YSMA

# The Acropolis Restoration News

21-22 • June 2024

*Trial positioning of an orthostate block in the Parthenon's west pediment. Photo K. Karanasos, 2021*

# 2021-2022, The progress of the restoration works on the Acropolis

The prospects at the beginning of 2021 seemed rather ominous. The Service, in conformity with circulars regarding measures to mitigate the spread of the COVID-19 pandemic, put into effect a strict work programme, according to which physically present staff did not exceed 50% of the total number of employees. Following the lifting of restrictions, technical staff returned to normal work, while the option for 20% of the personnel to engage in remote work remained available until mid-2022.

Despite the obvious difficulties, the Service responded satisfactorily both in terms of the work that was in progress and the submission of proposals for new undertakings and projects. At the end of 2022, the absorption rate of the project "Restoration and Conservation of the Acropolis Monuments", funded by the National Strategic Reference Framework (NSRF) 2014-2020, was 82%, and its tangible outcome had been delivered at the same rate. The completion of delayed actions was deferred to the end of 2023, after the relevant extension was approved. The protection of the Acropolis monuments was given priority among the projects included by the Hellenic Ministry of Culture in the "National Recovery and Resilience Plan, Greece 2.0". Coordinated by G. Didaskalou, Secretary General of Culture, analytical proposals were submitted and the project "Restoration, Conservation and Enhancement of the Acropolis Monuments", with an estimated budget of 10,000,000 €, was launched in mid-2022, through the recruitment of staff of different specialties, covering around 70 new posts.

Undeniably, the realization of the 7th International Meeting for the restoration of the Acropolis monuments was a major success for the Service, not only because this hybrid event took place without any technical problems during the pandemic, but mainly because the Service responded to the objectives of the venture as these were set in early 2021. Of course this could not have been made possible if the "Study of the West Ascent" had not been completed, on account of the unflagging effort of the President of the Committee for the Conservation of the Acropolis Monuments (ESMA) Prof. M. Korres and his collaborators Chr. Takos and E. Malkakis. The studies prepared over the last years on the restoration of the walls was the second major topic thoroughly presented at the Meeting by YSMA's Technical Office for the conservation, consolidation and restoration of the Circuit Walls of the Acropolis and its Conservation Office.

*Trial positioning of a stone block of the backing wall of the Parthenon's west pediment. Photo K. Skaris, 2022.*

For the period 2021–2022, the following works were undertaken: the Technical Office for the conservation and restoration of the Parthenon is staffed by the architect R. Christodoulopoulou, who serves as the Head of the project, the architects K. Karanasos, Dr L. Lambrinou, V. Manidaki, A. Papandropoulos, K. Skaris as well as the civil engineers A. Vrouva, Dr I. Dourakopoulos and Dr E. Pasiou. In charge of the technical crews are the marble technicians G. Aggelopoulos and S. Kardamis.

The restoration programme of the monument's west pediment is well underway, as the stone blocks of the orthostate and the cornice have been restored. At the same time, restoration works on the 3rd course of the backing wall have been completed, while works performed on the 4th course are in progress. However, the design of the new clamps that will ensure the successful connection between the architectural members of the tympanum and the respective backing wall blocks has not been completed. A series of experimental tests are conducted under the supervision of one of ESMA's members, Prof. Ch. Mouzakis, in order to confirm the outcomes of the relevant study set out by A. Vrouva. After the completion of the study, the orthostate blocks of the tympanum will be repositioned.

The north wall of the cella is being restored at the level of the 2nd course, whereas work has progressed up to the 9th block from the east. In parallel with the application studies on the structural restoration of architectural members and their assembly method, the study on the attribution of the ancient stones in the east part of the north wall's 2nd course was updated. In 2022, works for the restoration of the partition wall separating the cella from the opisthodomos, which will be entirely built of new marble, commenced. Financed by the Recovery Facility, the restoration of the toichobate of the south wall of the Parthenon cella was launched, following the updating of the study on the restoration of the toichobate and the orthostate of the cella's south wall, by L. Lambrinou.

Two research programmes in collaboration with the National Technical University of Athens (NTUA) were carried out to meet the needs of the work executed on the Parthenon during the reporting period. The first one under the title "Design control of titanium horizontal elements between marble architectural members", is supervised by Prof. S. Kourkoulis, while the second programme "Design control of titanium dowels between marble architectural members" is coordinated by Prof. E. Vintzileou.

Aside from restoration programmes, works related to the worksite were also completed, the most important of which was the construction of a worksite access track west of the Parthenon. Furthermore, scattered architectural members and fragments from the old Acropolis Museum were arranged, while 12 coffered slabs belonging to the ceiling of the west pteron from the Chalkotheke site, north of the Parthenon, were transferred and stored. Also, marbles used during the interventions by N. Balanos were moved and placed north of the Parthenon in order to be used for the construction of seats.

The Technical Office for the conservation, consolidation and restoration of the Circuit Walls, under the direction of the civil engineer D. Michalopoulou, consists of the architects K. Mamalougas and A. Chatzipapa. During 2021, the architect Ch. Pinatsi and the civil engineer Dr E. Kakogiannou worked in the Office, while the architect A. Spyropoulou and the civil engineer Dr I. Dourakopoulos joined it in 2022. Responsible for the restoration crew is the marble technician G. Vasdekis.

In the area B17 of the north wall, where filling with new stone blocks had been completed in accordance with the approved study, the following works were performed: filling of lacunae within the wall using compatible mortar in places that were inaccessible prior to the removal of the metal support-buttressing system; filling of lacunae found in the later stonework in the upper part of the wall's inner face and also on a surface around 15m$^2$ in area in the west face of the adjoining tower-shaped buttress that was not included in the original study. Other works involved dismantling of the metal support-buttressing system of the wall and part of the bearing scaffolding by means of a bridge crane; modification of the scaffolding for the conservation of the ancient stones of the lower courses and application of injected mortar to the interface between the rock and the ancient bearing stones of the wall.

During the period under consideration, the project "Consolidation of the Mycenaean stairway retaining walls" came to fruition. Overall, a surface covering around 140m$^2$ was repointed and a stonework occupying 18m$^3$ was reconstructed.

In addition, in the autumn of 2022, a scaffolding fitted with a bridge crane was mounted in the B12 area of the north wall, where restoration works will be immediately launched, according to the approved study prepared by A. Chatzipapa.

As for instrumental monitoring, in 2021 recordings obtained from the accelerometer array (contract with the Institute of Geodynamics of the National Observatory), and also by means of a fibreoptic system at the foundation of the Propylaia Pinakotheke (OSMOS Hellas) continued. In the autumn of 2021, the removal from the monuments and the rocky slopes of unwanted vegetation was assigned to a crew of specialist linemen.

In 2021, the "Geotechnical-structural study of the Circuit Walls of the Athenian Acropolis and their rocky substratum in selected sites of immediate priority" drawn up by GEOPER Consultants Engineers SA, in partnership with DOMOS Consulting Engineers, under the supervision of D. Michalopoulou and N. Ninis, was approved by the Central Archaeological Council (KAS). The approval decision dated 31.12.2021 set forth terms which the researchers took into consideration during the preparation of the implementation study. This study, alongside the "Strategic plan for the interventions in the Walls of the Athenian Acropolis" elaborated by the Technical Office for the conservation, consolida-

*Elaborating a fragment for the orthostate of the south wall of the Parthenon cella. Photo R. Christodoulopoulou, 2022*

*Setting up a scaffolding for the commencement of works in the B12 area of the Acropolis north wall. Photo V. Eleftheriou, 2022*

tion and restoration of the Circuit Walls of the Acropolis (D. Michalopoulou, K. Koutsadelis, Ch. Pinatsi, E. Kakogiannou and A. Chatzipapa) and the Technical Office and Laboratory of Surface Conservation (E. Aggelakopoulou, E. Xinopoulou and A. Tsimereki), as well as the "Study for the restoration of the north wall in the area B15 of the classical postern" prepared by K. Mamalougas, were approved by KAS, in August 2022.

Since early 2021, YSMA undertook to investigate the preservation state of the pedestal of Agrippa that leans to the northwest. Given that the monument has not been incorporated into one of the established Offices of the Service, the coordination of the works was entrusted to a three-member team consisting of two engineers working in the Technical Offices of the Circuit Walls and the Parthenon (D. Michalopoulou and K. Karanasos) and a conservator of the Conservation Office (K. Frantzikinaki). Reference to the studies drawn up and the measures proposed is made elsewhere in this issue.

The project deliverable, for which the Conservation Office was responsible, carried out in the context of the NSRF 2014-2020, was completed on time at the end of 2021. It was followed by the drafting of reports on the preservation state and proposals for conservation interventions necessary in other parts of the monuments, where works were launched. In charge of the Technical Office and Surface Conservation Laboratory is the chemical engineer Dr E. Aggelakopoulou.

On the Parthenon, the conservation of the horizontal geison blocks and the orthostates of the west pediment was completed, under the supervision of the conservator A. Panou. On the tympanum's backing wall, works executed on the dismantled members and the majority of the repositioned stones finished. On the cella's north wall were conducted all scheduled works and, in the summer of 2022, works on the toichobate of the cella's south wall commenced.

On the Walls, systematic interventions were performed in the stones of the lower layers of the classical phase in the north wall's B17 area, coordinated by the conservator A. Tsimereki. Works on the stones of the north wall in the area B12 continued and, in the summer of 2022, systematic conservation work began on the inner face of the B14 area.

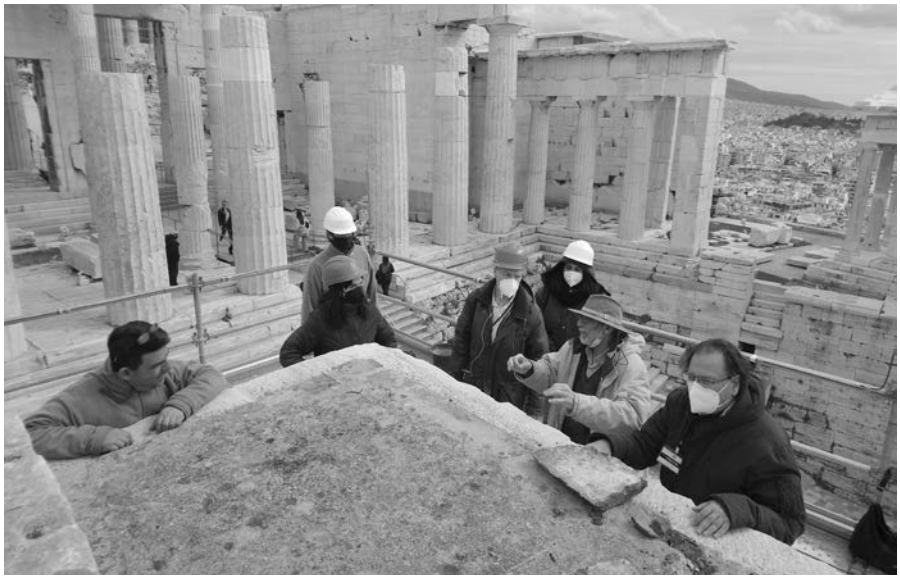
At the Propylaia, conservation works on the portal wall, led by the conservator K. Frantzikinaki, were completed, while works were initiated on the inner side of the rest of the Pinakotheke walls.

*Clearing vegetation from the monuments, 2021*

On the pedestal of the Monument of Agrippa, surface conservation work began in October 2021, directed by the conservator K. Frantzikinaki, following the approval of the relevant report and, by August 2022, the first phase of the project that concerned the upper part of the monument, from the crepis to the pedestal's crown, had been brought to completion. The next phase that involves the foundation will be implemented in parallel with consolidation measures proposed in the structural study.

At the Erechtheion, conservation work on the columns of the north porch was launched, supervised by the conservator G. Frantzi.

The Technical Office of Surface Conservation implemented the research programme titled "Design and assessment of structural mortars for joining large poros and marble fragments and of anchoring titanium/stainless steel rods" in collaboration with the Technical University of Crete (supervised by Prof. P. Maravelaki) and the NTUA (coordinated by Prof. A. Bakolas).



*Inspection of the monument of Agrippa by ESMA's members. Photo V. Eleftheriou, 2021*

The inventorying, documentation and cataloguing of scattered architectural members on the Acropolis site –under the supervision of the Head of the Office, the archaeologist Dr E. Sioumpara, with the participation of the archaeologist Dr A. Livieratou– continued throughout 2021, a time when the project's deliverable was achieved. The project, financed by the NSRF 2014-2020, includes the documentation and management of 400 scattered architectural members from the area of the Chalkotheke. These fragments were recorded and studied and, following the photogrammetric documentation of their original position, were divided into ensembles depending on their morphology, and transferred in accordance with the above classification into arranged stone piles north of the old Acropolis Museum.

In 2022, the Technical Office for Inventory, Documentation and Cataloguing Scattered Architectural Members embarked on new undertakings, with the participation of the archaeologist Dr M. Mylonas. These involve the preparation of studies, the documentation, as well as the transfer and arrangement of scattered architectural members. The "Study for the enhancement of the bases of the inscribed accounts of the tamiae of Athens" drawn up by E. Sioumpara and A. Livieratou, and also the "Study for the enhancement of the pedestals of votive offerings from the Chalkotheke and the restoration of two family pedestals" by E. Sioumpara were completed and approved by ESMA. Moreover, the preparation of a study for the systematic mapping of all scattered stones on the Acropolis rock and the proposal for the partial restoration of the pedestal of the small votive offering of the Attalid Dynasty commenced. One hundred and eight architectural members from the stone pile near the Arrephorion were moved and documented whereas, as part of the re-arrangement, around 180 members were transferred in total. In addition, 202 fragments were removed from the stone pile on the east face of the Arrephorion revetment for the creation of a walkway.

The Technical Office and Electromechanical Support Team, led by the mechanical engineer-museologist G. Kehagias, supported until September 2022 the operation of YSMA's worksites by coordinating the maintenance and repair of the existing equipment, but also the provision and installation of new equipment, the collection of waste, fuel supply, etc.

In 2021-2022, the Service produced a wide range of photogrammetric surveys and three-dimensional images in support of all works that were underway. Responsible for the photogrammetric documentation is the surveying engineer D. Mavromati, whereas in the Office also works the surveying engineer S. Kyparissi. During the period in question, the "Study of topographic and photogrammetric surveying on the Parthenon" continued through the collaboration of ELPHO Ltd. – FOTOPO SA, under the supervision of D. Mavromati, who also completed the preparation (tender issues – assignment) and supervision of the study "Production of a three-dimensional model of the Propylaia North Wing". The project was implemented by the consortium of Astrolabe Engineering – I. Partsinevelos – FOTOPO SA and TOPOSITE LP.

At the end of 2022, an invitation to electronic tender was announced for the assignment of the study "Topographic and photogrammetric surveying on the Parthenon and production of three-dimensional models of its architectural members and scattered material", with an estimated budget of 400,000 €, the tender issues of which were also prepared by D. Mavromati. Photographic documentation and the production of three-dimensional models and orthophotos were carried out through insourcing and involved more than 130 architectural members of the Parthenon, columns of the same monument but also of the north wing of the Erechtheion, as well as areas of the walls and the rocky substratum (B12 area, SE corner). Moreover, three-dimensional images of the Acropolis west access (photographs of 2020 and 2021), the pedestal of Agrippa and the rock in the area west of the Parthenon were produced.

During 2021-2022, YSMA's Documentation Office was run by permanent staff, the Head of the Office, Dr E. Lempidaki, the archaeologists E. Ka-

*Conservation of the toichobate blocks of the south wall of the Parthenon cella. Photo S. Gabrielidou, 2022*

*Conservation works on the north Acropolis wall, B12 area. Photo A. Tsimereki, 2021*

rakitsou and E. Petropoulou and the administrative employee P. Konstantopoulos, while the archaeologists Dr D. Andrikou, S. Poulou, Dr Ir. Pervolaraki and S. Alexaki, as well as the librarian M. Maznoki contributed to the activities undertaken in the context of the NSRF 2014-2020 and the Recovery and Resilience Facility. The filling of the computer scientist vacancy, following the retirement of I. Alexopoulos, proved to be particularly difficult, with the exception of the employment of D. Iliopoulou who retained the position until August 2021.

