

Progress Report on the Laconian Churches' 3D Survey Project – The Spatial Hub 3D Scholarly Edition –

Ryo Higuchi¹, Koji Murata^{2,3}, Elena Ota⁴, Kazufumi Takeda⁵, Keitaro Shimizu^{6,7}

¹ Faculty of Architecture, Nippon Institute of Technology, Japan - higuchi.r.7496@gmail.com

² Institute of Library, Information and Media Science, University of Tsukuba, Japan - kmurata@slis.tsukuba.ac.jp

³ Center for Digital Humanities and Social Sciences, Nagoya University, Japan

⁴ JSPS Postdoctoral Research Fellow, Komazawa University, Japan - wabisuke@komazawa-u.ac.jp

⁵ Institute of Art and Design, University of Tsukuba - takeda.kazufumi.gn@u.tsukuba.ac.jp

⁶ Play Life Studio Inc. keitaro.shimizu@playlife-studio.com

⁷ Department of Interdisciplinary Information Studies, The University of Tokyo, Japan

Keywords: 3D Scholarly Edition, 3D Survey, Byzantine, Greece, Laconia.

Abstract

This paper describes an ongoing project dedicated to three-dimensional survey and digital preservation of Byzantine churches in the historically significant Laconia region of Greece. Constructed between the fourth and fifteenth centuries, several churches in this region exhibit significant deterioration. Employing photogrammetry via UAVs, action cameras and DSLR cameras, the project has thus far achieved the 3D capture of 67 churches within the Sparta and Eurotas municipalities, resulting in a 7.2 TB dataset. To facilitate interdisciplinary research and address the limitations in traditional architectural representations, the authors are developing 'Spatial Hub', a web-based platform designed to create 3D Scholarly Editions. This platform currently incorporates functions such as in-scene annotation, online collaborative editing, virtual reality compatibility and spatial analysis tools. Future developers will focus on integrating features, including temporal display control, dimensional grid overlays, multi-view visualisation, comparative analysis across multiple churches and AI-driven automated annotation for machine learning applications. Spatial Hub is envisioned as a crucial communication instrument for researchers. It is also applicable to other regions and scholarly disciplines dealing with limited textual evidence.

1. Introduction

Throughout Byzantine history, spanning roughly the fourth to the 15th century, a remarkable number of Christian churches were built. Each varied in its purpose, size and architectural style serving as a centre of social life. These churches are significant for several reasons. Not only are they invaluable historical sites offering insights into Byzantine society, but they also profoundly influenced the architecture of Eastern Europe and the Middle East (Ousterhout, 2019, pp. 679–713). While thousands of these churches still stand within the empire's former territories, some remain active in modern communities. However, only a few have been properly preserved, while many others unfortunately face deterioration.

Since 2019, the authors of this paper have been conducting research in the Laconia region of Greece (Figure 1) under the permission of the Ephorate of Antiquities of Lakonia¹. This region is particularly notable for Byzantine history. While the Byzantine Empire experienced a gradual decline in power and territory, Laconia remained under its rule until the empire's final stages, except for a temporal occupation by the Franks during the first half of the 13th century. Consequently, Laconia's fall to the Ottoman Empire was later than Constantinople, the Empire's capital. This region represents one of the few regions where Byzantine churches continued to be erected until the very end of the Empire. Amongst these, certain churches, such as those in Mystras, a UNESCO World Heritage site, exemplify a culmination of Byzantine culture. Drandakis (1996) notes that over 200 of these churches contain frescoes, while Nagatsuka (1994) and Bender (2019; 2022) have documented numerous other undecorated churches. Most of these churches date from the

13th century onward, following the Byzantine reconquest of the region from the Franks.



Figure 1. The Location of Laconia (The background imagery was obtained via Google Earth Image data © SIO, NOAA, U.S. Navy, NGA, GEBCO; Landsat / Copernicus.)

Our project in Laconia has three aims: 1. To gather and record the most comprehensive data possible on the churches, which are currently facing deterioration. 2. To create a database from the collected data that can be utilised cross-disciplinary such as by historians, art historians and architectural historians, and 3. To explore methodologies for academic application of this database while considering its potential as an educational and touristic resource. We previously proposed a conceptual model under the second aim. This paper reports the progress of our research and presents the status of our 3D viewer and church database, 'Spatial Hub', which has been developed based on these findings, along

¹ This paper employs 'Laconia' as the standard English term for the Greek region Λακωνία. However, when citing the official English names of Greek administrative bodies containing Λακωνία, we will use their designated spelling, 'Lakonia'.

with its future potential. Furthermore, the paper outlines strategies for academic utilisation of Spatial Hub and its possibilities as a resource for tourism and education.

