despoina & Tsioukas, Vassileios & Mardiris, Vassilios & Koutsoudis, Anestis & Anestis, & Arnaoutoglou, & Fotis, & Chamzas, Christodoulos & Christodoulos,. (2007). Preservation of Architectural Heritage Through 3D Digitization. *International Journal of Architectural Computing* vol. 5 - no. 2, pp. 222-237. 5. 10.1260/1478-0771.5.2.222.
24. Prokop, Anna & Nazarko, Piotr & Ziemiański, Leonard. (2021). Digitalization of historic buildings using modern technologies and tools. *Budownictwo i Architektura*. 20. 083-094. 10.35784/bud-arch.2444.
25. Bolognesi, C.M.; Fiorillo, F. Virtual Representations of Cultural Heritage: Sharable and Implementable Case Study to Be Enjoyed and Maintained by the Community. *Buildings* 2023, 13, 410. <https://doi.org/10.3390/buildings13020410>
26. Diavlos gmet, live web streaming service, <https://diavlos.gmet.gr/event/e4107>, last accessed 2023/02/11.
27. Argolikos Archival Library of History and Culture, <https://argolikivivliothiki.gr/2022/11/23/histor-of-agios-theodoros-in-nafplion/>, last accessed 2023/02/11. (Αργολική Αρχαιολογική Βιβλιοθήκη Ιστορίας και Πολιτισμού)
28. G. Chorras,:"The Holy Monastery of Aria in Nafplio", PhD dissertation, department of Theology, National and Kapodistrian University of Athens, Athens (1975). Γ. Χώρας: Η Αγία Μονή Αρείας, διδακτορική διατριβή, Θεολογική σχολή του Εθνικού και Καποδιστριακού Πανεπιστημίου Αθηνών, Αθήνα (1975)
29. Moreas S.A., The French scientific expedition of the Moria (1829-1838), Melissa Publishing House; Bilingual edition (2012). ΜΟΡΕΑΣ Α.Ε., Το έργο της Γαλλικής επιστημονικής αποστολής του Μοριά 1829-1838, εκδοτικός οίκος ΜΕΛΙΣΣΑ, (2012)
30. Personal Archive of Nikolaos Tobras, public notary based in Nafplio Greece
31. Personal Archive of Nikolaos Retalis, former owner of Agioi Theodory church