In terms of the documentation and management of documents, entry in the Database of documentation material concerning the restoration works on the Parthenon and the Walls continued. Other tasks that carried on involved the systematic registration in Access databases of relevant audiovisual material on the restoration of the monuments, but also AutoCAD files of the works, the entry of documentary material in the library (books, exhibitions, studies, journals, etc.) and the enrichment of YSMA's OpenABEKT library catalogue with new material. The electronic catalogue of drawings and photographs was completed in substitute of the respective handwritten log books of drawings and photographs.

The photographic documentation of the restoration processes and the filming of selected works on the monuments continued by the photographer T. Souvlakis and the outside collaborator K. Arvanitakis respectively. On the occasion of the 7th International Meeting for the Restoration of the Acropolis Monuments (2021), three films were produced related to the works performed. One more film on the documentation of the monuments' restoration but also the management and promotion of pieces of evidence was produced by the Office in the spring of 2022. All films are available on YouTube through YSMA's website.

In 2021, YSMA's website (www.ysma.gr) was redesigned placing emphasis on its operational security. As part of the upgrading of the services to visually impaired visitors, the Documentation Office engaged in the updating of an information leaflet on the Acropolis works in Braille and uppercase letters, whereas similar care was taken in the context of the website's design.

The archaeologists of the Documentation Office E. Petropoulou and E. Karakitsou kept the minutes of ESMA's meetings, which are now convened through videoconferencing except for a small number of meetings that take place on the archaeological site.

During 2021-2022, YSMA's Information and Education Department consisted of its Head, the archaeologist Ir. Kaimara and the archaeologists A. Leonti and A. Koutsoudaki. Due to the measures against the spread of the coronavirus disease, the educational programmes for schoolchildren resumed at the end of 2021. The educational programmes "The Acropolis monuments", "The Parthenon sculptures" and "Olympian riddles: Searching for the ancient gods in the Acropolis Museum" were attended by more than 1,600 school students, whereas in one programme participated students from the Special School for the Deaf and Hearing Impaired of Argyroupoli. In the second semester of 2022, two courses were organized for educators.

The publishing activity of the Department was prolific including the leaflets: "A Greek temple ... for kids!", "Educational activities about the Acropolis" and "Exploration map of the Acropolis for children", published in Greek and English, as well as the "Ten questions on the restoration and construction of the Acropolis monuments", issued in Greek. Of the digital activities, the most important was the conversion of the website "The Parthenon frieze repository" from an Adobe Flash environment into an open-source model, in collaboration with the National Documentation Centre (EKT) and the Acropolis Museum that was completed in early 2022. The redesign of the educational games of the same application followed immediately thereafter. The educational activity "Learn, play, create!" was posted on YSMA's website, while the Acropolis educational resources repository was supplemented with new educational material and publications.

The contribution of YSMA's Accounting Office during the preceding period was significant. Consisting of its Head, P. Katsimichas, and M. Mouzoura, E. Soulakou, A. Kapalou and A. Moschouris, its work involved the particularly demanding management and monitoring of the resources of the NSRF and

***Photo-textured three-dimensional model of the north wing of the Propylaia. Study: "Production of three-dimensional model of the Propylaia north wing", 2021***

the Public Investment Programme (PIP) funding schemes for the restoration and conservation project of the Acropolis monuments, but also the preparation and submission of a proposal in order to secure funding from the Recovery and Resilience Facility.

Responsible for the effective management of materials was E. Zygouras, while YSMA's Secretariat Office, despite being understaffed, successfully fulfilled its administrative duties owing to the contribution of its Head, Ch. Papanikolaou, as well as E. Drakopoulou and E. Katri.

For the current period, the Service assisted the Ephorate of Antiquities of the City of Athens (EFAPA) and the contractors' crews entrusted with the improvement of the archaeological site's infrastructures (drainage network, cordoning, panels, etc.) but also the old Acropolis Museum.

Following a request by the Directorate of Prehistoric and Classical Antiquities (DIPKA) regarding the updating of the files of monuments inscribed on the UNESCO list, the Offices of Documentation and Education undertook to enrich the Acropolis file with material produced between 2015 and 2021 (studies, films, publications, conferences, etc.). In the context of UNESCO's updating YSMA, in cooperation with DIPKA and EFAPA, presented the recent restoration work and provided informational material to a group of experts who visited the archaeological site from the 26th to the 29th of April 2022.

On the initiative of DIPKA a Risk Management Plan for archaeological sites is drawn up, including among others the Acropolis. YSMA collected and made available material, such as three-dimensional images of the rock, reports on damage incidents, plans of the premises and drawings of the equipment of the laboratories, recordings of instrumental monitoring, etc.

In 2022, the collaboration between YSMA, the NTUA and Japan's Kanagawa University to monitor the accelerometer array on the Parthenon was renewed for three more years.

*Meeting of the ESMA on the Acropolis. Pictured from the left: Ch. Mouzakis, N. Valakou, M. Korres, M. Mertzani, P. Koufopoulos, F. Mallouchou and V. Eleftheriou. Photo R. Christodoulopoulou, 2021*

The research programme SCIENCE, implemented by YSMA, in collaboration with the NTUA, Harokopio University and private bodies in the context of the national action "Bilateral and multilateral R&T cooperation between Greece and China" of the Operational Programme Competitiveness, Entrepreneurship and Innovation (EPAnEK), continued during the reporting period through the processing of satellite map images.

In the wake of the approval of the studies on the restoration of the building at 13, Polygnotou Street in order to house the "Charalambos Bouras" Documentation Centre for the Acropolis Works in 2020, the project's economic-technical study and tender issues were completed and the building license was issued. On 7.5.2021 the project's inclusion in PIP 2021 was approved, with an estimated budget of 3,331,600 €, the Directorate of Protection and Restoration of Modern and Contemporary Monuments (DPANSM) acting as the implementing body, and the participation of the Directorate of Conservation of Ancient and Modern Monuments (DSANM) and YSMA. The building's restoration and the conservation of its painted and ceramic decoration are in progress.

In conclusion, reference will be made once again to the 7th International Meeting for the restoration of the Acropolis Monuments (hybrid conference) that focused on the topic "The Acropolis restoration works: The new programmes" (11–13.11.2021). According to ESMA's standard practice, the proposals for future restoration programmes on the Acropolis monuments are presented and discussed in international meetings held at regular intervals. Eight years ago, at the 6th International Meeting, ESMA's then President, the late Charalambos Bouras, presented the final proposals for four of the Parthenon programmes (north wall, west wall, coffered ceiling of the Opisthonaos and west pediment), referred to the restoration programmes of the Walls that were about to be launched, and concluded his presentation by talking about the restoration of visitors' access and circulation through the Propylaia as a future, yet crucial project.

At the beginning of 2021, the proposal of ESMA's President M. Korres regarding the restoration of the west access and the necessity to proceed to the project, in parallel with the ongoing restoration programmes, was discussed at the Committee.

Meanwhile, the studies on the resto-

*Snapshot from the 7th International Meeting for the restoration of the Acropolis monuments. Photo T. Souvlakis, 2021*

*Updating the participants on the future restoration programmes, during the 7th International Meeting. Photo T. Souvlakis, 2021*

ration of the Walls had been completed, including both the "Strategic Plan of the interventions in the Acropolis Walls" elaborated by an interdisciplinary team of YSMA, as well as the "Geotechnical – structural study on the Acropolis Circuit Walls and the rocky substratum" by private researchers selected after a relevant tender. It was, therefore, necessary for these two serious issues, the interventions in the west access and the Walls, to become the topic of a new international meeting.

Despite time restrictions and the difficulties which the pandemic brought about, the 7th International Meeting was held in November 2021 by YSMA and ESMA, in collaboration with the General Secretariat of Culture, the Ephorate of Antiquities of the City of Athens and the Acropolis Museum. There is no doubt that the success of the Meeting was the result of the coordinated efforts of the Documentation Office and the Information and Education Department that were chiefly responsible for the planning. It should be stressed that, for the first time, the event provided to remote participants the chance of attending the Conference, and also of exchanging views with those who were physically present in the amphitheatre through a specially designed webpage.

The Conference papers were organized in six thematic sessions. The first session included the recently implemented works on the Acropolis; the second concerned the presentation of the restoration programme of the west ascent that involves the removal of the present spiralling ascent to the Acropolis leading up to the monument through the Late Roman Gate –commonly known as Beulé Gate– and the restoration of the west stairway to the sanctuary of the Acropolis in the form it had acquired during the arrangement of the 1st c. AD. The third session was held on the Acropolis, where the conference participants were informed about the proposals of future programmes but also about the ongoing restoration works. The fourth session focused on intervention proposals in the Wall which are put forth on a case-by-case basis depending on the area of the monument, its preservation state and potential hazard. They are divided into plain, purely rescue steps and more complex interventions which will contribute to the enhancement of the remains of the classical Wall lying hidden underneath later superposed layers or are visible, yet their continuity is interrupted by later additions. In the fifth session were presented monument management proposals from other projects abroad, mainly Italy. Finally, in the last day, during a six-hour-long session, 32 participants took the floor expressing their own views on the proposals discussed.

The Conference was attended by around 250 participants, 110 of whom were physically present and 140 were online whereas, through the "Watch on YouTube" page, 1,568 unique users (watching in Greek) and 167 visitors (watching in English) were counted.

The participants were given access to two key studies discussed during the Meeting: the "Strategic Plan of the interventions in the Acropolis Walls", YSMA's digital edition, and the "Study of the West Ascent", for the printing of which ESMA's President was personally responsible. An exhibition was organized at the Acropolis Museum temporary exhibition gallery with material coming from these studies.

Three films-videos on the restoration works were produced and presented in the context of the Meeting. Aside from the visit to the Acropolis monuments during the Conference, one more visit was held, at a later time, to inform online participants.

After the completion of the event, a questionnaire was sent to the participants regarding the restoration programmes that constituted the Meeting's main theme. The responses underscore the concerns over demanding restoration issues and will substantially contribute to the final proposals put forward, according to which the future programmes on the Acropolis monuments will be carried out.

***Vasiliki Eleftheriou***
*Architect Engineer*
*Director of YSMA*

** Translation by D. D.*

The tympana of the Parthenon pediments were internally reinforced by a backing wall. They consisted of thin vertical marble slabs that served as the background for the sculptures, while the backing wall was built in the *opus isodomum* masonry system. The tympanum is around 29m long and the maximum height of the triangular face from the base to the apex is about 3.5m. The thickness of the stone blocks of the orthostates (a total of ten blocks with an average length of around 2.4m each) ranges between 0.25 and 0.45m. The standard backing wall stone blocks are usually 0.5m in height, 1.8m in length and 0.8m in thickness.

In the original construction, aside from the typically encountered iron clamps and dowels used for holding the stone blocks together, as these were positioned in direct contact with each other without any mortar (in dry masonry), special metal clamps connected the tympanum stones to those of the backing wall. These metal connectors were necessary, since the backing wall functioned as a counterweight to the tall and lean orthostate slabs which are inherently prone to topple over during seismic excitation. The so-called "twisted clamps", a term coined by Penrose in 1888, constituted a special feature of the original construction.

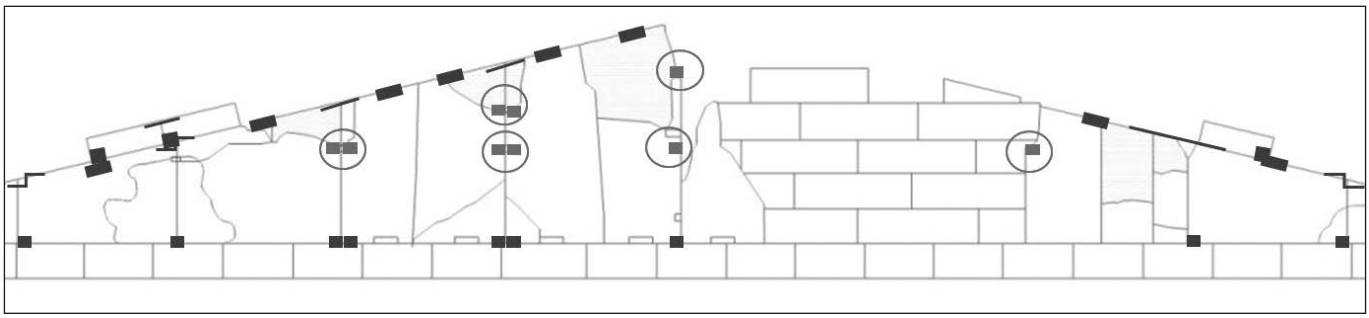
In the ongoing restoration programme, during which the restoration of the west pediment is underway, it was found necessary to redesign these connectors. The redesign had to take into consideration the damage which the monument had endured and, at the same time, comply with safety requirements against seismic events.

**Preservation state of the structure**

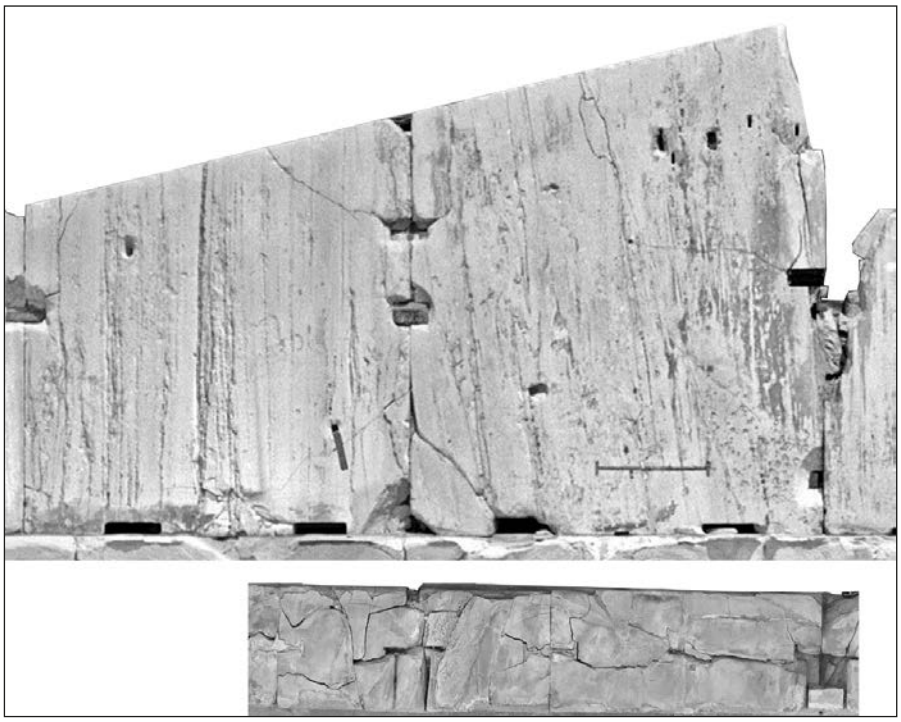
The monument spanning 2,500 years of history has suffered damage mainly inflicted by human encroachment and accidental factors, but also wear caused by the ageing of its materials. As other researchers (Korres, Zambas, Toumbakari) have also pointed out, deterioration involved fractures and cracks in the anchorage area of the metal clamps and dowels of the orthostate blocks, associated with the function of these elements, damages caused by the monument's bombardment during the Ottoman-Venetian War, and vertical cracks related to the crystalline structure of the material. Three blocks were thus dismantled and restored, in accordance with the standard practice, and are now ready to be remounted in their original position.

