For almost five decades research into, and preservation of, the historic sites and monuments of northern and southern Cyprus have developed on different tangents. The post-1974 division of the island has created an imbalance in cultural heritage management which has been widely acknowledged, discussed, and in some notable cases, lamented. This is especially true of the northern part of the island where a political solution to the 'Cyprus Problem' remains a precondition for international engagement and recognition, regardless of the lack of progress made on this complex issue since 1974 and despite historic opportunities being missed in the recent past. Even as this is being written the quest for a political resolution remains characterised by a debilitating stasis which in turn has led to on-going vulnerability and loss of the island's shared heritage.

The conference New Approaches in Recording, Preserving and Studying of Cultural Heritage in Divided Cyprus: Problems & Opportunities was held in Kyrenia / Girne in September 2019 and was conceived as an advanced academic discussion into the challenges created by this existing political and academic status quo; curated as an opportunity to reconceptualise a realignment leading to new pathways and opportunities; and envisaged as a forum to investigate how a return of sophisticated investigation, careful conservation, and international publication of heritage sites might yet be possible - even in the absence of a comprehensive island-wide political solution.

This volume includes the proceedings of that conference in the form of nineteen articles that each engage with diverse and complex themes associated the past, present and future of Cyprus' cultural heritage.

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TOWARDS RECORDING, PRESERVING AND STUDYING CULTURAL HERITAGE IN DIVIDED CYPRUS: PROBLEMS & OPPORTUNITIES

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EDITED BY
LÂTİFE SUMMERER
MARKO KIESSEL-HAZAR KABA

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In memoriam

Rıza Tuncel
(1971-2022)

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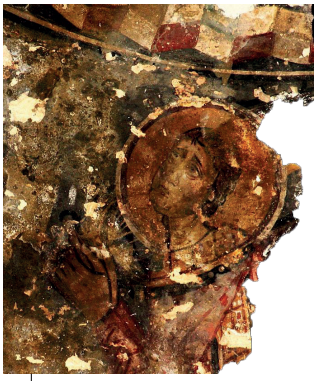

An Integrated Approach to Archaeological Heritage: The Shipwreck Museum in the Kyrenia Castle, Cyprus

ALESSANDRO CAMIZ* – ZEYNEP CEYLANLI**

GIORGIO VERDIANI***

> "ὥστ᾽ ἔγωγε, καθάπερ οἱ ποιηταί, δέομαι ἀρχόμενος τῆς διηγήσεως Μούσας τε καὶ Μνημοσύνην ἐπικαλεῖσθαι"
>
> "Consequently, like the poets, I must begin my narrative with an invocation of the Muses and Memory"
>
> Plato, *Euthydemus*, 275d.

INTRODUCTION

Digital survey tools allow a fast acquisition of large datasets, documenting extensively the different phases of buildings and urban settlements; the data integration level has recently evolved so to keep together details at different scales and now is easy to manage, with a significant improvement in the overall understanding of built heritage. In this case, we integrated Terrestrial Photogrammetry, Aerial Photogrammetry and Terrestrial Lasergrammetry for the documentation of a large fortification, the Castle of Kyrenia, which concomitantly provided extensive data for the design of a museum inside the castle. The survey started within the international workshop held therein in May 2018, with the scientific coordination of Girne American University (Cyprus), Özyeğin University (Turkey), and Florence University (Italy). Different student teams, supervised by experienced tutors, collected about 360 laser scans, more than 1900 UAV (Unmanned Aerial Vehicle) aerial pictures, over 30000 terrestrial hi-res photographs, and covered the external walled enclosure with a 3D eye remote shooting unit mounted on

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a telescopic pole. After a preliminary partial data processing accomplished on site for teaching purposes, the complete data elaboration is still ongoing within the research activities of DIDAlab (System of laboratories of the Architecture Department at Florence University), with the cooperation of Özyeğin University, Istanbul. Within the specific case of the Kyrenia Castle, a densely stratified construction, dating from the Byzantine times to the Lusignan transformations, and the Venetian redesign, through some lesser Ottoman modifications and the English additions, the research established formal and meaningful relationships between the container, the castle, and the content, the archaeological collection. The castle hosts today a collection of artefacts, mostly belonging to the underwater excavations of the Kyrenia Shipwreck. This collection awaits to be reorganised within the museum, including its greater part, which to this day lies in the deposits, by enhancing the communication with the visitor. We connected the design task to three different levels of interiority, the museum in the castle, the ship in the museum, the collection inside the ship. Within this topological stratification, which dates diachronically from the 4th c. BC, to the British colonial rule of Cyprus, it is necessary to establish a visitor path that can determine a comprehensible narrative of the collection and of the museum itself.