2. Researching Laconia's Churches: A Historical Overview of Research and the Aim of Our Project

The scholarly exploration on Laconia's church architecture, including the renowned site at Mystras, began in the second half of the 19th century. By the 1930s, some of these churches were already undergoing restorative efforts (Orlandos, 1937). Researchers tended to concentrate on key urban areas such as Mystras (Millet, 1899; 1910), Geraki and Monemvasia (Millet, 1916; Traquair, 1905–06). However, from the 1950s onward, areas of research have broadened, notably with Drandakis's investigations into churches beyond these major centres (e.g. Drandakis, 1955). Drandakis, who dedicated nearly 50 years to Laconian study, aimed to produce a comprehensive catalogue of the region's churches, even publishing a preliminary version in 1996. Unfortunately, his work was never completed. Nonetheless, the region still continues to attract scholarly attention, researchers such as Papageorgiou (2009), Foustieris and Chouliaras (2021), Chouliaras (2021), Arbanitopoulos (2022) and Bender (2022) contributing to the field. While numerous studies have focused on these churches, the majority have not prioritised the creation of architectural drawings. These studies often rely on pre-existing drawings without critically assessing their accuracy. Consequently, Bender's (2022) undertaking, with new drawings, is a notable exception. As Higuchi and Murata (2023) previously highlighted, existing drawings often fall short of accurately representing the buildings' actual forms. We contend that the three-dimensional shapes of these structures themselves hold important historical information, revealing the artisans' skills and their movement within the area, the inaccuracy of existing drawings poses a challenge when researchers attempt to use these churches as reliable historical evidence. Taking these obstacles into account, our team is currently surveying churches throughout Laconia, which comprises of five administrative districts. We initially focused our research on the Sparti municipality – home to both the UNESCO World Heritage site of Mystras and Sparti, the region's administrative capital – and its eastern neighbour Eurotas municipality, which includes the notable town of Geraki. Within these two municipalities, prior research has identified 103 churches dated to the Byzantine era (Drandakis, 1996; Mexia and Florou, 2015; Bender, 2022). To date, our team surveyed 67 of them (Figure 2): 44 in the Sparti municipality (out of 68 identified) and 23 in the Eurotas municipality (out of 35 identified). For a list of these churches, see Table 1.

Our fieldwork centres on generating precise three-dimensional measurements of churches, complemented by high-resolution imagery. We accomplish this through photogrammetry, utilising unmanned aerial vehicles (UAVs), action cameras and digital single-lens reflex (DSLR) cameras. The number of photographs captured varies according to the size of churches. For standardized churches in Laconia (such as Ag. Iōannēs Chrysostomos, as discussed below), we typically captured between approximately 1,500 and 5,000 images, whilst larger churches required more than 10,000 photographs. Our total data volume currently stands at approximately 7.2 terabytes. We believe these data form essential preliminary resources for future research, benefiting not only our research but also the wider academia. Accurate 3D data on these churches, processed by Agisoft Metashape Professional software, can markedly enhance their use as historical sources, offering deeper insights into past societies.

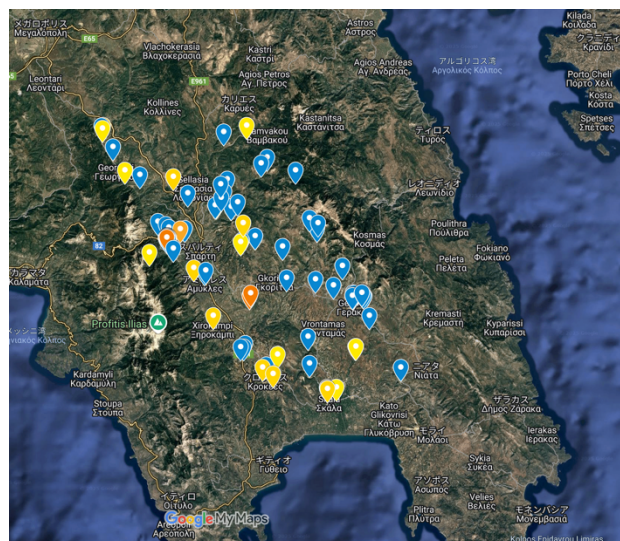


Figure 2. Churches in Sparti and Eurotas indicated by blue markers are already surveyed by the authors. Orange markers indicate surveys in progress. Yellow markers indicate churches unsurveyed. (The base map was created using Google My Maps. Map data ©2025 Google, Image ©NASA)

3. Spatial Hub – 3D Scholarly Editions for Architecture

In this section, we argue why it is increasingly important to digitally preserve architecture. Subsequently, we describe our new spatial tagging 3D viewer 'Spatial Hub'. Here, we use the church of Agios Iōannēs Chrysostomos (St. John Chrysostom) in Geraki, Laconia, as an example (Figure 3). This small church, measuring 4.7 m × 11 m, is valuable because of an inscription explicitly mentioning the date 1450 and of the well-preserved wall paintings that cover almost the entire interior. However, the inscription is a later addition. The building and frescos are estimated to date from an earlier time.