The most severe damage mainly resulted from the fire of the 2nd century AD, affecting the backing wall blocks. The fire caused serious thermal cracks within the backing wall. Although the east face of the stone blocks seemed intact, a few centimetres beneath their surface, a multiple fracture network was noticed reaching around the midpoint of each block's thickness. The failure mechanism was also confirmed by experiments conducted on the worksite by the architect K. Skaris. Given that the load-bearing capacity of the thermally affected marble is reduced and the anchorage areas of the transverse clamps are fractured, the restoration planning had to take account of tight constraints. It was decided to restore most of the stone blocks in situ –without dismantling, as they were undisturbed since the original construction– by using

*The Parthenon's west pediment. Photo S. Gesafidis*



*The Parthenon's west pediment. The ancient connections of the tympanum's orthostate blocks are schematically marked; the position of each twisted clamp is shown within a circle. Substrate: V. Manidaki, L. Palaiologos, 2016*



*Top: The preservation state of the orthtostate blocks. Photogrammetric survey: D. Mavromati. Bottom: The preservation state of the backing wall stones before restoration. Photogrammetric survey of the of the upper surface of the 3rd course. Photos G. Gesafidis. Photogrammetric survey: D. Mavromati, S. Kyparissi*

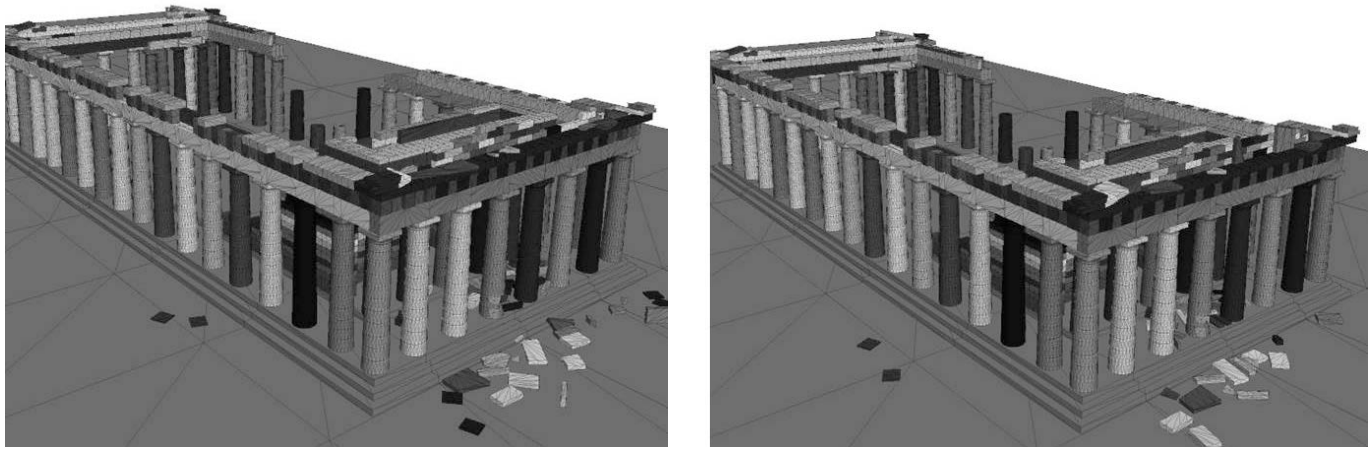
grout injections and titanium reinforcement. Very few blocks preserved in poor condition were dismantled and restored in the laboratory. The regained load-bearing capacity of the restored stone blocks was deemed reduced compared to that of the original structure, according to the findings of specific endoscopic investigation carried out by the civil engineer Dr I. Dourakopoulos following the completion of the interventions. The anchorage area of the transverse load-bearing clamps was also considered irreparably damaged.

**Seismic response assessment of the structure**

In order to assess earthquake hazard and the forces that would be exerted on the joining elements, the structure was numerically simulated using the Discrete Element Method (DEM). According to this method, the stone blocks were modelled as rigid elements, and all deformations took place on the structure's joints, while the clamps were modelled as non-linear springs. For the simulation of the joints and the connectors, suitable parameter values were adopted, based on previous experimental studies carried out by the Laboratories for Earthquake Engineering, Reinforced Concrete, and Testing and Materials of the National Technical University of Athens (NTUA).

The damping and period parameters, being significant for the simulation, were calibrated in order for the models to agree with the recorded accelerograms obtained from the accelerometer array installed by the Acropolis Restoration Service (YSMA) in collaboration with the Institute of Geodynamics of the National Observatory of Athens (scientific coordinators: I. Kalogeras, N. Melis). For the calibration, the recordings of the Magoula earthquake of 2019 at the base and epistyle of the Parthenon's north colonnade were used.

Following the calibration of all its pa-



*Numerical analysis results on the freestanding orthostates. Left: Bagnoli-Irpino earthquake - Collapse of the tympanum's central section. Right: Athens' earthquake - Collapse of the tympanum's central section.*

rameter values, the model was used to determine the design loads of the clamps between the stone blocks of the orthostates and those of the backing wall. The seismic scenarios evaluated corresponded to the most powerful seismic event that could have occurred in Athens over the last 2,000 years (from a research programme launched in 2009 by YSMA in collaboration with the Laboratory for Earthquake Engineering of the NTUA, coordinated by Prof. I. Psycharis). Five real earthquake accelerograms were considered: two recordings from the earthquake that hit the region of Campano Lugano in Italy in 1980, one from the 1994 earthquake in Northridge, California, USA, one from the Kozani event in 1997, and one from the 1999 tremor at Athens, with the appropriate amplification factors, while a range of different dimensioning schemes for the connectors were assessed.

It was analytically proved that the connectors were critical for the tympanum's behaviour and for preventing a possible fall of its central section. In the case of freestanding orthostates, lacking connectors, numerical analysis predicted significant damages caused by the collapse of the stone blocks of the orthostates, thereby demonstrating the necessity to redesign these clamps. In addition, this analysis specified the design force for the special clamps that equals around 7 tonnes.

The study of the recordings of the drifts of the central orthostate and the backing wall during excitation showed that the freestanding orthostates oscillated, swaying back and forth around their base, while the backing wall tended to gradually slide eastwards. In all cases in which the models featured connectors between the two faces of the tympanum, drifts were reduced and the two faces behaved uniformly experiencing a significantly decreased oscillatory motion.

**Designing and testing special clamps**

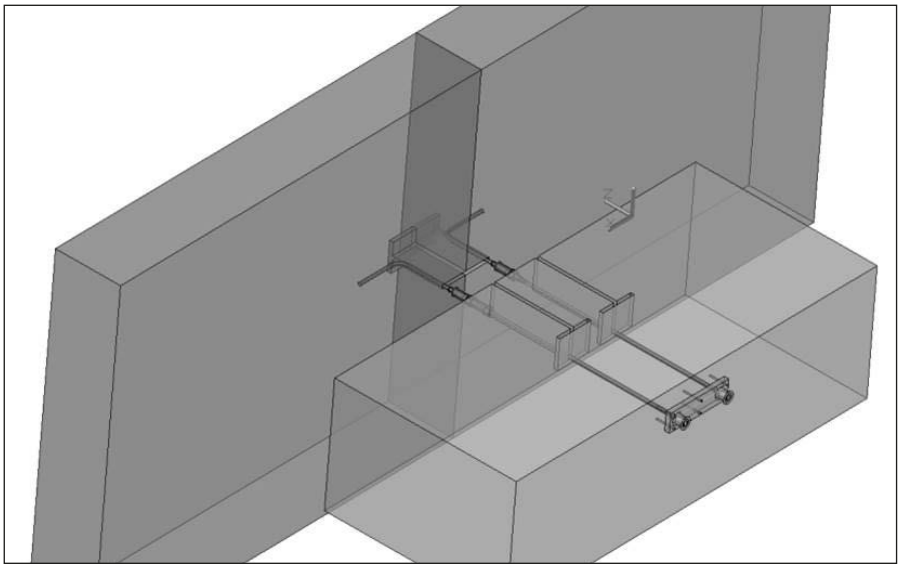
It was decided that the connectors would follow the ancient arrangement, namely the clamps would be anchored to the structure's ancient mortises. The design aimed at carrying the design loads, preserving archaeological evidence to the best possible extent. Furthermore, the system would remain invisible within the marble, as was the case with the original structure, at least in the orthostates' west face. As for the backing wall, due to the marble's serious structural damage in the anchorage areas of the transverse clamps, it had already been decided that the connectors of the two faces would be anchored to the east facade so as to ensure the backing wall's function as a counterweight. The designed connectors consisted of two parts made of titanium, fastened with a specially shaped nut.

The part designed to be anchored to the orthostate stone block took the form of an L-shaped rod. One end was inserted into a hole opened in the marble, 45cm long (this section was smooth and perfectly embedded in the hole without mortar), while the other end, 27cm long, was threaded to be fitted with the nut. The part anchored to the east face of the backing wall was a one-metre-long rod, threaded at one end for the attachment of the special nut, while the other end took the form of a truncated cone, so as to cause the least possible damage to the ancient mortises. Overall, the anchorage consisted in a mechanical wedge anchor, resembling those used for prestressed tendons. The minimum load-bearing section of the connector was 13.5mm in diameter.

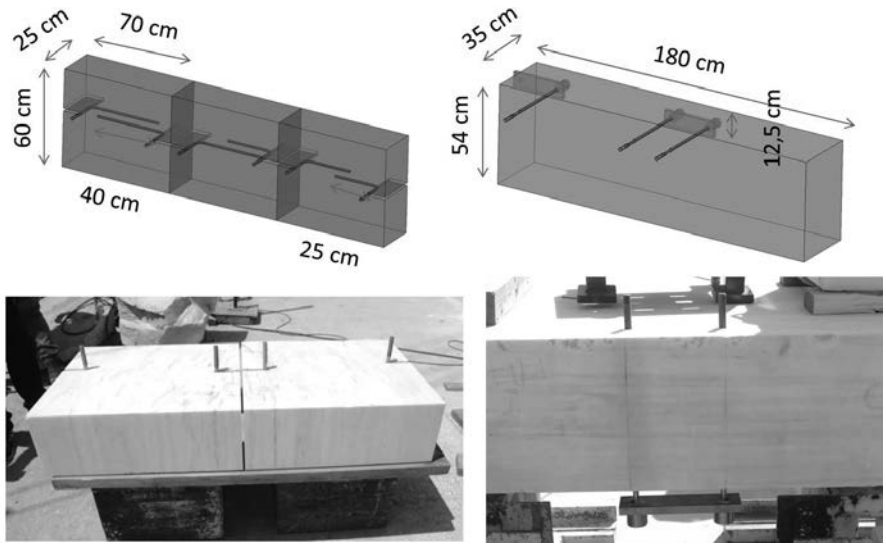
The anchorage system was tested on the Parthenon worksite and, for that purpose, two specimen types were prepared.

Tensile testing of the metal elements of the connectors' specimens was performed using a rigid metal table and a hydraulic jack. The load was manually applied and measured with a manometer connected to the jack.

The tests demonstrated that the anchorage systems on the backing wall stone blocks could withstand the seven-tonne load design, while the L-shaped rods for anchoring the clamp within the orthostate blocks systematically failed, sliding out of the hole at a lower pullout force that amounted to around 2 tonnes.



***Schematic representation of the connectors' final anchoring system to the tympanum's orthostate blocks and a stone of the backing wall, showing the connecting system. The transparency of the stones enables us to discern the ancient mortises and the designed connector with its two sections, the L-shaped part inserted into the orthostate, and the horizontal part that is anchored to the backing wall stone.***




*The composite marble-titanium specimens. Left: the part corresponding to the orthostate. Right: the part corresponding to the backing wall stones. On the top is depicted a schematic representation, on the bottom the physical specimens (implementation).*

**Redesigning and retesting the L-shaped part**

The design of the connections was reappraised and the anchorage to the orthostates now involved the fixing of the L-shaped part into the hole using cement paste. Therefore, the part of the rod inserted into the hole had to be threaded. Two types of compression threads were examined –typical and low– aiming at the minimization of the damage to the ancient mortises.

Three of the L-shaped rods were tested to failure. Their minimum load-bearing capacity was around 9 tonnes, within the projected design levels. Finally, the composite connection specimen was modelled connecting the two parts to each other so as to be simultaneously tested. Five specimens were prepared for testing in order to ensure that the part anchored to the orthostate blocks would not fail before the connection's horizontal element, which was to be fixed into the stone blocks of the backing wall. The test results showed that the anchorage system was reliable, since it was the horizontal part that systematically failed, the fracture values of which were larger than the desired design load that reached 8.5 tonnes.

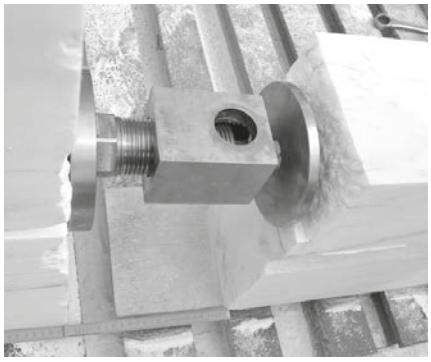
**Designing a strut**

The "twisted clamp" system was supplemented with a strut required to withstand compressive forces. For ergonomic reasons, the strut should be fixed before the joining elements. This possibility, too, was tested at the Parthenon's worksite. Testing showed that it was feasible to set the strut in place beforehand.

**Conclusions**

During the restoration of the Parthenon's west tympanum, it became necessary to redesign its joining elements. In order to determine the seismic forces exerted on the clamps, a systematic analysis was conducted that entailed the structure's simulation, using the

*Snapshots from the testing procedure: on the right the moment of failure of the anchoring system is captured.*



*Fixing the strut specimen; the hole for the visual inspection of the anchor's positioning is visible. Photo V. Manidaki, 2021*

Discrete Element Method (DEM). During analysis, the recordings obtained from the installed accelerometer array were utilized, after the damping parameters for this analysis were set.

The design of the connectors had to be consistent with the determined design forces, as these derived from the analysis and preservation state of the connected stone blocks. The design that conformed to the aforementioned requirements was tested in situ and was optimized in accordance with the test results. The aim of the testing was to ensure the sufficiency of the design for the expected loads.

From the tests undertaken on the worksite, the following were observed:

- The design of the unthreaded L-shaped rods inserted into holes opened in the marble specimens cannot withstand the pullout forces that correspond to the design forces.
- The design of the threaded L-shaped rods embedded in mortar in holes opened in the marble specimens can withstand the pullout forces that correspond to the design forces.
- Even though the anchors of the backing wall, generically designed as standard mechanical wedge anchors, proved sufficient during testing, it was decided by ESMA that it would be preferrable to use plain anchorage with a double nut. The composite specimen of the joining elements with the two parts (L-shaped and horizontal rod) and the specially designed nut was tested demonstrating that, on the whole, the anchorage system was reliable, since only the intended part systematically failed within the desired failure load forces.

**Acknowledgements**
This research project was supported by the Committee for the Conservation of the Acropolis Monumets and mainly Profs Ch. Mouzakis, M. Korres and P. Koufopoulos, the Laboratory for Earthquake Engineering of the NTUA and Prof. I. Psycharis, the mechanical engineer G. Parcharidis who joined the project as external partner, as well as YSMA's Director V. Eleftheriou, the Head of the Parthenon Restoration Project R. Christodoulopoulou, and a number of YSMA's staff members that included the foreman Sp. Kardamis, the marble craftsmen and workmen V. Velonas, D. Paparidis, G. Skalkotos, G. Koloniaris, N. Vailakakis, S. Chatzilias, M. Gasparis, M. Mentis, G. Kagiorgis, D. Kostas and E. Donga, the civil engineer Dr E. Pasiou and the architects V. Manidaki and K. Skaris. We are greatly indebted to them all.