THE CASTLE'S FORMATION PROCESS

The number of castles along the Mediterranean coast is impressive: together with the system of towers and the minor fortifications they created a network for inspecting and controlling the movement of ships and people. In specific cases, they were simply keeping and protecting a waterway or a port. In the case of the Kyrenia Castle, there is clearly a very articulated transformation through time, evolving accordingly to the evolution of weaponry and its different owners.[1] The Kyrenia Castle represents three distinct periods of architectural development, as the techniques of warfare advanced from bows and arrows to the invention of gunpowder and cannons. It is one of the best examples to trace the evolution of medieval military castles in the region. The three periods traceable in the architecture of the fortifications are Byzantine (330-1192), Lusignan (1192-1472) and Venetian (1472-1570).[2] The special position, with its strategic and practical importance, seems confirmed by the archaeological evidence besides the castle, Roman mosaics and

1 Camiz et al. 2016.
2 Enlart 1899.

Roman catacombs suggest the presence of earlier settlements. The "Kyrenia Shipwreck" is the common name used to indicate the important finding of a ship from the 4th c. BC in the waters in front of Kyrenia.[3] This important relic is currently visible inside the castle museum.[4]

Today the castle, with its round towers, solidly built curtain walls and ramparts, represents one of the best architectural examples of the medieval and Venetian military architecture. Inside the castle, in still well recognizable conditions, there are prison cells, accommodation and water cisterns created to provide support in case of siege. The drawbridge over a moat was the only way to access the castle. In the harbour, a chain tower is still in place, used to control incoming unwanted ships. The gun ports facing the land are worth an explanation, since they expected an attack to arrive not only from the sea. However, in 1571 the castle surrendered to the Ottoman army without a single shot.[5]

The Lusignan period castle entrance is visible after the end of the Venetian entrance rampart. The castle tower with its larger cut stones and coat of arms above the gate (placed during the British period) stands out from the Venetian period masonry work. The squared tower entrance of the Lusignan castle gate also had a *portcullis*. After the entrance a short tunnel suddenly turns left, this is a defence system in case the castle door gets broken into, turning a blind corner and limiting the number of enemies to pass by and giving a better chance in pushing them back.

The North-East tower of the Kyrenia castle is still an intact Lusignan "horseshoe-shaped" tower with angled footing and loopholes for firing longbows (Fig. 1).[6] The battlements, first built by the Lusignans, were later improved by the Venetians; they can be seen today on the northern curtain wall. During this time, an enemy attack would have used catapults instead of cannons. Ballista, crossbow, swords and arrows were the most common weapons. The Lusignan castle include a *donjon* or keep, which is partially visible today as part of the museum exhibition, where King Peter's pregnant mistress was supposedly imprisoned by his jealous wife.

During the Lusignan period, Kyrenia was a fortified town with its own towers and was part of the castle's fortification. The castle was further enhanced by the Venetians and went out of use during the Ottoman period.[7]

3 Katzev 1981.
4 Katzev 2008.
5 Hill 1948.
6 Jeffery 1918.
7 Petre 2010.

The Byzantine castle is the first evidence we have for Kyrenia and it is possible to trace the fragmentary remains. The main and prominent architecture from the Byzantine period is the chapel of St. George. Originally built outside of the Byzantine castle (and later outside Lusignan period castle). Venetians however, built their north-west tower enveloping it within the castle. All the castle's stones came from nearby stone quarry named Chrysokava. This area later became an Early Byzantine worship place.

THE STRUCTURE OF THE WORKSHOP

During the workshop in Kyrenia, "Reading and Designing the Kyrenia Castle" held in May 2018, an articulated group of participants from 30 different countries has studied the Castle of Kyrenia. 56 students, 15 tutors and ten professors had the opportunity of considering this large castle from the point of view of the documentation, diagnosis, design and hypothesis of reuse and enhancement of its monumental apparatus (Figs. 2-3). We divided the subject into three main tasks: the gathering of historical documentation, both from bibliographic sources and reading the evidence on site; the digital survey of the building with a specific attention to the museum areas; the design intervention on the museum areas.[8] The aim of the workshop, as coordinated with the Municipality of Girne and the Department of Antiquities and Museums (Eski Eserler ve Müzeler Dairesi), was to acquire data for the digital survey of the castle and then to design a new Archaeological Museum inside the castle. For this survey, time factor was extremely important. Given the size of the building we had to operate the survey while, teaching and following the post-processing and the preparation of the drawings/products coming from each scanning day. Nevertheless, it was possible to fit it all within in the mere time of one week.