Figure 3. Exterior of Ag. Iōannēs Chrysostomos Church from the northeast.

Our main goal is to capture any data on church buildings as accurately as possible and to make these data available for a broad spectrum of academic fields. Higuchi and Murata (2023) previously introduced the concept of '3D Scholarly Editions', which outlines a model for achieving this goal. Two key characteristics of our 3D Scholarly Editions are: accessibility for users beyond architectural studies, and a minimization of potential human intervention that could affect objectivity. Because our database already contains over 100 churches and of

the need for high-resolution images, we have chosen to upload our 3D data to a web-based platform where we can attach relevant information. This platform is Spatial Hub. We made this decision considering the balance between cost and data quality, fully aware of the growing use of HBIM (Historical Building Information Modelling) in managing, maintaining and preserving historical buildings and its potential for even wider adoption (Yang et al., 2020; Siewczyński and Szot, 2025; Yu et al., 2025).

Following this strategy, we developed Spatial Hub as a platform to host our 3D Scholarly Editions. Our ongoing aim is to centralise the necessary functions for 3D Scholarly Editions into Spatial Hub, a 3D platform featuring capabilities such as metaverse integration and spatial tagging. While it will still take some time for it to fully function as a platform ready for comprehensive academic use, we will outline its current capabilities and future development plans below.

3.1 Currently Implemented Features of Spatial Hub

3.1.1 In-Scene Commenting:

Users can leave comments as virtual sticky notes directly within the 3D space.

3.1.2 Online Viewing and Collaborative Editing:

Users can access Spatial Hub for viewing and real-time collaborative editing. Since 3D models can be accessed via web browsers, software installation is unnecessary. This enables researchers at multiple locations to access the same 3D data and have updates and new tags reflected in real time, thereby supporting their discussions.

3.1.3 VR Device Compatibility:

Spatial Hub allows users to enter the 3D space in VR mode using VR devices, providing an immersive experience.

3.1.4 Spatial Analysis Tools:

Users can measure the distance between two points by placing pins within the 3D space (Figure 4) and freely cut through the 3D model at any orientation or location (Figure 5).

3.1.5 Added value over existing generic viewers:

A comparative survey of major web-based 3D information platforms clarifies the unique advantages of Spatial Hub.

- 3DHOP (CNR-ISTI, LGPL) is an open-source viewer that can be extended via a JavaScript API, yet it lacks multi-user synchronisation and provides annotations but no measurement tools.
- Sketchfab is offered as commercial SaaS; although a REST API is available, real-time collaboration remains in beta and both measurement and annotation functions are limited.
- CesiumJS (Apache-2.0) excels at high-precision geo-spatial visualisation, but measurement and annotation must be added through third-party plug-ins and browser-side multi-user sync is only partially supported.
- Potree (TU Wien, LGPL) specialises in massive point-cloud rendering with a JavaScript API, yet offers only basic distance tools and no native multi-user mode.

In contrast, Spatial Hub has been developed entirely from scratch around a Unity WebGL client and an AWS serverless backend. Via a publicly documented REST/WebSocket API it delivers high-quality real-time rendering, supports synchronous multi-user sessions, and exposes distance, area, and volume measurements together with CIDOC-CRM-compliant annotations as first-class, citable data. This integrated approach unifies 2D imagery, 3D geometry, GIS layers, and rich metadata within a single reproducible workspace—moving far beyond the isolated-file paradigm of existing viewers.

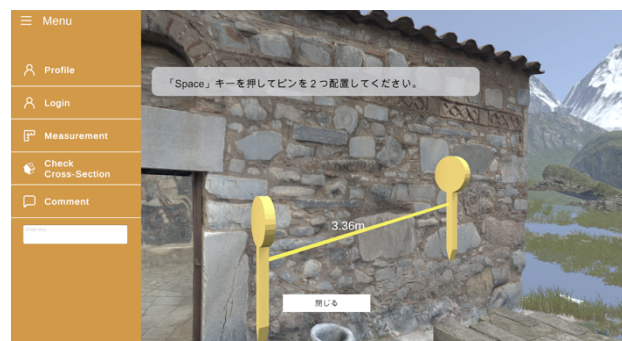


Figure 4. Measurement tool of Spatial Hub



Figure 5. Sectional tool of Spatial Hub.