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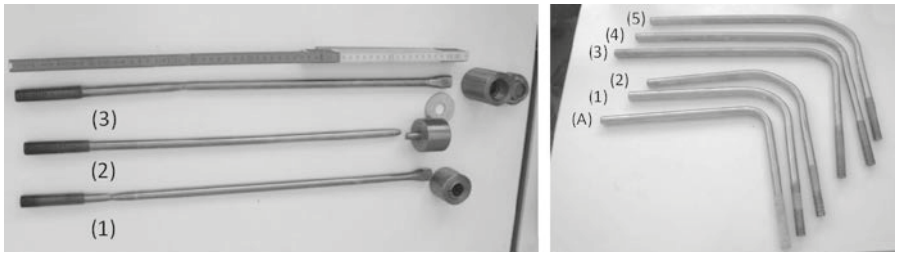
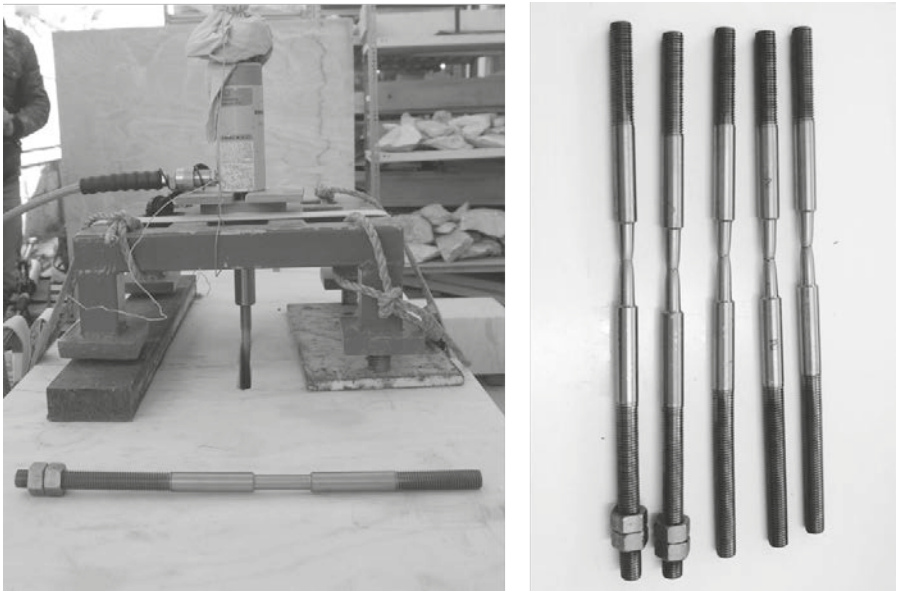
** Translation by D.D.*




***Left: The three horizontal specimens of the connector after testing. Right: The L-shaped parts after testing (specimen A was not tested, serving as reference geometry for rods 1–5 that were tested)***



***Left: testing the composite specimen. Right: the specimens after the completion of testing***

# The use of digital technology to produce new marble additions in restoration works on the Acropolis

**The traditional method**

Using new marble to create supplementary additions for fractured, ancient architectural members is a typical procedure in restoration works in the Parthenon and other monuments of the Athenian Acropolis. As a rule, these new additions are fashioned in such a way as to restore the original geometry of the architectural members. Since the establishment of ESMA in 1975 and its more sophisticated approach, new additions have been created, but in accordance with the principle of respecting the existing fractured surface.

This method differs from that used in previous interventions conducted by N. Balanos, in the period 1898-1933, and by A. Orlandos (1920-1958), when an ancient block's surface was systematically carved, and its geometry flattened, to allow for the creation of a suitable new addition. Only in some cases, such as during the restoration of the Poseidon temple at Sounion in 1958, were the broken surfaces of architectural members less invasively carved.

A pointing device, or "pantograph", was first used in Greek restoration works to form new marble additions during the restoration of the Stoa at Brauron (1961-62), under the direct supervision of museum sculptor Stelios Triantis. In 1967, when the Brauron works were completed, architect Charalambos Bouras illuminated the theoretical background behind this procedure, reporting "*In this way they were able to achieve not only the best possible bonding, but also managed to leave the ancient member fully intact*" (F. Mallouchou, "Charalambos Bouras and the Restoration of the Ancient Monuments in Greece," *IROS KTISTIS*, 2018, pp. 65).

This principle of using a pointing device continues to be fundamental to the way we approach and treat new marble additions today. On the Acropolis, it was initially used in the restoration of the Erechtheion (1979-1987), then was progressively adopted for all restoration works on ancient monuments in Greece. The basic aim is to achieve the best possible adherence of a new addition to an ancient member, in particular along the fractured contact edge between the original material and the new marble. The fewer and smaller the gaps left in the joint, the better the bonding, and the better the final aesthetic result. Furthermore, the ancient material remains intact, in the "historical" condition in which it has been preserved until today. Thus, fractured surfaces previously considered of no importance are now retained and protected, allowing specialists to draw scientific conclusions about the kind of damage they have suffered through time – for example, cannon ball strikes, fire damage, fracturing from seismic events, and cracking due to the expansion of corroded metal joinery. In adopting this improved method of producing new additions, we now avoid the loss of any original material or important scientific information –both of which can contribute to a greater understanding of the pathology and the history of an ancient monument.

The pointing device, a mechanism used by artists in the precise copying of sculptural reliefs, is similarly employed by technicians to copy the exact fractured surfaces of architectural members during restoration works. This is the same process used by sculptors to transfer desired shapes from their preliminary plaster models to the raw marble.

In the case of ancient broken architectural members, the fractured surface where the bonding is to be carried out is first prepared by identifying the existence of friable, weathered areas, which are cleaned if necessary. Then, a decision must be made how the new addition will be adhered, with consideration given to the specific geometrical characteristics of the ancient member's fractured surface. To achieve proper bonding, it is necessary to define the axis along which the new addition will move until it completely binds to the ancient fracture. Next, areas of the original marble typically termed "dark areas" or "skoura" by the technicians, which protrude and obstruct the movement of a new addition as it is fitted to an ancient fragment, are identified. Clay is then applied to these "skoura" and so during the copying of the

*The traditional method of creating new marble additions with the use of a pointing device. Photos K. Skaris, 2020*

ancient, fractured surface these marked areas are disregarded. In general, the outline of a new addition is precisely drawn on its recipient ancient fragment in agreement with a previously prepared architectural study. Also, when marble additions are initially prepared, the overall dimensions of a new marble piece are left larger than necessary, in order to allow for a margin of error during the precise final carving process (apergon).

After these initial steps, a cast is made of the ancient member's fractured surface. Plaster is applied to produce a mould, which is then copied onto the marble with the use of the pointing device. This technique has been continuously used over the past 50 years in the restoration works of the Acropolis, where young apprentice-technicians employed on the worksites are trained by older, more experienced master craftsmen.

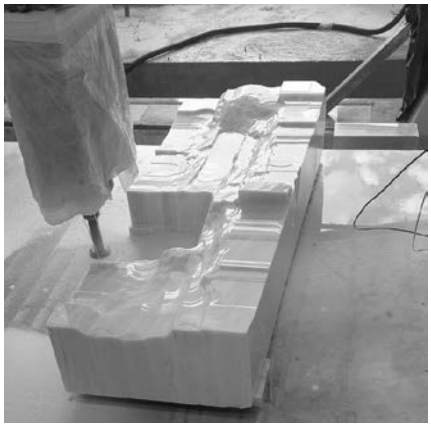
*Adjusting a new marble addition for the Parthenon's orthostate, northeast parastasis. The addition was created in CNC with digital scanning of the mould. The "mixed method." Photo V. Manidaki, 2014*

**The "mixed method"**

In some cases, since the first decade of the 21st century, and in parallel with the "handmade" production of new marble fillings in the Acropolis works, a secondary process has also been used to create new additions. This alternative process amounts to an automated treatment of marble blocks placed in carving machines that employ digital technology (CNC) –a service provided under contract by the Venus Marble Group. Plaster casts are also used during this process –but the marble additions are machine-carved. This method is comparable to the traditional approach, as copying with the use of a manually operated pantograph has been replaced with the use of a machine pantograph (CNC). The greatest difference, however, lies in the need to digitally scan the casts and to create digital models. For the sake of distinction, it is proposed that this procedure be called the "mixed method".

Experience with this mechanized, digital method, however, has shown that although such production of large new additions is faster and benefits the process, there is still the need to conduct trial fittings and to apply further treatment by hand to achieve the best possible bonding of new additions. In the digital process, some small distortions in large moulds are inevitable and negatively affect the precision of the method. This problem is intensified because during the process a further copy con-

*Left: a mould for a new addition for the frieze on the south wing of the Propylaia. Right: a trial placement of the new marble addition created in CNC with digital scanning of the mould. The "mixed method." Photo V. Manidaki, 2014*



*Treatment of the new marble addition for block Δ.TA4.6 in a CNC machine. Photo V. Manidaki, 2022*

sequently has to be made –that is, one generated with digital scanning of the mould– in order to accurately create the new addition. Failures of a more serious nature, furthermore, sometimes occur in cases of large moulds with more complicated surfaces. As a result, new additions to ancient blocks have to be repeatedly readjusted, thus ultimately allowing little significant reduction in the time required to complete the work.

**Exploring a new method**

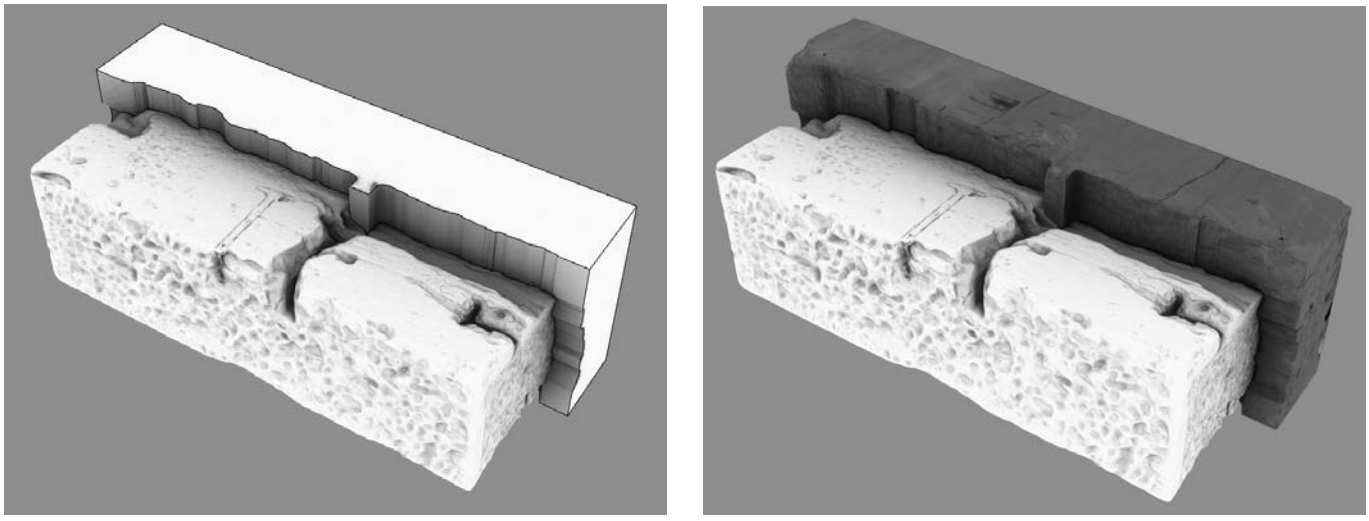
In recent years, further advances in the technology behind the process of digital scanning of models have begun to offer the possibility of producing more accurate new marble additions, while also reducing the amount of work needed for final adjustments. In harnessing these new developments, the shortcomings of the "mixed method" theoretically can be prevented and total completion time can be reduced by directly creating a digital model of the new marble addition, thus skipping the production of actual plaster casts.

This new approach has been conceived by V. Manidaki and K. Skaris, based on both knowledge acquired from the traditional process of creating new marble additions, and on extensive experience gained through the use of highly accurate digital models of architectural members while preparing restoration studies for the Acropolis monuments. Likewise, experience gained from supervising the creation of new additions produced in CNC machines during the "mixed method" has also contributed to a keener understanding of the level of accuracy and greater facility that ever-advancing digital methods can offer.

In order to adopt a new, completely digital process as a major part of the methodology for the restoration works currently ongoing in the Parthenon, a test of the process in action must first be conducted. For this reason, it was decided to undertake a pilot study using the latest digital technology that would aim to produce a new addition from a particular piece of marble of large scale and demanding geometry. Specifically, the new addition selected for the study would be for block Δ.TA4.6 from the backing wall of the Parthenon's west pediment (dimensions: 190 x 65 x 50cm), which would require the digital scanning and production of a very difficult relief on its broken surface.

Undertaken in summer 2022, the pilot study has provided the opportunity to re-evaluate the entire digital process of producing new additions and specifically its accurate implementation. Skaris was responsible for digitally designing the new marble addition, which was based on a three-dimensional model of the original ancient member designed by surveyor-engineer S. Kyparissi. The machine-carving of the new addition was carried out by an external collaborator (Spartan Stones) in an electronic pantograph of high definition (± 0.5 mm), with CNC technology of 5 axes, capable of processing marble pieces of large scale (length 2.5m, height 1.5m, width 1.5m). The goal of the design was not only to accurately form a contact surface, but also to allow enough roughness to ensure the proper bonding of the adhesive mortar.

*Adjustment of the new marble addition on the ancient block Δ.TA4.6. Photos V. Manidaki, 2022*



*Left: digital design of the new marble addition for block Δ.TA4.6. Study: K. Skaris. Right: the new addition produced in CNC. Digital composition of the models: S. Kyparissi, K. Skaris, 2022*

After subsequent trials, it was found that the use of a very thin cutting tool of a diameter of 5mm, in a processing step of 0.5mm, consistently produced the necessary geometric characteristics of the new addition's surface, giving it also a discreet finishing touch that clearly betrays the mechanical process that has taken place. The pilot study has generally demonstrated the high accuracy of the copy and the success of the digital design of the three-dimensional model for the new marble addition.

Nevertheless, the design of the digital model of the new marble addition and the increase of the *apergon* (the extra raw marble left to allow for a margin of error during final carving) revealed the difficulties inherent to the task, mainly concerning its outline. On the one hand, digital models of ancient, fractured surfaces are highly accurate to ensure that the new additions are their exact copy. They are composed of many triangular surfaces (meshes), whose sides are less than a millimetre. However, this fact makes their processing extremely difficult. The intersection of these surfaces with other digital objects (solids, surfaces) cannot be automated, but demands a treatment of the triangles along the edges and entails the risk of altering the scanned geometry. This process of digitally forming the edges of the new addition was found to be a demanding, specialized task that increases the cost and time of production of the digital model. For this reason, it has been suggested that a perimeter zone on the outline of a new addition be manually pre-formed similar to the *apergon* of the traditional method. The difference remains, however, that digital scanning is used instead of constructing a mould.

Overall, following discussion of the method, Manidaki and Skaris have offered three suggestions to improve the process:

- To cut the volume of marble used for the new addition in the form of a rectangular prism oriented on the axis of movement chosen for adhering the addition to the ancient fracture. This solution has proved to improve the ergonomics of transferring marbles around the worksite, thus decreasing the time needed for bonding.
- To use clay in order to mitigate the inclinations in the binding areas of the ancient fractured surface that show steep or negative inclinations. In this way, there is no need for further treatment of the surface of the newly produced marble addition.
- To manually pre-form the edges of the new addition on the ancient fracture, then scan these edges together with the ancient surface to create a single digital model.

In January 2023, further testing of the new digital method was undertaken by pre-forming the edges of the new addition for block Δ.TA5.5. Initially, the axes of reference/adjustment were carved on the lower seat of the block and the perimeter zone was formed with sheets of inflated polystyrene cut –according to the edge of the new addition. The small gaps between the sheets and the fragment were covered with clay so as to create a continuous surface. In this way, the perimeter zone was pre-formed along the contact edge between the ancient fracture and the new marble addition. This zone corresponds to the *apergon* of the new marble, which is removed during the final treatment of the surfaces, following the bonding.

The areas of the ancient fracture's relief that presented negative inclinations (dark areas, *skoura*) or inclinations nearly parallel with the adjustment axis of the new addition were mitigated with localized filling-in with clay. In addition, the whole surface of the fracture was covered with clay to a thickness of 1mm – except for the zone inside the edge, where the marble remained uncovered – in order to achieve the best possible fit of the new addition, and to minimize the extent of the joint remaining visible between the ancient and new material.

After block Δ.TA5.5's ancient surface was prepared in YSMA's laboratories, it was scanned to make its digital representation. This model was oriented on the basis of the axes of reference/adjustment of the new addition, which were included in the model as objects (lines, curves). Such an approach simplifies the process of preparing the actual sculpted model of the new addition, as there is no need to digitally design the perimeter zone, but only to determine the relevant position of the surface to be processed in light of the available volume of marble, and to carve the axes of reference/adjustment on the lateral surfaces of the new addition.