We accomplished this result adopting an integrated survey, mixing the coverage from lasergrammetry with photogrammetry survey based on different sources, so to define a quite complete and well exploitable coverage of the whole castle. The different teams collected a full 3D laser scanner survey of the central court and of its surroundings, a large set of aerial photogrammetric pictures with a small UAV, thousands of terrestrial hi-res photographs, and a 3D eye complete imagery of the castle. The team of professors and tutors processed a part of the data collected on site during the workshop for teaching purposes.

8 Camiz – Verdiani – Ceylanlı 2018.

Within the different activities brought on, one team documented with photographs and drawings the different types of masonries present in the castle for restoration purposes[9], and one other team documented with terrestrial digital photogrammetric techniques some of the archaeological fragments in the castle.[10]

Exploiting these bases, the design teams proposed different solutions for a new exhibition area for the Kyrenia ship relic and redesigned the showcases inside the existing museum to exhibit the collection of artefacts found during the underwater archaeological search for the Kyrenia shipwreck. Hopefully, it would be very useful to acquire further funding for such a research project based for now only on the participants' goodwill, the possibility to move this museum to a new condition, emerged quite clearly from the work of the design group, a challenge that may find in the castle a subject of great potential.

LASER DIGITAL SURVEY

Since the very first planning of the workshop, we decided to have a 3D Laser Scanner Survey as the central element of all the measurement interventions. We made this choice because of some fundamental aspects: the 3D Laser Scanner is a fully trustable procedure, easy to teach (and learn). Furthermore, the operative range of measurement and the many quality/density features combinations allow the complete coverage of very large buildings in a short time. The set of software to manage and move the point cloud datasets from visualization to CAD integration are easily accessible and nowadays quite simple in their basic functions (so once again well suitable for teaching them in the short time of a workshop). Finally, the team of professors and tutors participating in the workshop was well experienced in using these tools and in planning fast operations. The 3D laser scanner in use for this survey was a Zöller-Froelich Z+F Imager 5006h, a phase-shift laser scanner capable to gather points at a distance up to 80 metres with an accuracy of about two millimetres on normal reflective materials. For all the scans we preferred to use settings with a density of points in "middle" mode (this setting created single point-cloud up to nine million points) or "high" mode (this setting created single point-cloud up to 19 million points) and with an accuracy mostly set to "high" (with a redundancy of five for each

9 Farre – Valletta – Ezdeşir 2019.
10 Attenni et al. 2019.

measured point). In this way, each scan station asked about three to six minutes, plus the positioning times. Because of the quite high level of details and the possibility to have always articulated shapes with well recognizable characteristics, we reduced the use of targets to simplify and improve the alignment procedures to a minimal, using mostly paper "black and white" checkerboard targets. A logic of "reduction" of the occlusion spaces[11] and of "support" to the following automatisms in point-cloud alignments[12], guided the planning of the survey strategy. In this way, it was possible to have short post processing times and fully descriptive results. The lasergrammetry survey covered the part of the castle from the main entrance up to the central court along the main passage and from there to the museum areas, the inner part of the northern tower, all the higher passages and the area of the church. In five days, we completed 257 scan stations, gathering about 2.5 billion of points (Fig. 4).

The needs of the workshop guided the post-processing strategy, starting from the second day of survey, one operator began to treat the datasets, checking them and bringing on the alignment of each scan into a unique point-cloud. In this way, each day of activity produced a single point-cloud, which was later processed by one of the student groups. The focus area of the groups was all around the museum area and the central court. The survey work started from there and moved around for the first three days. We mostly dedicated the last two survey days to the sectors out useful for the planning/design studies, like the top parts with passages and the church.