3.1.6 Technical Stack:

Spatial Hub employs the Unity Engine as its client-side renderer and an AWS Serverless stack—API Gateway, AppSync, Lambda, DynamoDB, S3, and CloudFront—on the backend. The Unity WebGL build is hosted on S3, allowing end-users to run the system as a standard web application. A real-time connection layer supports synchronous user communication, shared object manipulation, and spatial tagging. All components have been developed entirely from scratch over the course of this project.

3.2 Future Implementation Plans

3.2.1 Temporal Display Control:

This function treats individual parts of the building as separate objects, allowing users to freely show or hide them to visualise changes over time.

3.2.2 Dimensional Grid Overlay:

This function displays dimension units as a cubic grid, facilitating the assignment of standard dimensions used during the building's construction.

3.2.3 Multi-View Window:

This function simultaneously shows multiple windows with different viewpoints of the same model.

3.2.4 Comparative Multi-Church View:

This function shows multiple churches from the same viewpoint, enabling the direct comparison of sections, elevations and floor plans.

3.2.5 Automated Annotation for Machine Learning:

This function automatically extracts the necessary training data for image recognition machine learning using AI.

3.2.6 Interoperability with IIIF:

Spatial Hub will expose its content through the International Image Interoperability Framework to maximise reuse: 2D derivatives (orthophotos, plans, texture maps) will be delivered via the standard IIIF Image API, making them instantly viewable

in existing viewers like Mirador. 3D meshes will be wrapped in experimental IIIF Presentation Manifests that embed glTF files, following the draft model proposed by the IIIF 3D Technical Specification Group (IIIF Consortium, 2020; IIIF 3D Community Group, n.d.). These manifests already render in community plug-ins and support spatial annotations alongside images and AV. Core descriptive fields exported from our CIDOC-CRM records populate each manifest's *metadata[]*, while *requiredStatement* conveys the CC BY or on-request licence. *WebAnnotations* created in external IIIF viewers will round-trip to Spatial Hub through its API, keeping commentary synchronised across platforms. Adopting IIIF places the corpus on a rapidly maturing standards path and ensures long-term, tool-agnostic accessibility once the 3D specification is finalised.

We conceptualise Spatial Hub not merely as a repository of precise cultural heritage measurements but also as a collaborative platform designed to facilitate interdisciplinary enquiry. To this end, we are integrating functions that enable researchers in distant locations to engage in a more seamless and productive discourse. Furthermore, the raw three-dimensional data acquired from the 67 surveyed churches undoubtedly have the potential to reveal new insights. However, the considerable volume of these data necessitates a strategic approach to transcend the inherent limitations of human cognitive processing. Rather than relying solely on intuitive reasoning, our aim is to harness the capabilities of AI to discern patterns within the collected data, thereby aiding in its analysis and interpretation.

4. Conclusion

Our team have been conducting 3D surveys of churches in the Laconia region of Greece. By the beginning of 2025, we finished surveying 67 churches in Sparta and Eurotas municipalities. Subsequently, we started building the necessary features in Spatial Hub to turn these churches into 3D Scholarly Editions. Moving forward, we plan to implement key functions for academic research, particularly tools that help analysing the churches, such as temporal display control, dimensional grid overlay, multi-view windows, the ability to compare multiple churches side by side and automated annotation using machine learning. Our surveys of Laconian churches are still in progress: hence, the amount of data will continue to grow. Correspondingly, the main goal of this project is to use AI to help us handle extensive 3D information in a way that humans can actually work with. In doing so, we hope to uncover new insights that traditional methods have not provided.

The capacity of Spatial Hub to serve as a communicative tool that facilitates interdisciplinary research is not confined solely to the churches of Laconia region. Its applicability extends naturally to other areas containing Byzantine ecclesiastical architecture and, indeed, has the potential for broader applications beyond the Byzantine sphere. Numerous academic disciplines focus on regions or periods with limited textual documentation, leading to significant scholarly efforts to discern the social realities of those contexts through material culture, thereby transcending the limitations of written sources alone. Within this scholarly landscape, interdisciplinary research and communication platforms, such as Spatial Hub, assume a crucial role. Indeed, Spatial Hub's spatial tagging and AR/VR functions exhibit marked potential for application in the tourism and education sectors. the sustained preservation of cultural heritage necessitates broader public awareness and engagement beyond the academic community. However, due to management and conservation considerations, public access to many cultural heritage sites remains limited. In such cases, the implementation

of location-based check-in services or the utilisation of AR/VR capabilities to present diverse information on these sites can effectively disseminate valuable cultural heritage information for tourism and education purposes.

Acknowledgements

This paper is supported by the Kajima Foundation's General Research Grants in 2022-23 (PI: Koji Murata) and 2024-2025 (PI: Ryo Higuchi), JSPS KAKENHI Grant Number 19K13389, 20K14929, 23K12297, 24K17428 and Tokai Pathways to Global Excellence (T-GEx), part of MEXT Strategic Professional Development Program for Young Researchers.