**Steps of the improved method**

All of these investigations of the pilot study have led to an improvement in the method of producing new marble additions for broken ancient architectural members with the use of digital scanning/modelling and machine-carving. The improved method can be summarized in the following steps:

1. Conservation and clean-up of the broken surface of the ancient block to be bonded with a new marble addition. Whenever necessary, clay, plaster (or marble when the new additions are permanent and internal) are used to fill gaps in specific spots of the surface where the inclinations of the adherence direction of the new addition (dark areas, *skoura*) are negative, and to flatten the surfaces where steep inclination changes appear.
2. Designing of the edges of the new addition and creation of a perimeter zone with a temporary construction.
3. Orientation of the new marble addition to comply with an axis of reference/adjustment drawn on the ancient block's fractured surface, to ensure the best possible fit/bond.
4. Scanning of the ancient fracture and creation of a highly accurate, textured, three-dimensional model of the ancient surface between the original block and the new addition.
5. Digital designing of the new addition, on the basis of the axes of reference/adjustment that were previously marked on the ancient block and planning for the existence of *aperga* around its perimeter.
6. Placement of a rectangular volume of marble in the CNC machine by following the desired orientation of the geological layers, and machine-carving of the new addition based on the digital model.
7. Adjustment of the new marble addition to fit it to the ancient fracture, and examination of the width of the contact joint around its perimeter.

The improved method described above allows the production of high-quality new marble additions for fractured ancient architectural members which are equal in quality to those produced by means of the traditional method –but produced more quickly and at a more competitive cost. At the same time, the need for copying random, easily fractured surfaces hidden from view, using a technique similar to the one used for copying sculptures, can be minimized. The time benefit gained from a more rapid production of new additions also enables the marble technicians to focus more on the forming of a new addition's external surfaces, where the results of their experience and fine craftsmanship are more visible and more important to final aesthetic quality of the new addition.

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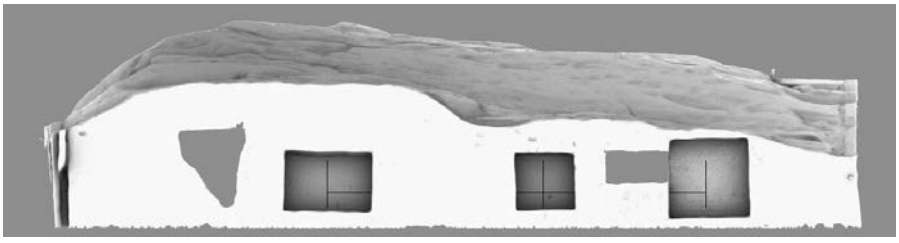
** We would like to thank chief marble technician G. Aggelopoulos, as well as marble technicians G. Kagiorgis, P. Georgopoulos, M. Tzioumas, and E. Doga, of the Parthenon worksite for their invaluable, much-appreciated contributions during the pilot study on the Acropolis and the trial fitting of new marble additions to ancient members. Most importantly, we are greatly indebted to J. Leonard for kindly reviewing the English text and making crucial suggestions.*

***Creation of a perimeter zone on block Δ.TA5.5 to mark the edges of the new addition. Photo K. Skaris, 2023***



***Model of ancient block Δ.TA5.5. On its lateral side we can see inside the square apertures the axes of reference/adjustment for the new addition.***
***Model design: S. Kyparissi, 2023***

The monument standing on the west side of the Acropolis of Athens is known as the monument or pedestal of Agrippa, according to the inscription preserved on its west face. Its construction has been attributed to the king of Pergamum Eumenes II (197–158 BC) who, following his victory at the Panathenaic Games in 178 BC, commissioned the Pedestal at this site upon which a tethrippon (four-horse chariot) was mounted, driven by himself and his brother, the later king Attalus II (159–138 BC). During the 1st century AD, the tethrippon was replaced by a statue depicting the general and son-in-law of Emperor Octavian, Agrippa, as a charioteer. The Pedestal of Agrippa belongs to the category of monuments which, like their choragic counterparts, were installed in public spaces to commemorate an event, honour a figure, or merely serve as offerings to the gods. A large number of monuments of this kind could be found in every sanctuary or public centre in ancient cities. Its architecture recalls other pedestals similar in form, mounted at Delphi by the Pergamene rulers, but also in other Greek sanctuaries. In Athens, a similar monument was erected in front of the Stoa of Attalus, but there were also two other pedestals, unknown, until Professor M. Korres, in the early 1990s, identified a large number of stones (more than a hundred) as belonging to them. Therefore, the significance of this monument lies in the fact that it is the only one of its kind at Athens preserved in its original location.

*View of the monument of Agrippa from the SW. Photo T. Souvlakis, 2021*

The monument of Agrippa is rectangular in plan, built of greyish blue Hymettian marble, while its base and crown are made from Pentelic marble. The Pedestal's stereobate –namely the visible upper levels of the foundation– is similarly built of larger blocks of Hymettian marble, combined with conglomerate used in the monument's invisible parts, as can be seen today on its south side. The monument consists of the stereobate, a three-stepped crepis, an Attic-Ionic base, a slightly tapering shaft built in the *opus pseudo-isodomum* system, and a protruding crown upon which the plinth's blocks were placed. The Pedestal of Agrippa, including the crepis, is around 9.50m high and rests on a foundation, the maximum height of which is 4.50m. The monument was erected on the existing deposit of the Mnesiclean revetment, almost parallel to the foundations of the north-western wing of the Propylaia, and was adjusted to the already built classical ramp leading to the Acropolis sanctuary. Part of the north retaining wall of this ramp was incorporated into the south half of the foundation of the Pedestal of Agrippa.

The later history of the Pedestal has been associated with that of the monuments of the Acropolis west access. In the 14th century, during works aimed at the improvement of the defensive capacity of the Acropolis, the bastion connecting the Pedestal of Agrippa with the tower of the temple of Athena Nike and the SW corner of the north-western wing of the Propylaia was built. As a result of the bastion's expansion during the Ottoman Occupation period, the monument's south and east sides were further protected. Hence, it was the north and particularly the west side of the monument that were more exposed to extreme weather and mainly the impact of projectiles during the various sieges of the Acropolis. In March 1835, following the demolition of the second bastion of the medieval fortification, the monument was completely freed from the added structures. During the term of P. Eustratiades as Ephor of Antiquities (1865), the west side was repaired, whereas in 1914, N. Balanos undertook a more extensive intervention (waterproofing of the crown and filling of the west side with concrete). Small-scale interventions (joint and crack sealing) were more recently carried out, when G. Dontas served as Ephor of Antiquities (1970).

The monument's westerly deviation from the vertical plane was already recorded since the late 19th century (Richard Bohn). At the beginning of 2021, the Acropolis Restoration Service (YSMA), in collaboration with the Ephorate of Antiquities of the City of Athens (EFAPA), undertook the investigation of the causes of these deformations with the intention of sub-

mitting a proposal for their treatment, in parallel with the necessary conservation works on its surface. Initially, the current preservation state was documented by means of a photogrammetric survey (creation of orthophotomosaics of the four faces and a three-dimensional photo model) under the supervision of the rural and surveying engineer D. Mavromati. Simultaneously, in order to tackle the causes of soil erosion, rainwater drainage was arranged and the space surrounding the monument to the west was waterproofed. A scaffolding was mounted to facilitate works; then a system for the codification of the monument's architectural members was drawn up, while its pathology and the alterations to its original geometry were recorded. During these works, the overall and individual dimensions of the monument were measured in the traditional method, at the level of the joint between the base and the shaft, at the stone blocks of the crepis (from underneath) and those of the stereobate (north, west, south and east, on the upper course). From the measurements it became apparent that the greater changes in the original dimensions are encountered on the shaft's base, as well as the three steps of the crepis and the stereobate courses on the south side, while the smallest changes are found on the north side. The changes which the other two sides (east and west) have undergone are approximately the same. It was noticed that, as we move from the uppermost to the lower part of the monument, these changes have increased. As a result, from its base and further below, the originally rectangular (in plan) Pedestal has roughly turned into a trapezoid.

Concurrently, the current preservation state of the surface of the architectural members was described and assessed, the pathology of the monument's surface was recorded, while loosened or detached fragments were collected and stored.

Following the initial recordings, it appeared that the course of action required would be aimed in two directions. It involved, on the one hand, conservation works on the Pedestal's surface targeted at the removal of the corroded connecting elements, the sealing of joints, etc. and, on the other, investigation in order to elaborate a structural study that would deal with the monument's deformations. The first stage included conservation works, while the consolidation measures proposed in the structural study would constitute the second stage.

The identification of the forms of deterioration and their extent on the surface of the architectural members served as a guide to establish the proposed conservation interventions in order of priority. The main causes of deterioration were mechanical, chemical and biological factors, but also the mortars and iron clamps used during earlier interventions for the consolidation of parts of the monument. The deterioration of the building material also depends on its mineralogical and chemical composition, as well as its physicomechanical properties when exposed to environmental conditions. The effect of combined deterioration factors was often observed on the same sections of the monument.

In the aforementioned recording it was ascertained that the west side's stone surface was more seriously damaged compared to the other sides. The impact of cannonballs had created lacunae in the Hymettian stone blocks, which during past interventions were filled –as already mentioned– with concrete, and caused severe disintegration of its surface.

More specifically, these areas suffered from cracking, networks of cracks, fractures, successive flaking with unstable fragments, and internal gaps due to mechanical stress, combined with thermal action to which the stone blocks were subjected. Differential weathering was observed on the surface of the monument's building material as a result of its inhomogeneous composition due to impurities. The elimination of the building material's secondary components owing to environmental conditions led to the formation of cracks, cavities and sometimes craters. Discolouration of the stone surface was caused by the corrosion

*View of the monument of Agrippa from the W before it was completely freed from the later structures (Karl Wilhelm von Heideck, 1835)*

of the iron clamps used by N. Balanos during his restoration in 1914. Chemical or mechanical damage on the stone surface and the mortars used in past treatments was caused by the presence of micro-organisms and vegetation growing in the joints between the stone blocks and, mainly, in parts where earlier mortars had failed, but also by bird droppings. Soot deposits had accumulated, especially on the Pedestal's crown stone blocks, in areas which, due to their position, could not be washed by rainwater.

The geophysical survey undertaken on the monument and its foundation subsoil in August 2021 by means of a ground-penetrating radar system (GPR) (on the Pedestal's sides) and electrical resistivity tomography (ERT) (to the west, at ground level) was intended to investigate the monument's internal structure, the stratification and tectonics of the site and its surrounding area, as well as to record possible failures.

It was followed by a geotechnical survey (August 2021) through which the stratification and geotechnical features of the monument's foundation deposits and rocky substratum were examined. Two trial boreholes were drilled, 10cm in diameter each, to a depth of 8.5 and 9.5m respectively; the walls of the boreholes were videotaped, while laboratory tests established the mechanical properties of the geomaterials.

The geophysical and geotechnical surveys assigned by YSMA and EFAPA, respectively, to the consultancy firm of the geologist M. Poultsidis, briefly concluded the following:

- The subsoil of the foundation is dominated by mixed stratigraphic sections. The east side rests on the geological limestone substratum that dips down westwards forming a high slope angle.
- To the west, the north part of the foundation rests on loose deposits and the bedrock is found at a depth of around 6m, while further south, the foundation sits on a retaining wall (of the pre-existing ramp of the Classical period), with the bedrock lying at a depth of 7m.

*View from the S after the scaffolding was mounted to the crown of the Pedestal. Photo V. Eleftheriou, 2022*

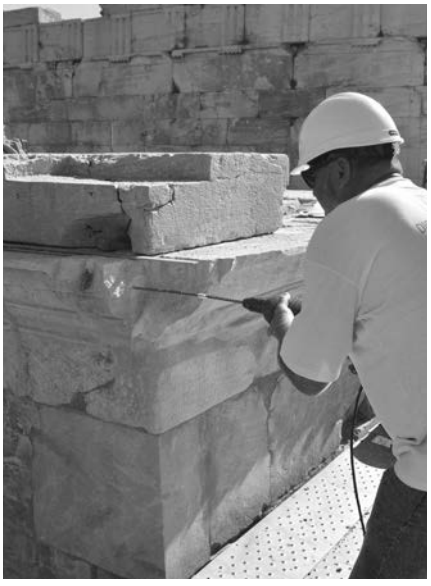
- A structure that recalls a floor consisting of two courses of stone was found at a depth of 0.60m from the monument's bearing surface.
- GPR (north and west) and ERT (west) measurements have detected soil moisture zones.
- GPR scanning of the Pedestal's shaft has shown the presence of an outer marble layer, 30 to 40cm thick, as well as a second layer, also of marble, the thickness of which does not exceed 1.20m. It is believed that the part in the shaft's centre is made of poros stone. This structure along the shaft's height is interrupted by continuous layers of marble demarcated by the low-height stones. Similarly, the crepis is formed of continuous marble layers. Furthermore, the lower part (foundation base) was built of solid mortared rubble surrounded by the masonry to the north and the repair to the west.

Finally, an endoscopic investigation was carried out in September 2021 by the Engineering School of the Department of Architecture of the University of Patras, in order to examine the thickness of the lithosomes, where possible, and also the preservation state in the interior of the Pedestal's foundation. At the end of 2021, the scaffolding was further elevated up to the crown so as to extend conservation work over the monument's entire surface.

The first stage of the programme concerned the conservation of the crown's stone surfaces to the Pedestal's second course, including the replacement of the waterproofing material that covered part of the crown.

The conservation interventions involved preliminary consolidation of severely disintegrating sections by spraying or by injection impregnation with saturated solution of calcium hydroxide, the mechanical removal of ineffective pointing and sealing mortars applied in past consolidation interventions and also the removal of loose fragments. Then followed the cleaning of cracks and flaked areas with hydrogen peroxide ($H_2O_2$) and their filling with hydrated lime-metakaolin grouts in the appropriate ratios depending on the case. For the consolidation of severely disintegrated surfaces and the filling of cracks and flaked areas, metakaolin-lime grout was used. Hydrated lime-metakaolin mortar and marble powder or calcareous sand were employed for the sealing of cracks and the

*View from the E during works for the reattachment of a fragment of the monument's shaft. Photo P. Vlachouli, 2022*



*View from the SW during the consolidation of a stone of the monument's crown. Photo K. Karanasos, 2022*

filling of larger lacunae –depending on the size of the lacuna– with the addition of inorganic pigments for the final chromatic reintegration (harmonization) of the mortar into the Pedestal's authentic stone blocks.

Fragments were reattached through the application of white cement paste. Titanium pins were used in those cases in which the reinforcement of the bonding was deemed necessary. The surface of the iron clamps and dowels was protected with Paraloid B67 to which nano-alumina was added. In those areas of the marble that were discoloured due to the corrosion products of the iron elements, rust stains were removed with neutralized thioglycolic acid solution.

In parts of the monument affected by biological growth, cleaning and removal of roots were undertaken, followed by the sealing of joints with mortars of the composition described above. In parallel with the aforementioned works, it was realized that as a result of the corrosion-swelling of the connecting elements on the upper base of the crown stones to the south, part of the existing waterproofing material was lifted. This extended over a southerly inclined surface, around 4m$^2$ in area. The waterproofing material was replaced with a new suitable premixed mortar applied in two layers, consisting of a mixture of hydrated lime/pozzolanic material, without the addition of cement. The intervention was completed with the application of a water-resistant material to the surface.

Responsible for the planning of the intervention and the selection of the appropriate materials was the Head of the Technical Office and Surface Conservation Laboratory, chemical engineer Dr E. Aggelakopoulou. In the works for the restoration of the monument's waterproofing participated staff members of the Service's conservation and restoration teams.

It was necessary to replace eight corroded clamps of the 1914 intervention with new elements made of titanium while, at the same time, loose fragments were fixed to stone blocks of the shaft and the crown with titanium rods.