The software in use for the post-processing of the 3D Laser Scanner data were Autodesk Recap and Bentley Pointools 8Vi. These are two very practical tools, with Recap capable to accept directly the ZFS (proprietary file format of Z+F laser scanners) files from the Z+F (Zoller & Fröhlich) unit, process them in fast, automatic (and easy to teach) mode and implement the point-cloud data into other Autodesk software. The aligned point-cloud was then the base to produce some very basic reference for the students' group: vertical and horizontal sections, fronts, plan views, orthographic and perspective views of the castle. We selected the views according to descriptive needs and following specific questions from the students and tutors. After the definition of the views, most of the time, the drawing was extracted in raster

11 Bini – Bertocci 2012.
12 Pomerleau – Colas – Siegwart 2015.

image mode, using the simplest solution for producing classic 2D drawings. We postponed all the 3D and advanced modelling needed for our research to the following steps of the workshop.

TERRESTRIAL PHOTOGRAMMETRY

In the last ten years, the renovation of photogrammetry has brought incredible advantages in all the disciplines. Nowadays the evolution of these tools undoubtedly provides a great opportunity for any built heritage documentation. The increased use of these tools is evident the integration of GPS and 3D laser scanner data makes the use of photogrammetry strategic and efficient. The use of different dataset (3DLS, GPS, Images) is moving to full integration, leaving the separation of tools/kind of surveys[13] as a past condition. The fast operations and the good results, in creating a model become as simple as taking pictures. For most of the students, at their first experience, the use of software based SfM/IM procedures[14] does look simple and intuitive.

The automatization of the photogrammetry processing and the almost immediate generation of 3D models create sometimes the conditions for operating in a sort of "black box". On one side, the pictures enter and on the other, the textured 3D model comes out. It looks like the renewed photogrammetry has inverted the satirical aphorism of Ambrose Bierce when in his "Devil's Dictionary" at the word "Picture" he wrote: "A representation in two dimensions of something wearisome in three."[15] Thus, it is clear that the quality depends on the quality of the pictures. Becoming a good photographer, at least from a technical point of view, with clear knowledge about the photographic aspects, and how they may affect the photogrammetric results, is the most relevant step any student should take to start using conscientiously a camera to produce 3D models. Keeping the students out of this understanding is most of the case a poor choice.

The workshop had various photogrammetric activities, in many of them, the students were called to use and to get better experienced with their own cameras, while, at the same time, a set of professional pictures were taken by tutors and/or professors to create a solid completion of the digital documentation of the castle.

We divided the photogrammetric works by subjects and tools. One considered the external front of the castle (using both a Nikon D800e full frame,

13 Guidi 2014.
14 Guidi – Gonizzi – Micoli 2014.
15 Bierce 2018.

36.3Mp DSLR with a 24-120mm F4 Nikkor zoom lens and a 3D Eye kit with Sony Cyber-shot DSC-QX30 20.1 Mp camera, 10 meters pole and remote control); one about the relic of the ship in the shipwreck room. Another one examined the graffiti in the shipwreck room.[16] One surveyed the church[17] using only the Nikon D800e with the Nikkor 24-120mm F4 and a Micro-Nikkor 60mm F2.8; one about the single fragments around the main court, developed with various cameras.[18] Moreover, some group of students experimented the photogrammetry shooting and processing on one front of the central court, using their own equipment.

We processed the photogrammetric data partially in place, but postponed the accurate and final processing to the following phases. The problems related to in-place operations included the processing time and the absences of a robust internet connection. We could not solve the first issue the short time of the workshop, but resolved the second by not uploading the pictures to the online service of Autodesk Recap. We processed most of the photogrammetric data with Agisoft Photoscan, and two well performant notebooks. We tested Reality Capture software to allow the participants to compare the different results, the computing times, the specific differences in the workflow from the pictures to the final 3D model.

We instructed the students how to work correctly for terrestrial photogrammetry, details about their cameras and about the tools in use in the workshop (the characteristics and benefits of a professional high-resolution DSLR and of the 3D Eye kit). They got all the information on how to perform basic treatments of their images and 3D models to enhance the results, without going too much in details about an advanced solution for pre-processing the pictures and post-processing the 3D models.[19]

AERIAL PHOTOGRAMMETRY

Taking pictures from the air is one of the most common need (and dream) in archaeological external survey, in the last years it became a common task in any well-structured intervention.