The authors are grateful to the Ephorate of Antiquities of Lakonia and especially to Dr. Panagiotis Perdikoulis for facilitating and supporting the survey.

The rights to the images of Figure 3–5 belong to the Ministry of Culture and Sports. The Church of Agios Iōannēs Chrysostomos in Geraki is within the domain of the Ephorate of Antiquities of Lakonia, Hellenic Ministry of Culture and Sports/ Hellenic Organization of Cultural Resources Development.

References

- Arbanitopoulos, S., 2022. *Η πόλη του Μυστρά (1262–1460). Η πολεοδομική οργάνωση και η λειτουργία ενός υστεροβυζαντινού αστικού συγκροτήματος. (The City of Mystras (1262–1460). The urban organization and function of a late Byzantine urban complex).* Ο Δ Α Π (Οργανισμός Διαχείρισης και Ανάπτυξης Πολιτιστικών Πόρων), Athens. 2 vols. (in Greek)
- Bender, L., 2019. Looking beyond the city walls of Mystras: The transformation of the religious landscape of Laconia, in: Mattiello, A., Rossi, M.A. (Eds.), *Late Byzantium Reconsidered: The Arts of the Palaiologan Era in the Mediterranean*. Routledge, London, 104–117. <https://doi.org/10.4324/9781351244831-7>
- Bender, L., 2022. *Ermitages et monastères rupestres byzantins de Laconie (Péloponnèse): Archéologie et paysages. (Byzantine rock-cut hermitages and monasteries of Laconia (Peloponnese): Archaeology and landscapes).* Akademska Knjiga, Vienna. (in French)
- Chassoura, O., 2002. *Les peintures murales byzantines des églises de Longanikos – Laconie –. (Byzantine wall-paintings of churches of Longanikos in Laconia).* Athens. (in French)
- Chouliaras, I.P., 2021. Οι αποτοιχισμένες μεταβυζαντινές τοιχογραφίες του βυζαντινού ναού του Αγίου Νικολάου στα Βέροια Λακωνίας. (The detached post-Byzantine wall paintings of the Byzantine church of Agios Nikolaos in Veria, Laconia), in: *Αρχονταρίκι: Αφιέρωμα στον Ευθύμιο Ν. Τσιγαρίδα. Υπουργείο Πολιτισμού και Αθλητισμού - Οργανισμός Διαχείρισης και Ανάπτυξης Πολιτιστικών Πόρων*, Athens, 645–656. (in Greek)
- Dimitrokallis, G., 2001. *Γεράκι: Οι τοιχογραφίες των ναών του κάστρου (Geraki: Wallpaintings of churches of the Castle).* Athens. (in Greek)
- Drandakis, N.B., 1955. Ο Ναός Των Αγίων Θεοδώρων Της Λακωνικής Τρύπης. (The Church of Agioi Theodoroi of Trypi in Laconia), *Επετηρίς Εταιρείας Βυζαντινών Σπουδών* 25, 38–87. (in Greek)