In March 2022, YSMA entrusted the preparation of the structural study "Permanent stabilization measures for the Pedestal of Agrippa on the Acropo-

*View from the S of the monument's superstructure before conservation. Photo K. Frantzikinaki, 2022*

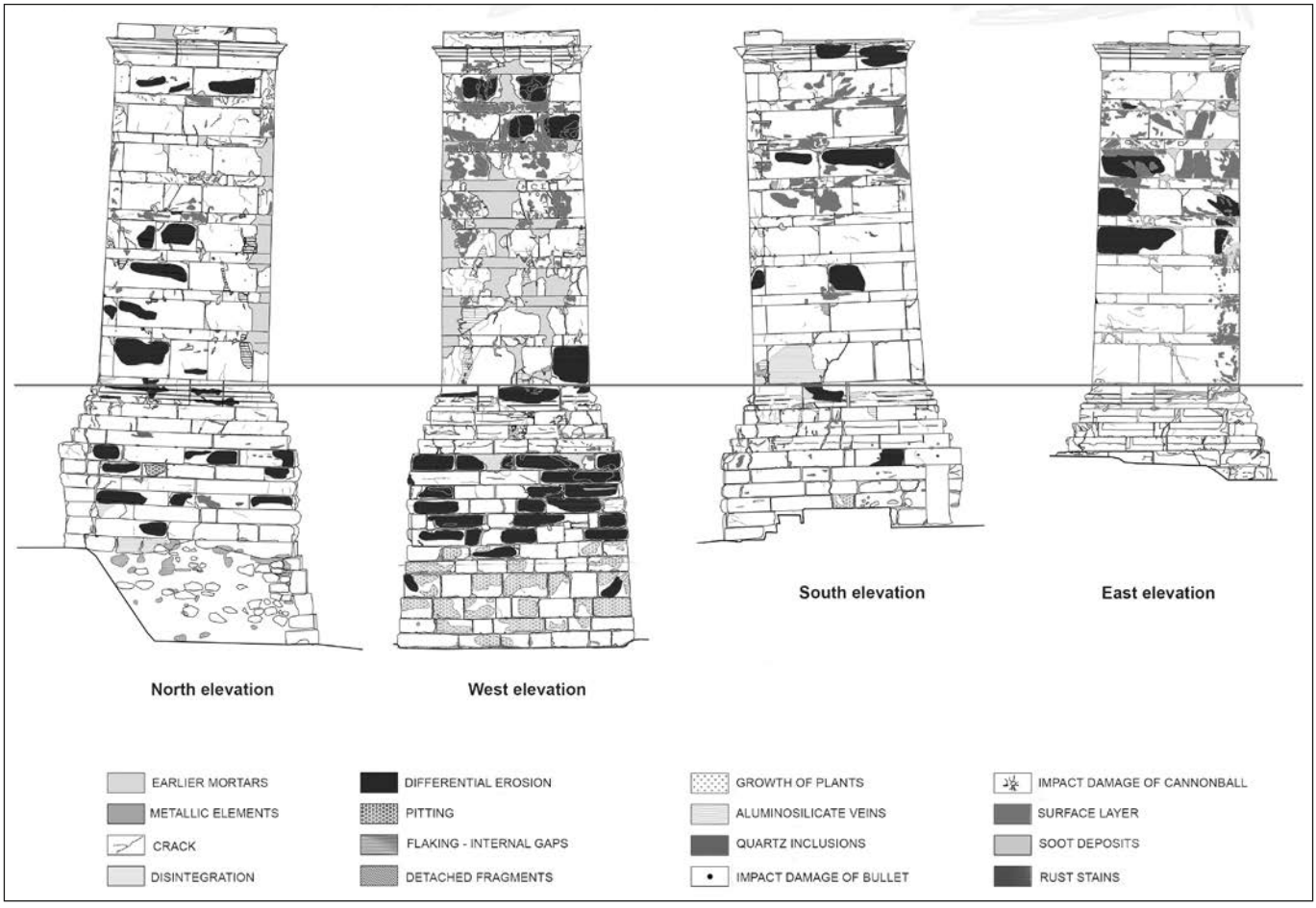
*View from the S of the monument's superstructure after conservation and the restoration of the crown's waterproofing. Photo K. Frantzikinaki, 2022*

lis of Athens" to the civil engineer V. Papavasileiou, under the supervision of a scientific sub-committee consisting of ESMA's President, Prof. M. Korres and the members Profs Ch. Mouzakis and P. Koufopoulos.

Based on the data (archaeological, architectural, geometric, geophysical, seismological and geotechnical) provided by the Service, the evaluation of the monument's pathology, the Pedestal's risk assessment (examination of the substratum, and the substratum-pedestal interaction) and the analyses in critical parts and inspected cross sections, the researcher has pointed out the following:

- The Pedestal leans to the NW; its shaft has a westward tilt of 25cm and a northward tilt of 10cm.
- The Pedestal's tilt has been attributed to subsidence and the movement of its foundation to the west, as it rests on different soil substrata (limestone – deposits of the Mnesiclean revetment – retaining wall of the classical ramp) and also because of the interaction between the deposits and the wall of the Mnesiclean revetment.
- The action of water affects the mechanical properties of the deposit materials and aggravates the "deposit – Mnesiclean revetment" system.
- Earthquakes affect the monument either as direct load, inflicting cumulative damage on the existing condition (given that the monument stands on unyielding ground) or through the "Mnesiclean revetment – ground – monument" interaction mechanism.
- The pathology mainly on the north, but also the south side of the monument is ascertained on grounds of subsidence and the foundation's movement to the west (fracture of stones – widening of joints).
- The average stresses produced by the monument in the ground are 300k Pa.
- Static and pseudo-static analyses for the monument's response to frequent earthquakes [TR=100years], with geometrically unfavourable assumptions for its bearing capacity, bring about small eccentricities e<l/6, while in the case of rare seismic events [TR=475years] they induce large eccentricities e ~ l/3.
- Based on the current geometric data, the Pedestal is considered stable; however, in seismic events, the existing damages will worsen. Finally, the most vulnerable part of the structure is the base of its foundation.

Based on the outcomes of the study on the Pedestal's stabilization in its cur-




*Pathology of the monument's surface. Mapping of the preservation state of the surface: K. Frantzikinaki, 2022*

rent condition, the following measures will be implemented:

1. A tie system will be applied to the second layer of the foundation below the crepis, aiming to hold together those parts into which the Pedestal's foundation is prone to split. The tie system will be mounted on each face, at a height of 4m above ground level on the west side of the monument and will consist of 4 metal corner elements made of AISI 316L stainless steel and a pair of tie-rods, Ø30 in diameter, of the same quality.
2. Grouting or repointing will be undertaken in order to reinforce the north and west sides of the foundation's base, but also the three first courses of the stereobate in the area where the tie system will be fixed.
3. Two slightly prestressed rods made of AISI 316L stainless steel, Ø30 in diameter (one with N/S orientation and one with E/W orientation) will be used to hold the opposite sides of the stereobate in place at the level of the external tie system.
4. Grout composed of cement-based mortar will be used to create a thin barrier layer at the foundation's base.
5. An appropriate number of stones will be removed and replaced on the north side of the Pedestal's foundation. The same will apply on the foundation's west side, if it is deemed necessary during the intervention.
6. The monument's instrumental monitoring will include: geodetic measurements, installation of inclinometers atop the Pedestal that will measure the angle of tilt, and also in the trial pits that will keep track of possible ground motion.

The structural study was presented to the ESMA in December 2022 and subsequently submitted to the Central Archaeological Council (KAS) for approval, following the necessary amendments.

In the works of the first stage participated the civil engineer Dr E. Pasiou, a team of conservators consisting of: P. Vlachouli, A. Kladios, I. P. Kotsifakos, L. Lambrou, Ch. Laskaridis, K. Melas, I Moraitis, M. Pangalou, E. Papadimitropoulou, M. Petraki, I. Skalkotos, L. Stefaniotis, E. Tzebelikos and E. Fragkiadaki, as well as a team of technicians working for the restoration consisting of: K. Vagianos, G. Vasdekis, G. Vassos, R. Vidalis, D. Grigoropoulos, A. Botzios, P. Rizopoulos, G. Schizas, M. Tzanoulinos, D. Trypakis and G. Chaldaios.

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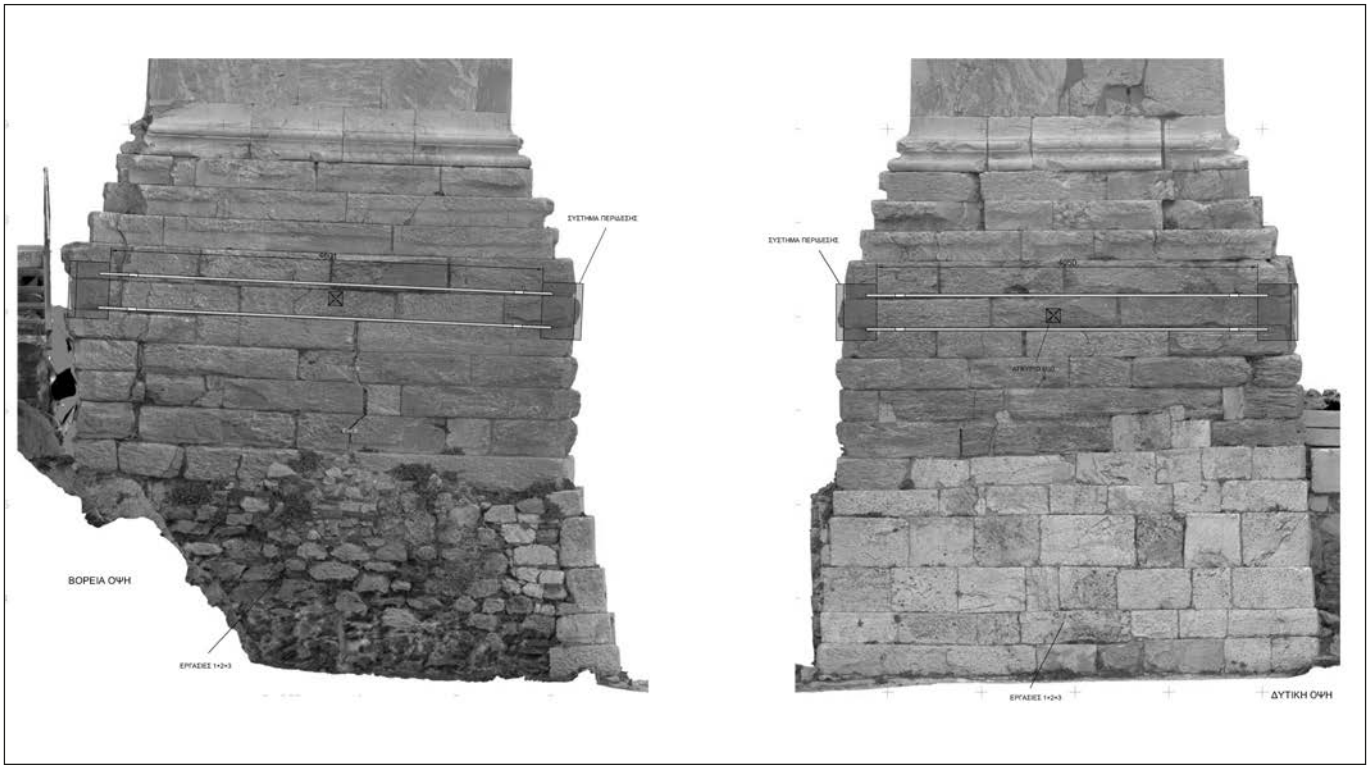



***Permanent stabilization measures for Agrippa's Pedestal on the Acropolis of Athens – North and west view. Study: V. Papavasileiou. Photography: S. Gesafidis. Geodetic measurements: I. Partsinevelos. Production of orthophotomosaics: D. Mavromati***

## 1. Introduction

Built over the ruins of the Ancient Agora, at the west end of Polygnotou Street, stands a beautiful mansion dating back to the 19th century. It is commonly known as the "Kolettis House", although this information is unconfirmed. The terracotta statue of a maiden mounted in the central niche of the facade, and the open garden enclosed by the low metal railings are the main reasons passers-by make a brief stop to get a closer glimpse of the Building and sometimes take a picture of it.

Being in close proximity to the Building where the central services of the Acropolis Restoration Service (YSMA) are based, it was the ideal proposal to house the Archive of the interventions undertaken in the Acropolis monuments, when it became clear that, on the one hand, there has been a significant increase in the amount of archival material and, on the other, this evidence had to be accessible to the public.

The request to the then Secretary General of the Hellenic Ministry of Culture, Dr Lina Mendoni was fulfilled in 2012, following the decision not to house the C. P. Cavafy Archive in the building at 13, Polygnotou Street, as originally planned. The enthusiasm in YSMA was great, but so was the responsibility for the way public property would be handled. The Service had to move fast and methodically in order to reach its goal. Among the immediate measures necessary were the clearing of the Building and the garden, and their protection against "squatters". At the same time, it was essential to prepare the appropriate studies in order to incorporate the project into a funding programme. In this direction, efforts were made to use effectively the pre-existing studies on the repair of the Building's damages, but also on its change of use. However, it was obvious that its new use would impose significant constraints on the planning of the interventions while, concurrently, the way monuments are nowadays treated entails better practices in historic building restoration, the most characteristic of which is the elimination of the use of reinforced concrete jackets in imparting additional strength to stonework.

*View of the north facade of the main Building 1 from the garden. Photo K. Skaris, 2019*

In articles that follow, brief reference is made to the steps taken by the Service, the Building's preservation state, but also the Archive itself that will be accommodated in its facilities. From this position, I would like to point out certain advantages derived from the project implemented by YSMA, namely the restoration of the Building at 13, Polygnotou Street, for the establishment of the "Charalambos Bouras" Documentation Centre for the Acropolis Works.

**Protection and promotion of the Archive by making it available to the public.**
It is true that, owing to digital technology, the rapid growth of an archive no longer requires the respective increase in the storage space where the pieces of evidence will be kept and, in this sense, the demand for the expansion of YSMA's Archive is not as imperative as in the past. On the other hand, it is crucial to give access to archival material in order for anyone interested to be able to obtain information. With this in mind, it is certain that aside from the systematic storage of evidence with the aid of up-to-date means, a range of social and educational undertakings will be hosted in the Building.

**Protection and enhancement of a significant monument serving as bearer of historical, architectural and aesthetic values.**
Through the support of the Society of the Acropolis Friends and the Paul & Alexandra Canellopoulos Foundation, exemplary studies were elaborated including detailed drawings, based on exhaustive research. The architect K. Skaris, systematically collected a large amount of data that will be used during the Building's restoration. The graphic restoration drawings depict the special morphological features of the architecture of the edifice, while its building phases are confirmed during the works as the masonries are being exposed. The project is currently in progress, financed by the National Strategic Reference Framework 2014-2020, implemented by the Directorate of Protection and Restoration of Modern and Contemporary Monuments, whereas conservation works are carried out by the Directorate of Conser-

vation of Ancient and Modern Monuments. Through the excellent collaboration with both services of the Hellenic Ministry of Culture, we do hope that the "Charalambos Bouras" Documentation Centre for the Acropolis Works will soon be put into operation.

**Protection and enhancement of the Monastiraki-Plaka historic area**

An architectural ensemble consisting of restored traditional houses that have become functional in urban life, housing mainly Services of the Hellenic Ministry of Culture, as well as other bodies is preserved within the immediate vicinity of the Acropolis of Athens and the archaeological sites of the city centre (Ancient Agora, Roman Agora, Hadrian's Library). Forming part of this ensemble, the Building at 13, Polygnotou Street turns into a major landmark in direct "dialogue" with its neighbouring buildings. Situated in the heart of the historic centre of the modern city, at the point at which the historical quarter of Monastiraki-Plaka adjoins the archaeological excavation site, the building complex at Polygnotou Street bears witness to the ongoing concern of the Greek State for the preservation and valorisation of the archaeological wealth of Athens and its architectural heritage.