The easy access to UAV technologies and the availability of simplified systems, allowed anyone the use of a "flying camera."[20] It is worth to say that such

16 Bertocci – Verdiani – Şevketoğlu 2019.
17 Volzone – Cioli – Bigongiari 2019.
18 Attenni et al. 2019.
19 Verdiani 2011.
20 Gilli – Gilli 2016.

a condition meets the need of regulations and rules, so, the actual conditions for using this global innovation must accomplish to local and specific rules, drone operators should always follow authorizations and laws. In the case of the castle, having a flight with a UAV unit was a great contribution in terms of completion and integration of the digital survey. Using a DJI Spark unit, equipped with a 12 MP camera, the series of flights produced a sub-selection of 1303 usable shots, covering all the top parts of the walls and completing a massive, but well detailed 3D model of all the external parts of the castle and its near surroundings.[21]

The operators started all the flights from the central courtyard and from the castle's upper parts, while some secondary flights covered the streets surrounding the castle. The participants to the workshop were able to assist the operation and post-process various image sets taken from the UAV, obviously, it was not possible to have a "hands on" experience in flight mode, but they received a well-detailed description of all the procedures and operational conditions.

DESIGN EXPERIMENTATION

Three design teams worked in close contact with the lasergrammetry team who provided the necessary cloud datasets of the whole structure useful for the CAD programs during the design process. The given design assignment was to re-evaluate the spatial characteristics of the castle and the existing museum section and come up with a proposal for an archaeological museum entirely dedicated to the Kyrenia shipwreck[22], which indeed holds a preeminent role in the history of underwater archaeology.[23] The design teams approached the castle museum from different angles: the design program was set comprehensively from the main entrance of the castle to the showcases for the artefacts with a separate temporary structure for the shipwreck, and focused on the existing museum section to create an affordable real-time solution as a response to the request of the museum administration.

Both approaches acknowledged the changing characteristics of museums in terms of pedagogy, cultural production, economic appraisal, and social interaction where the museum is designed in consideration with the "bodily,

21 Camiz – Bercigli 2019.
22 Katzev 1981.
23 Katzev 2008.

sensory and affective impacts of spaces and objects on visitors."[24]

The tutors and students did not conduct the design intervention merely as a museum design exercise, but also examined throughout the workshop the means of understanding and promoting the cultural heritage. One of the groups chose to introduce a new architectural extension redefining the visitor's path (Figs. 5-6).

The group working on the showcases highlighted the small artefacts belonging to the Kyrenia shipwreck, depicting a physical attribution to what the casings exhibit. Another group defined the existing problems of the current exhibition, and the physical inadequacies of the castle museum, proposing a practical yet inclusive design, where the sixth room on the northeast side of the inner courtyard was to include a contemporary structure to house the ship's relic.[25] We meant the design proposals to illustrate to the administrative organs a perspective plan of executing a well-rounded museum for the sake of the castle, the shipwreck and the city of Kyrenia.

CONTAINER AND CONTENT: LEVELS OF INTERIORITY

The designer who is establishing a new function within an existing building is always dealing with a high number of formal constraints. In the case of a heritage building the number of formal constraints increases dramatically. We intend here by formal constraints the given condition that delimits the designer's freedom in determining forms within the project. The contextual setting of such a condition is therefore delimiting the different possibilities of the project. Constraints are not only those given by regulations and codes but are also the consequence of the search of meaning in the designers' intention. As a meaningful *metafora*, it is like writing a comment to an existing text, a genre widely in use in the mediaeval tradition of religious literature.[26] Therein it was not possible to write freely, it was possible to write only in relation to the sacred text and its different levels of meaning. Jacques Derrida[27] was the first to establish this approach in modern philosophy giving birth to what was later referred to as de-construction. This became an architectural style which, by misinterpreting the sense of de-construction, was characterised

24 Tzortzi 2017.
25 Ceylanlı et al. 2019.
26 E.g. Fortunatianus Aquileiensis in Dorfbauer 2017.
27 Derrida 1967.

mostly by broken forms. Within the contemporary production of museum architecture, especially within archaeological areas, it is possible to parameterise the different levels of meaning and relationship that the formal constraints given by the context (the castle), could establish within the content (the collection). Within the specific case of the castle, the project established a formal and meaningful relationship between the container, the castle, and the content, the archaeological collection. The design activity determined how and where the visitor is able to read the meaning levels. As an example, we designed the museum entrance as a gate across a sacred limit, the *τέμενος*, which in the case of a museum acts as time gate. It became the place where the visitor goes across two different times, the contemporary time, and the trip in the past that the museum effectively impersonates (Figs. 7-9).