- Drandakis, N.B., 1995. *Βυζαντινές τοιχογραφίες της Μέσα Μάνης. (Byzantine wall paintings of Mesa Mani)*. Ev Αθήναις Αρχαιολογική Εταιρεία, Athens. (in Greek)
- Drandakis, N.B., 1996. Σχεδίασμα καταλόγου των τοιχογραφημένων βυζαντινών και μεταβυζαντινών ναών Λακωνίας. (Preliminary catalogue of the wall-painted Byzantine and post-Byzantine churches of Laconia). *Λακωνικά Σπουδαί* 13, 167–236. (in Greek)
- Fousteris, G.P., Chouliaras, I.P., 2021. Οι βυζαντινές τοιχογραφίες του Ναού του Αγίου Νικολάου στὰ Βέροια Λακωνίας (1292/3). (The Byzantine wall paintings of the church of Agios Nikolaos in Veria, Laconia (1292/3)). *Πρακτικά του Θ' Διεθνούς Συνεδρίου Πελοποννησιακών Σπουδών (Ναύπλιον, 30 Οκτωβρίου–2 Νοεμβρίου 2015)*, 2, 603–641. (in Greek)
- Higuchi, R., Murata, K., 2023. 3D Scholarly Editions for Byzantine Studies: Multimedia Visual Representations for History, Art History and Architectural History. *ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, 10(M-1–2023). <https://doi.org/10.5194/isprs-annals-X-M-1-2023-125-2023>.
- IIIF Consortium, 2020. IIIF Presentation API 3.0. <https://iiif.io/api/presentation/3.0/> (22 June 2025)
- IIIF 3D Community Group, n.d. IIIF 3D Community Group Charter. <https://iiif.io/community/groups/3d/charter/> (22 June 2025)
- Kappas, M., 2011. Ο ναός του Αγίου Νικολάου στο ρέμα του Σωφρόνη Λακωνίας. (The Church of Saint Nikolaos at the stream of Sophronis in Laconia.). *BYZANTINA SYMMEIKTA* 21(1), 255–337. (in Greek)
- Mexia, A., Florou, M., 2015. *Protection, presentation and enhancement of monuments that have been revealed within Sparta's urban tissue and their connection to the Byzantine monuments on the nearby Acropolis*. Ministry of Culture and Sports, Ephorate of Antiquities of Lakonia.
- Millet, G., 1899. Inscriptions byzantines de Mistra. (Byzantine Inscriptions from Mystras). *Bulletin de Correspondance Hellénique* 23, 97–156. (in French)
- Millet, G., 1910. *Monuments byzantins de Mistra: Matériaux pour l'étude de l'architecture et de la peinture en Grèce aux XIV^e et XV^e siècles. (Byzantine Monuments of Mystras: Materials for the Study of Architecture and Painting in Greece in the 14th and 15th Centuries)*. E. Leroux, Paris. (in French)
- Millet, G., 1916. *L'école Grecque Dans l'architecture Byzantine. (The Greek School in Byzantine Architecture)*. E. Leroux, Paris. (in French)
- Moutsopoulos, N.K., Dimitrokallis, G., 1981. *Γεράκι: Οι Εκκλησίες του οικισμού (Geraki: The Churches of the Settlement)*. Kentron Byzantinōn Ereunōn, Thessaloniki. (in Greek)
- Nagatsuka, Y., 1994. *Les églises byzantines en Laconie et dans ses environs: Recherches sur leurs architectures et leurs fresques. (The Byzantine Churches in Laconia and its Surroundings: Research on their Architecture and Frescoes)*. 2 vols., Thèse de doctorat, Paris IV. (in French)
- Orlandos, A.K., 1937. Ανατολίζουσai Βασιλικαί της Λακωνίας. (Eastern Basilicas of Laconia). *Επετηρίς Εταιρείας Βυζαντινών Σπουδών* 4, 342–51. (in Greek)
- Ousterhout, R.G., 2019. *Eastern Medieval Architecture*. Oxford University Press, New York, NY.
- Papageorgiou, J. 2009. Τοιχογραφίες του 15^{ου} αιώνα στο Κάστρο Γερακίου: ένα τοπικό ζωγραφικό εργαστήριο της όψιμης Παλαιολόγιας Περιόδου στη Λακωνία. (Fifteenth-Century Wall Paintings in the Castle of Geraki: A Local Painting Workshop of the Late Palaiologan Period in Laconia). *British School at Athens Studies* 16, 361–367. (in Greek)
- Siewczyński, B., Szot, J., 2025. BIM goals and uses in the management, maintenance and preservation of historic buildings: An open access perspective. Implementation characteristics of HBIM for improved documentation and lifecycle management. *npj Heritage Science* 13(1), 103. <https://doi.org/10.1038/s40494-025-01588-z>
- Traquair, R., 1905–06. Laconia: I.—Mediaeval Fortresses. *Annual of the British School at Athens* 12, 259–276.
- Yang, X., Grussenmeyer, P., Koehl, M., Macher, H., Murtiyoso, A., Landes, T., 2020. Review of built heritage modelling: Integration of HBIM and other information techniques. *Journal of Cultural Heritage* 46, 350–360. <https://doi.org/10.1016/j.culher.2020.05.008>
- Yu, Y., Raed, A.A., Peng, Y., Pottgiesser, U., Verbree, E., van Oosterom, P., 2025. How digital technologies have been applied for architectural heritage risk management: A systemic literature review from 2014 to 2024. *npj Heritage Science* 13(1), 45. <https://doi.org/10.1038/s40494-025-01558-5>