All of us, who take part in the restoration of the Acropolis monuments, see the connection of the operation of the Documentation Centre with the late Professor Charalambos Bouras as a homage to a scientist who dedicated his entire life to this endeavour. From his position as President of the Committee for the Conservation of the Acropolis Monuments (ESMA) for more than 30 years, it was he who played a leading role in drawing up and implementing the organizational regulations and policy of the Service's Archive, and endorsed from the start the proposal to house it in the building at 13, Polygnotou Street.

***Vasiliki Eleftheriou***
*Architect Engineer*
*Director of YSMA*

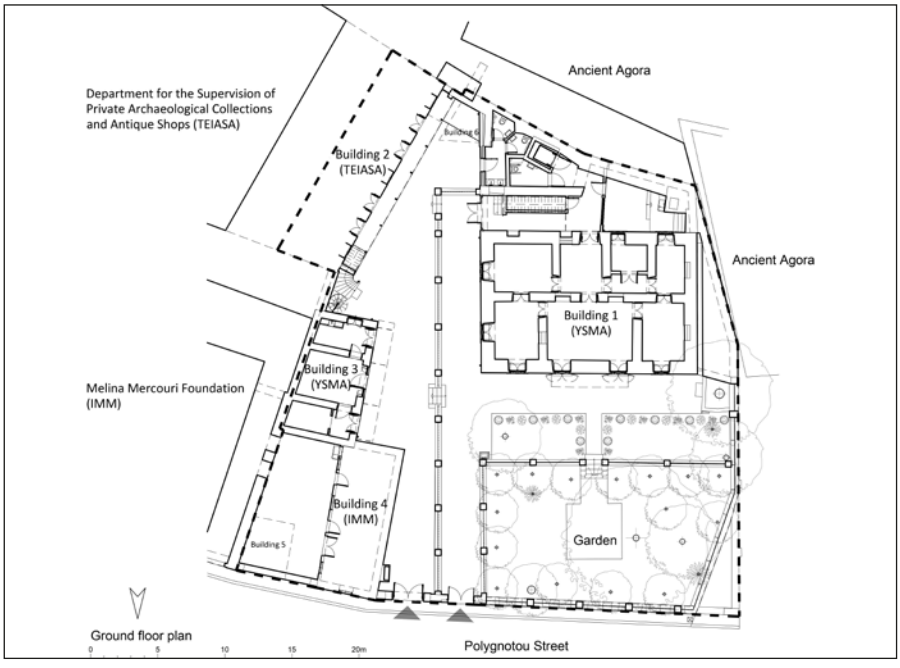
** Translation by D.D.*

## 2. Brief history of the so-called "Kolettis house" at 13, Polygnotou Street

The property at 13, Polygnotou Street is bordered by the archaeological site of the Ancient Agora to the south and west, the Melina Mercouri Foundation (IMM) and the Department for the Supervision of Private Archaeological Collections and Antique Shops (TEIASA) to the east, and Polygnotou Street to the north. The plot occupies around 1,160m$^2$, and four buildings are built on it. Building 1 is the largest, arranged over three levels; it covers 240m$^2$ in area, with a built-up area of 524m$^2$, featuring outdoor circulation corridors, an independent entrance on Polygnotou Street and a garden. Building 2 extends over two storeys, its coverage is 96m$^2$, and has a built-up area of 156m$^2$. Building 3 is a ground-floor structure, stretching over an area of 58m$^2$ and its built-up area is 47m$^2$. Buildings 2 and 3 share an outdoor communal space for circulation and an entry point at Polygnotou Street. Building 4 is also a ground-floor structure with a coverage and built-up area of 53m$^2$ and an uncovered space on the east for exclusive use.

Building 4 has been granted and functionally connected to the Melina Mercouri Foundation (IMM). Building 2 has passed to the Department for the Supervision of Private Archaeological Collections and Antique Shops (TEIASA). Buildings 1 and 3 have built-up areas summed into 571m$^2$ and, together with their outdoor spaces, have been handed over to the Acropolis Restoration Service (YSMA) in order to house the "Charalambos Bouras" Documentation Centre for the Acropolis Works.

According to D. Kambourgolou, the property's site was occupied in the past by the residence of K. Zografos. K. Biris (1966) reports that it was purchased as the residence of I. Kolettis; however, its form indicates that it was built several decades after his death. Moreover, he clarifies that it served as the residence of A. Manarakis, a prefectural engineer who lived in the second half of 19$^{th}$ and the first decade of the 20$^{th}$ century. S. Kydoniatis argues that the building dates back to Otto's reign. From the study of the early maps of the city of Athens (edited by M. Korres, 2010) it transpires that, in 1834, on the site of the property stood another, smaller, building.



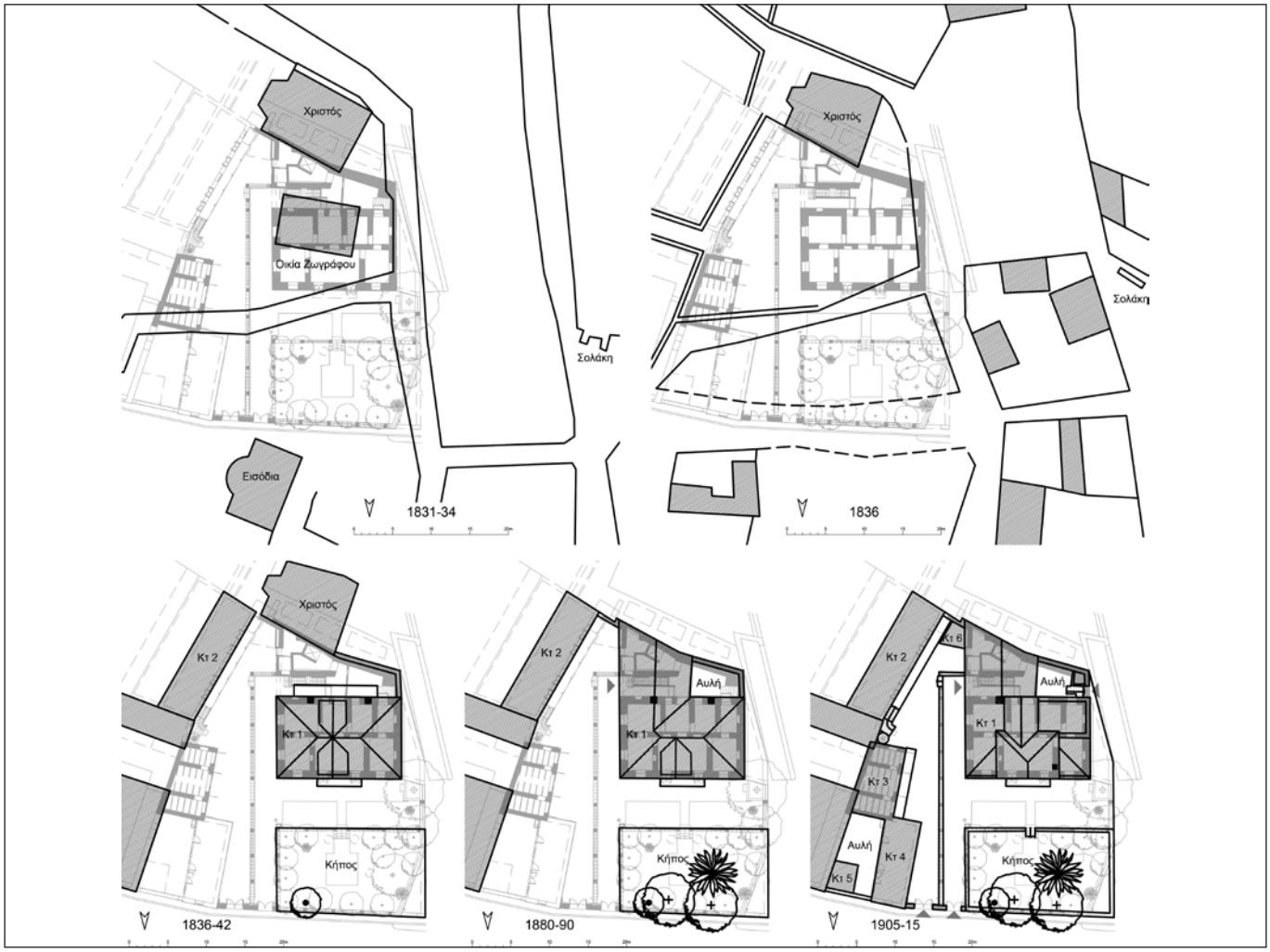

***General site plan. Architectural Study-Drawing: K. Skaris, 2020***

It may be possible that Kolettis used the old Zografos residence as his house from November 1834, as soon as he arrived in the new capital as Prime Minister, until his departure as ambassador to France in 1835. The residence must have been available, since Zografos had already departed as ambassador in Constantinople (1833-1837). The hypothesis proposed by Emm. Frangiskos (2009) that Kolettis may have lived for a short period of time, following his return from Paris in October 1843, in a property possibly identified with that at 13, Polygnotou Street, cannot be substantiated.

On a map of 1836, Polygnotou Street is depicted in its present-day layout, while the plot is shown unbuilt. On a different map of 1836-37, Building 1, together with the garden to the north and the ground floor of Building 2 are marked in red, as changes of the years that followed. In 1847, the outline of the two buildings and the garden in front of the north facade of Building 1 are shown. However, the Building had already been recorded for the first time in a photograph of 1842 (by de Prangey).

Zografos, upon his return from Constantinople in 1837, assumed office as Foreign Minister up to 1840. Perhaps at that time he replaced his old house with a new larger double residence, complemented by ancillary spaces and a garden, where the cypress tree that is still preserved today was planted. A few years later, Zografos at the age of 50, married the 17-year-old daughter of Michael Soutsos, Maria, who possibly inherited the property after his death in 1856. In 1906, Antonios Manarakis was known as a former prefectural engineer living at 13, Polygnotou Street. It is estimated that his career must have begun around 1870. However, it remains unknown whether he resided there since that time.

In summary, the ground floor and the upper storey of Building 1, alongside the garden and the ground floor of Building 2 constitute the first building phase of the extant complex that replaced an earlier edifice at some point between 1836 and 1842. Building 1 was rectangular in plan, lacking the later additions to the south, arranged over two functionally independent levels, the entry points of which were situated on the south. In fact, access to the




*The main building phases of the listed building at 13, Polygnotou Street. Study-Drawing: K. Skaris, 2020*

*View of the ceiling painting of the 2nd floor of Building 1. Photo K. Skaris, 2012*

upper floor was gained through a staircase furnished with a canopy in direct contact with the south facade. The Building was covered by a hipped roof featuring a wooden cornice that ran along its edges, skylights in the centre of the north and the south side, and two chimneys. The large hall on the ground floor had a naturally coloured coffered ceiling made of timber, while traces of plain painted decoration have been detected on an underlying plaster layer on the upper storey. This phase was preserved without major alterations until the 1870s, as evidenced by historical photographs. It is believed that the large palm as well as the two pine trees were planted in the garden during that decade.

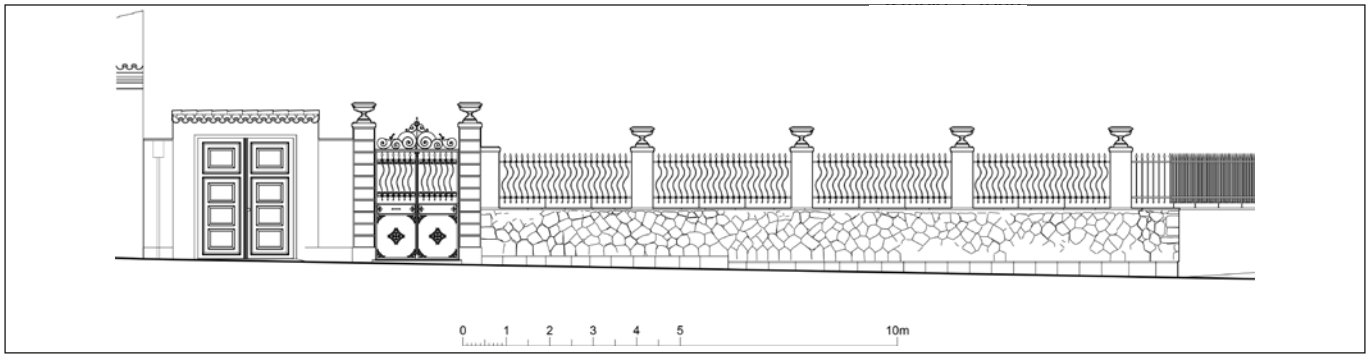
The addition of ancillary spaces to the south, and the two-storeyed entrance space were built before 1890. The presence of neoclassical decoration in underlying painting layers at the entrance as well as the first floor of Building 1 bears witness to a single building phase. The coating applied during the Othonian period was covered by a new layer upon which the painted decoration was rendered. The timber ceiling of the ground floor was repainted. The wooden canopy that covered the entry points of the residences and the staircase leading to the first floor were replaced with the impressive two-storeyed entrance, embellished with painted decoration on the ceiling and a new wooden stairway.

In a photograph of 1890 (ASCSA) it becomes evident that the addition of the second floor to the central section of Building 1 and also the addition of the first floor to Building 2 had not been built yet. These changes, but also the roof terrace at the SW corner of Building 1 were photographically documented in 1928.

In fired clay bricks belonging to Building 1 and possibly Building 3, relief stamps of brickmakers inscribed with the names "Δ(?)Λαρετζάκι/Χασάκι" and "Χασάκη" were found. The name D. Laretzakis (Δ. Λαρετζάκης in Greek) belonged to a brickmaker who was active already before 1890 until the 1910s, while the word "Hasaki" or "Hasake" (in Greek reads "Χασάκη") possibly alludes to the area surrounding the present-day Agricultural University where lay Hadji Ali Haseki's estate and tower (information by M. Bardanis).

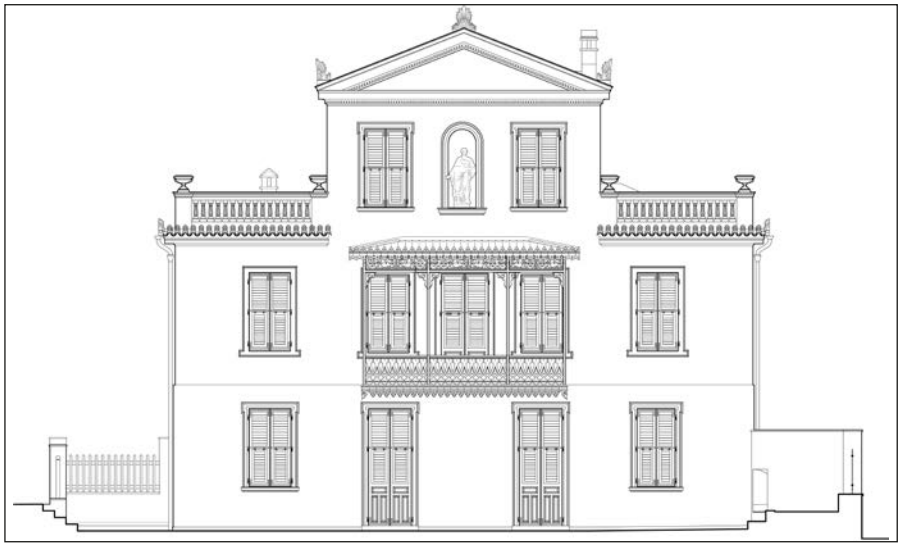
The abovementioned pieces of information and the presence of ceiling paintings rendered in the Art Nouveau style at the entrance, the first and the second floor of Building 1 indicate a single renovation phase that must have taken place between 1905 and 1915. At that time, the second floor with the interior wooden staircase was added, the gables were formed, the parapets and the niche containing the terracotta statue in the north facade were created, and the roof terrace with the iron beams was constructed at the Building's south-western corner. Furthermore, the north balcony was renovated through the addition of new timber decoration, and the entrance staircase was repaired. The same decorative style is also encountered in the canopy of Building 3. This Building, covered with iron beams and small, low-rise vaults in between, belongs to the same phase as, perhaps, Building 4. It is presumed that the upper floor of Building 2 was added at that time. These interventions constitute the last historical phase of the property's development that seems to coincide with the retirement of A. Manarakis in 1906. In a topographic map of 1930 (ASCSA), Buildings 5 and 6, which were later demolished, are also depicted.