CONCLUSIONS

The "Kyrenia Castle" workshop has been the occasion to establish an operative base of knowledge and to gather a significant amount of data about a castle that represents a challenging monument in the Mediterranean scenario. The first digitalization of this fortification is the starting point of a series of studies. This paper, following the poster brought in the CHNT/VH conference in Vienna in the November 2018, presents the roadmap about the post-processing of the digital resources produced in the castle in the days of the workshop (Fig. 10).

If the workshop was the moment to disseminate and strictly collaborate, the following phases are the moments for reflections, in-depth research, accurate calculations, experiment and testing with different solutions. This research facilitated the development of a series of papers describing the various activities and the specific experience and investigations, centred on the castle. A series of Master Degree and Specialization Thesis include the development of an HBIM[28] of some parts of the castle, the proposals for a new museum, an intervention plan about a set of strategic restorations and new approaches to the presentation of some valuable items inside the castle, like the Kyrenia Ship and the various graffiti. The historical value of the subject and the technically advanced intervention, mixed with professional and academic competencies has brought to a high-quality teaching moment, even

28 Brusaporci 2015.

in the variety of proveniences, interests, approaches, the people involved in this experience have found a moment of measuring themselves with the importance of the monument, with history. A moment where Cultural Heritage and New Technologies have really found a common ground.

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Fig. 1 – Aerial view of the Kyrenia Castle (drone photo A. Camiz, 2018).

Fig. 2 - A group of participants working with the 3D Eye unit (photo G. Verdiani, 2018).

Fig. 3 - Group photo of the workshop participants (photo Z. Ceylanlı, 2018).

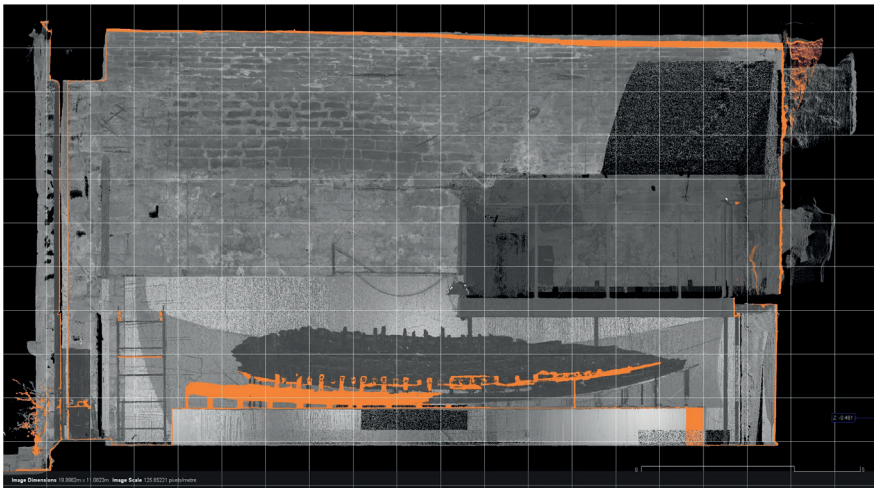

Fig. 4 - A section across the room containing the shipwreck (laser scanner generated point cloud, G. Verdiani, 2018).

Fig. 5 - Proposal for a museum extension hosting the ship relic, Nariste Ibraeva, Kyrenia shipwreck museum, INT302 Interior design studio VI, Girne American University, Faculty of Architecture, Design and Fine Arts, Prof. Dr. Alessandro Camiz, spring 2017-18.