Table 1. List of churches in the municipalities of Sparti and Eurotas

ID	Name	Municipality	Location	Date	Survey	Reference
1	Ag. Geōrgios	Sparti	Longanikos	14C.		Drandakis 1996
2	Koimēsis Theotokou	Sparti	Longanikos	13–14C.	done	Drandakis 1996
3	Ag. Apostoloi	Sparti	Longanikos	14–15C.		Chassoura 2002
4	Ag. Nikolaos	Sparti	Agorianē	ca. 1300	done	Drandakis 1996
5	Ag. Nikolaos	Sparti	Konditsa	14C.		Drandakis 1996
6	Panagia Vrestenitissa	Sparti	Vrestena	ca. 1400	done	Drandakis 1996
7	Panagia	Sparti	Megarē Brysē	Late (13C.?)		Bender 2022
8	Ag. Nikolaos	Sparti	Verria	13C.	done	Drandakis 1996
9	Ai-Giannakēs	Sparti	Vassaras	14C.	done	Drandakis 1996
10	Kato Ai-Giannakēs	Sparti	Vassaras	13C.	done	Kappas 2011
11	Ag. Dēmētrios	Sparti	Vassaras	14C.	done	Drandakis 1996
12	Ag. Iōannēs	Sparti	Tzintzina	14C.	done	Drandakis 1996
13	Ag. Dēmētrios Moschonēsiōn	Sparti	Kastori	12C.	done	Drandakis 1996
14	Ag. Loukas (Koimēsis Theotokou)	Sparti	Aleourou	14–15C.		Bender 2022
15	Theotokos	Sparti	Sellasia	?	done	Drandakis 1996
16	Ereipia naiskou	Sparti	Theologos	14C.		Drandakis 1996
17	Ktētorissa	Sparti	Theologos	Middle	done	Drandakis 1996
18	Paliomonastēro of Ag. Thessarakonta	Sparti	Theologos	13C.	done	Drandakis 1996
19	Askētario Ag. Iōannēs Prodomos	Sparti	Theologos	13C.	done	Drandakis 1996
20	Paliopanagia	Sparti	Theologos	1304/05	done	Drandakis 1996
21	Analēpsē	Sparti	Theologos	1304/05	done	Drandakis 1996
22	Ag. Nikolaos	Sparti	Aphragias	14C.	done	Drandakis 1996
23	Ag. Nikolaos	Sparti	Aphragias	11–12C.	done	Drandakis 1996
24	Ag. Theodōroi	Sparti	Trypē	13C.	done	Drandakis 1996
25	Ag. Nikōn	Sparti	Trypē	13C.	done	Drandakis 1996
26	Zōodochos Pēgē	Sparti	Pikoulianika	15C.	done	Drandakis 1996
27	Analēpsē	Sparti	Taygetos	13C. (1211?)		Drandakis 1996
28	Nikandros	Sparti	Magoula	?	done	Drandakis 1996
29	Panagia Chrysaphitissa	Sparti	Chrysapha	1289/90	done	Drandakis 1996
30	Ag. Iōannēs Prodomos	Sparti	Chrysapha	14C.	done	Drandakis 1996
31	Ag. Iōannēs Prodomos	Sparti	Tsilioto	13C.	done	Drandakis 1996
32	Ag. Dēmētrios	Sparti	Tsilioto	13C.	done	Drandakis 1996
33	Anonymous	Sparti	Tsilioto	Late		Drandakis 1996
34	Ag. Geōrgios	Sparti	Ydragogeo	14C.		Drandakis 1996
35	Ag. Nikolaos	Sparti	Kallonē	12C.	done	Drandakis 1996
36	Koimēsis Theotokou	Sparti	Zaraphōna	EC/ 10C./ 14C.	done	Drandakis 1996
37	Ai-Giannakēs	Sparti	Zaraphōna	14C.	done	Drandakis 1996
38	Anonymous	Sparti	Sparta	10C.		Mexia and Florou 2015
39	Anonymous	Sparti	Sparta	10C.		Mexia and Florou 2015
40	Ag. Dēmētrios	Sparti	Mystras	1263?–72		Drandakis 1996
41	Ag. Theodōroi	Sparti	Mystras	1290–95		Drandakis 1996
42	Odēgētria	Sparti	Mystras	c.1310		Drandakis 1996
43	Ag. Sophia	Sparti	Mystras	14C.	done	Drandakis 1996
44	Peribleptos	Sparti	Mystras	1358		Drandakis 1996
45	Euangelistria	Sparti	Mystras	15C.		Drandakis 1996
46	Pantanassa	Sparti	Mystras	1428		Drandakis 1996
47	Ai-Giannakēs	Sparti	Mystras	14C.	done	Drandakis 1996
48	Ag. Christophoros	Sparti	Mystras	14C.	done	Drandakis 1996
49	Ag. Anna	Sparti	Mystras	ca.1300	done	Drandakis 1996
50	Ag. Kyriakē	Sparti	Mystras	14C.	done	Drandakis 1996
51	Ag. Paraskevē	Sparti	Mystras	14C.	done	Drandakis 1996
52	Chapel near Ag. Nikolaos	Sparti	Mystras	Late?	done	Drandakis 1996

Table 1. List of churches in the municipalities of Sparti and Eurotas (continuous)