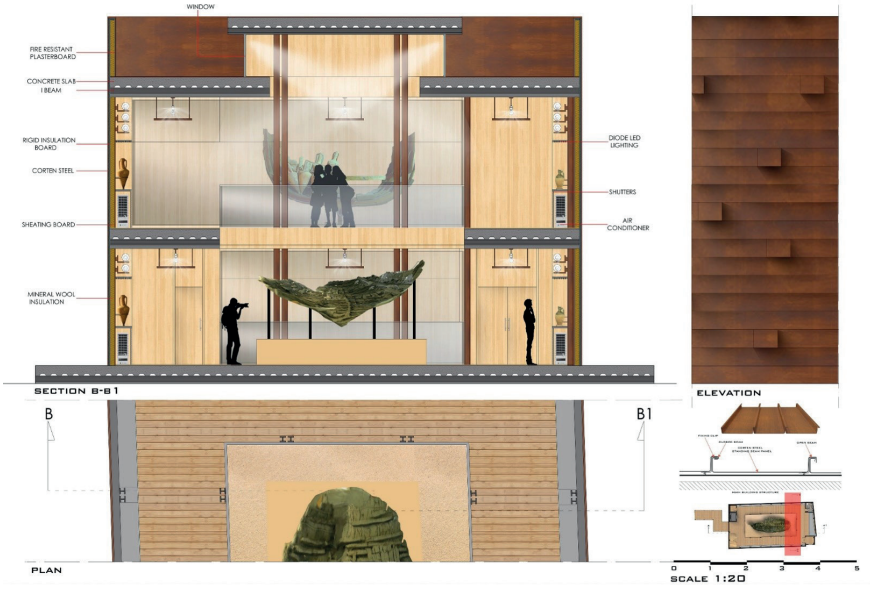

Fig. 6 - Section across the museum extension displaying the ship relic, Nariste Ibraeva, Kyrenia shipwreck museum, INT302 Interior design studio VI, Girne American University, Faculty of Architecture, Design and Fine Arts, Prof. Alessandro Camiz, spring 2017-18.

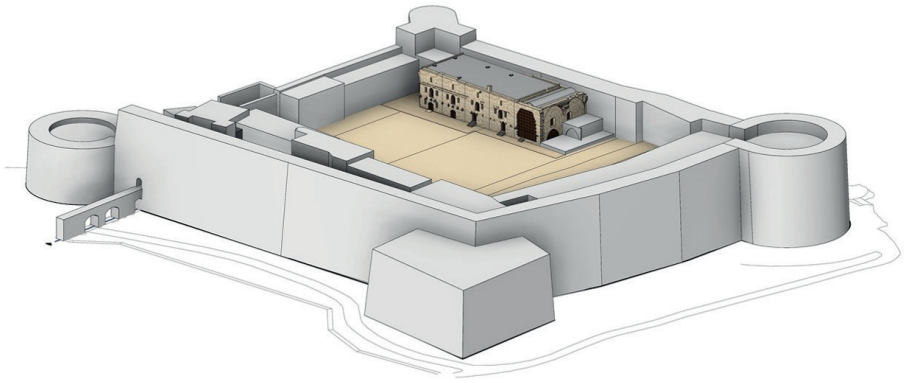

Fig. 7 - BIM documentation of the Kyrenia Castle (drawing F. Capparelli, 2019).

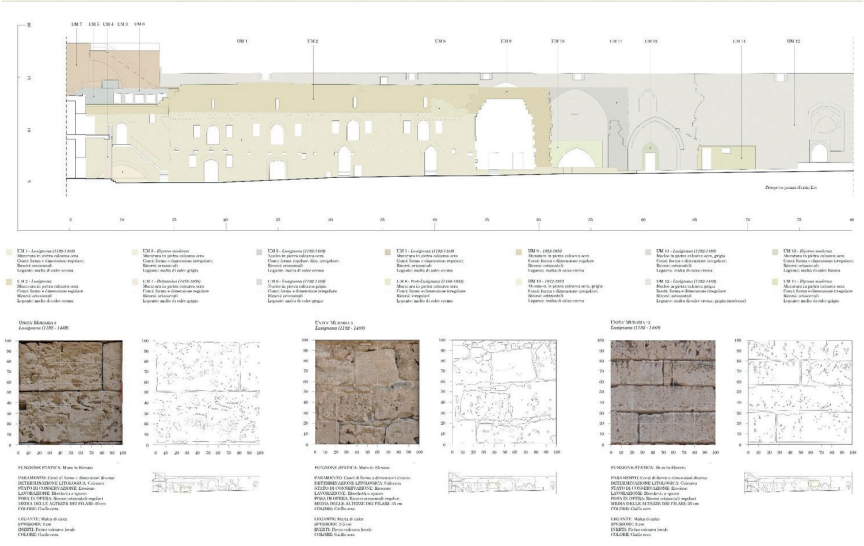

Fig. 8 - The survey of different masonry types (drawing E. Valletta, 2018).

Fig. 9 - Reintegration of a missing part of the palace's façade in Corten steel (drawing E. Valletta, 2018).

Fig. 10 - The poster (A0 format) as presented in occasion of the Cultural Heritage and New Technology/Visual Heritage Conference, Vienna, 2018.