ID	Name	Municipality	Location	Date	Survey	Reference
53	Chapel near Palace	Sparti	Mystras	14C.	in progress	Drandakis 1996
54	Palace Chapel	Sparti	Mystras	14C.		Drandakis 1996
55	Chapel in Kastro	Sparti	Mystras	13C.	done	Drandakis 1996
56	Ag. Geōrgios	Sparti	Mystras	14C.		Arbanitopoulos 2022
57	Langadiōtissa	Sparti	Parori	14C.	done	Drandakis 1996
58	Prophētēs Ēlias	Sparti	Alyklai	13C?	done	Drandakis 1996
59	Ag. Iōannēs	Sparti	Alyklai	?		Drandakis 1996
60	Ag. Nikolaos	Sparti	Alyklai	13C.	done	Drandakis 1996
61	Taxiarches	Sparti	Gkortsas	13C.	done	Drandakis 1996
62	Ai-Giannakēs	Sparti	Zoupena	11C.	done	Drandakis 1996
63	Ag. Nikolaos	Sparti	Leukochōma	14–15C.	in progress	Drandakis 1996
64	Ag. Paraskevē	Sparti	Leukochōma	Late?	in progress	Drandakis 1996
65	Ag. Nikōn	Sparti	Xērokambi	14C.		Drandakis 1996
66	Ag. Geōrgios	Sparti	Daphni	ca. 1300	done	Drandakis 1996
67	Ag. Nikolaos	Sparti	Daphni	13C.	done	Drandakis 1996
68	Ag. Iōannēs Prodoromos	Sparti	Daphni	?	done	Drandakis 1996
69	Euangelistria	Eurotas	Geraki	12C.	done	Drandakis 1996
70	Ag. Iōannēs Chrysostomos	Eurotas	Geraki	ca. 1300	done	Drandakis 1996
71	Ag. Athanasios	Eurotas	Geraki	13C.	done	Drandakis 1996
72	Ag. Sōzōn	Eurotas	Geraki	13C?	done	Drandakis 1996
73	Ag. Nikolaos	Eurotas	Geraki	13C.	done	Drandakis 1996
74	Ag. Theodōroi	Eurotas	Geraki	13–14C.	done	Moutsopoulos 1981
75	Ag. Geōrgios	Eurotas	Geraki	12C.	done	Drandakis 1996
76	Taxiarches	Eurotas	Geraki	15C.	done	Drandakis 1996
77	Theophania	Eurotas	Geraki	13C.	done	Drandakis 1996
78	Zōodochos Pēgē	Eurotas	Geraki	15C.	done	Drandakis 1996
79	Ag. Paraskevē	Eurotas	Geraki	15C.	done	Drandakis 1996
80	Ag. Dēmētrios	Eurotas	Geraki	13C.	done	Drandakis 1996
81	Prophētēs Ēlias	Eurotas	Geraki	15C.	done	Dimitrokallis 2001
82	Ag. Aikaterinē	Eurotas	Geraki	14C.	done	Dimitrokallis 2001
83	Anonymous	Eurotas	Geraki	14C.	done	Dimitrokallis 2001
84	Kokkinē Ekklesiā	Eurotas	Geraki	?	done	Drandakis 1996
85	Prophētēs Ēlias	Eurotas	Geraki	?	done	Drandakis 1996
86	Ag. Nikolaos	Eurotas	Geraki	13C.	done	Drandakis 1996
87	Ai-Stratēgos	Eurotas	Geraki	14C.	done	Drandakis 1996
88	Ai-Saranta	Eurotas	Grammoussa	13C.	done	Drandakis 1996
89	Paliomonastēro	Eurotas	Vrontamas	12C.	done	Drandakis 1996
90	Ag. Dēmētrios	Eurotas	Krokees	1286	done	Drandakis 1996
91	Koimēsis Theotokou	Eurotas	Krokees	14C.		Drandakis 1996
92	Ag. Athanasios	Eurotas	Krokees	?		Drandakis 1996
93	Anonymous	Eurotas	Krokees	13C.		Drandakis 1996
94	Ag. Kyriakē	Eurotas	Skala	?		Drandakis 1996
95	Ag. Nikolaos	Eurotas	Skala	?		Drandakis 1996
96	Ag. Geōrgios	Eurotas	Skala	10C?		Drandakis 1996
97	Ai-Giannakēs	Eurotas	Skala	?		Drandakis 1996
98	Anonymous	Eurotas	Skala	?		Drandakis 1996
99	Ag. Paraskevē	Eurotas	Ag. Andreas	?		Drandakis 1996
100	Ai-Stratēgos	Eurotas	Ag. Andreas	?		Drandakis 1996
101	Ag. Nikolaos	Eurotas	Niata	?		Drandakis 1996
102	Ag. Basileios	Eurotas	Apidea	?		Drandakis 1996
103	Ag. Nikolaos	Eurotas	Vlachiōtēs	?		Drandakis 1996