The movie "To Amaxaki" ("Horse and Carriage", 1957, directed by Dinos Dimopoulos), produced by Finos Films, includes scenes that provide valuable information on the Building's lost morphological elements. In the actors' dialogues, reference is made to the construction of the Building in 1836. Was it mere coincidence or did the scriptwriters of the film, Iakovos Kambanellis and Nikos Kiousis, documented oral testimonies from the people of the neighbourhood, who were




*Restoration proposal. Elevation of the north enclosure wall facing Polygnotou Street. Architectural Study-Proposal-Drawing: K. Skaris, 2020*

aware of the Building's Othonian phase? Is it possible that such oral accounts actually preserved the information about Kolettis's stay –albeit short– in the Building? The fact that Kolettis was described as a General, although he never did officially acquire the title, alludes to an honorary formal address that was eventually documented in the Building's declaration as a historical monument in 1960. Immediately thereafter, the property was expropriated and the archaeological investigation of its garden and outdoor corridors was launched by Brown University in 1965. During the excavation, the cypress, the palm and the two large pine trees remained unaffected. After the excavation, small-scale repairs were undertaken and two new palm trees were planted in the garden.

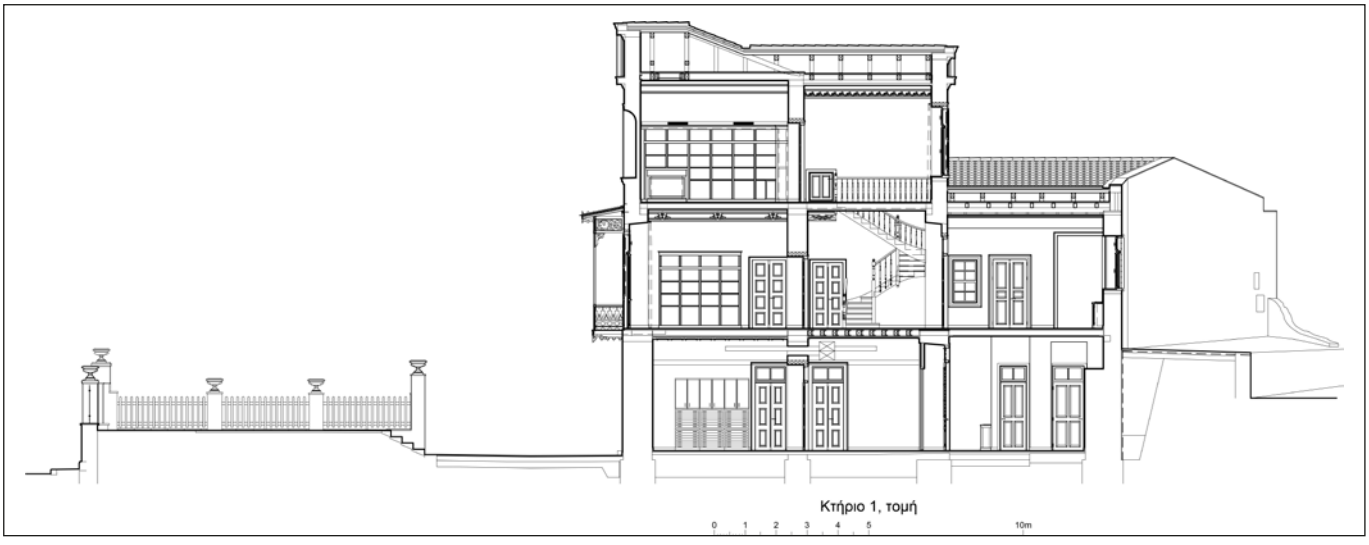


***Restoration proposal for the north facade of Building 1. Architectural Study - Proposal - Drawing: K. Skaris, 2020***

In 1965, the Ephorate of Antique Shops and Private Archaeological Collections was already based in Building 2, where the respective department is still housed today. In 1966, the offices of the 2nd Ephorate of Antiquities were moved to Building 1. In 1986, the collapse of part of the ceiling of Building 1 was documented in written communication, while cracks in the masonry and corrosion of the ceilings' load-bearing iron beams were observed. Following the aforementioned correspondence, repairs were carried out that involved the substitution of the roof terrace of the second floor with a reinforced concrete slab and also the replacement of the facades' coatings. However, the Building's structural problems were not comprehensively tackled.

The earthquake that occurred on September 7th, 1999 caused extensive damage to Building 1 and, therefore, it was immediately evacuated. In 2003, a restoration study was drawn up for Buildings 1 and 3 by the Directorate of Cultural Buildings and Restoration of Modern Monuments. The contractor selected was AKTA SA that undertook part of the work until September 2009. The Building was then handed over to the "Non-profit Civil Company - Centre for Neo-Hellenic Studies" in order to house the C. P. Cavafy Archive through funding from the TT Hellenic Postbank –a project that did not come to fruition eventually.

In 2012, Buildings 1 and 3 as well as their surrounding space were granted to the Acropolis Restoration Service (YSMA) to house its archive. In the period from 2009 up to the Building's bestowal to YSMA, squatters occupied Building 1 that caused a fire. As a result, part of the floor of the second storey and the ceiling painting underneath were destroyed.




***Restoration proposal. Cross section of Building 1 and the garden. Architectural study - Proposal - Drawing: K. Skaris, 2020***

Some of the initial measures taken by YSMA were to remove the squatters, block access points and take care of the garden. Unfortunately, however, the three palm trees were irreversibly infected by the red palm weevil and were felled in April 2013. Then YSMA prepared a floor space management programme for Buildings 1 and 3 and decided to keep its archive in their premises by establishing an organized Documentation Centre for the Acropolis Works. In fact, it was decided to name the Centre after the late Professor and President of the Committee for the Conservation of the Acropolis Monuments (ESMA), Charalambos Bouras.

YSMA immediately retrieved the hitherto available studies on the Building. It approached the "Centre for Neo-Hellenic Studies" which granted the license to use the studies prepared by CONFIDE Ltd. and AEINAES firm, with the consent of the researchers. However, the needs that had to be met arising from the Building's new use (Centre for the documentation of the Acropolis works) were completely different from those of the Cavafy Museum, and the architectural design had to be totally modified. This use necessitated the elaboration of a new structural (increased loads due to stack rooms) and a facility study (creation of new storage spaces with special conditions). In addition, historical research yielded new evidence for the restoration of the authentic morphological features. Finally, the later interventions, which were incompatible with the historical character of the buildings, and the new pathology elements spotted had to be dealt with from the very beginning. It was, therefore, necessary to lay out new implementation studies as well as an economic-technical study that would incorporate all of the restoration works which the Building and its surrounding space would undergo, but also the supply of its entire operational equipment.

Initially, a study was elaborated in which the new use was set out and the main options of the intervention were determined. Then, after painstaking search for funding, the implementation studies were assigned by the Society of the Acropolis Friends to private researchers (K. Skaris, entrusted with the architectural study; V. Papavasileiou, charged with the structural study; PROTON Consulting Engineers Ltd., responsible for the mechanical study), financed by the Paul and Alexandra Canellopoulos Foundation, with the exception of the conservation study updating that was carried out by the Directorate of Conservation of Ancient and Modern Monuments.

The new studies were scrutinized by a special committee set up by YSMA and approved by the competent bodies, and a building permit was issued. In 2020, the project was included in the National Strategic Reference Framework and is already underway implemented by Restore SA, under the supervision of the Directorate of Protection and Restoration of Modern and Contemporary Monuments, as regards the building works, and the Directorate of Conservation of Ancient and Modern Monuments that is accountable for conservation.

***Kosmas Skaris***
*Architect Engineer*

*Parthenon Restoration Project*

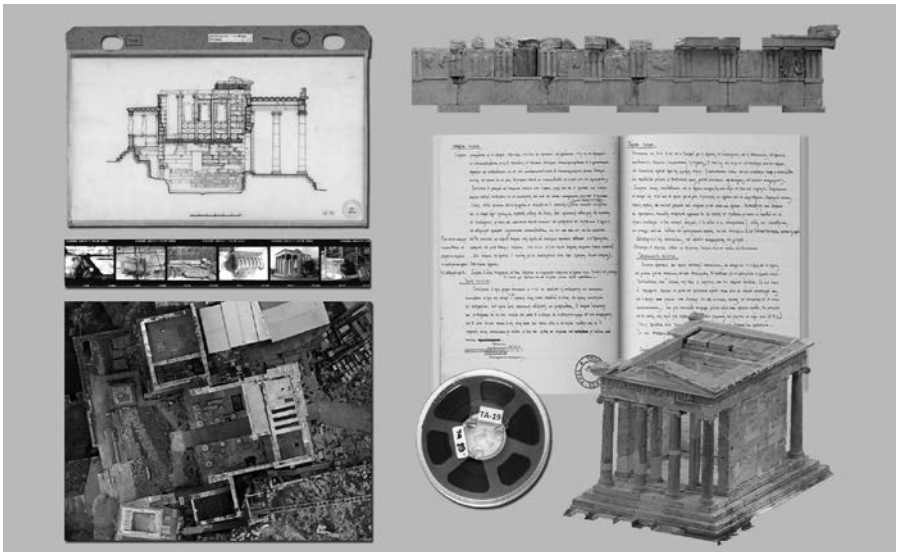
** Translation by D.D.*

## C. A new era for YSMA's archive

Nearly half a century after its foundation by the Committee for the Conservation of the Acropolis monuments, the public archive comprising information and evidence of all accomplished modifications on the Acropolis monuments and a detailed record and documentation of all contemporary restoration and conservation interventions, has become a valuable and continuously enriched knowledge repository of more than 300,000 primary documents.

In compliance with the need for the works to be transparent and reversible, the documentation archive of the interventions, which have played a crucial role in determining the method that must be employed for the restoration of the monuments of ancient Greek architecture, expanded by standardising specific documentation and digitisation practices, designing the necessary structures for the digital management of the documents, and producing various applications that enable the availability and promotion of its rich content.

This extensively thorough archive is housed until today in the central building of the Acropolis Restoration Sevice (YSMA), at 10 Polygnotou Street, in Plaka. The Documentation Office is responsible for its manage-



***Types of documents of the ESMA-YSMA Archive. Graphic design: S. Poulou***

ment and promotion. The permanent personnel of the Office, consisting of three archaeologists and an administration officer, systematically registers and records, in accordance with the rules of procedure as found in Φ.Ε.Κ.105/Β/1593/23.12.2002, in the central archive, and since 2002 in every worksite, every kind of document produced daily during the interventions. The number of the personnel increases when the interventions are supported by European funds, when three or four archaeologists, specialized in digital documentation and the promotion of archive material, and an IT specialist are employed by the Office to assist the work of the permanent staff.

The rich content of the archive has become known to the scientific community and the public from the publication and presentation in international meetings and workshops of the studies concerning the restoration of the monuments and the results of the research carried out during the interventions; the annual Acropolis Restoration News, other printed newsletters, exhibitions, films, the website of the Office (https://www.ysma.gr/) and various online applications make its content more accessible and known.

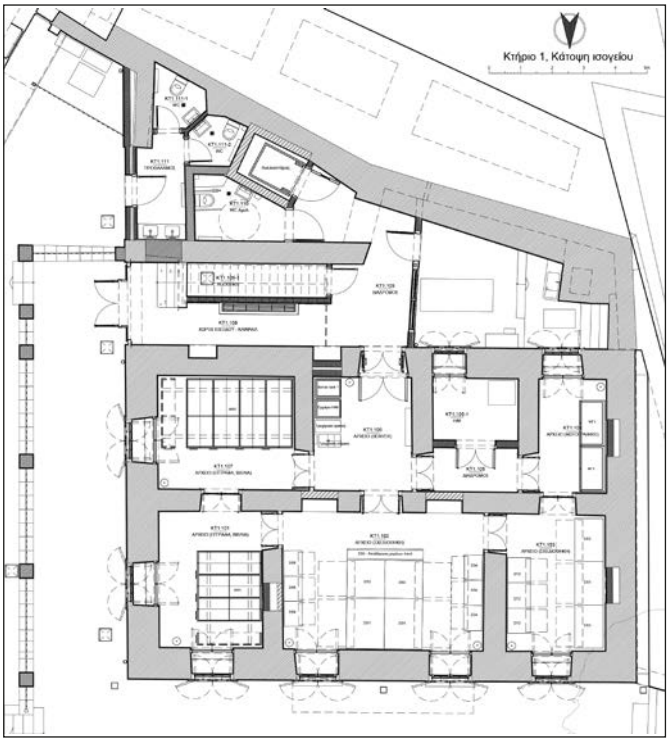
Reusing the listed building at 13, Polygnotou Street to house the "Charalambos Bouras" Documentation Centre for the Acropolis Works and relocating the documentation archive of the works to it, signifies a new era for the research in the history of the restoration interventions on the Acropolis monuments, as well as for the protection and promotion of their documentation archive. The Documentation Centre for the Acropolis Works, fulfilling the vision of the late Professor by following through on his plans, will provide conditions for organising and safeguarding the conservation of the authentic documentation archive material from the restorations, will facilitate researchers of ancient Greek architecture to access the entirety of this unique archive material, and at the same time increase the possibility of its exposure to the general public in a location incorporated in the design of the overall management of the Acropolis and its surrounding archaeological site. The archive material, organised according to international specifications and protected with a system of controlled air-conditioning and security systems, will find its final place inside the rooms of the building complex that have been specifically converted and equipped with modern archive systems.

The ground floor of the central building will store original archive material. Three halls in its east and south part, equipped with rolling shelving bookcases and filing cabinets, will store a collection of documents: administrative documents, reports, studies covering all the areas of the activities concerning the monuments and their restoration, work logs and record sheets of scattered architectural members.

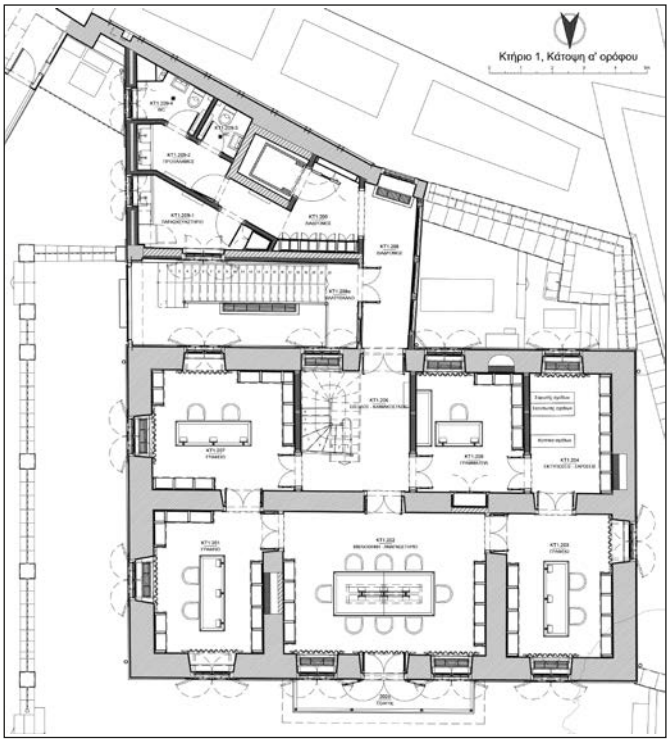
*Editions and digital applications of the ESMA-YSMA Archive. Graphic Design: S. Poulou*

The large central hall and the northwest part of the ground floor will accommodate about 21,500 documents, organised in plan cabinets and classified according to each monument: general plans documenting the preservation condition of the Acropolis rock and its monuments before the interventions, graphical representations of the monuments and their construction phases, technical drawings of the worksites and the mechanical equipment of the works, drawings documenting the present condition of the architectural members, technical drawings of their structural restoration, mappings of their degradation and the conservation interventions of their surfaces. We should mention here the specialised, already digitalised part of the collection, the archives of design automation (CAD) and photogrammetric documents including orthophotomosaics and three-dimensional texture models of the monuments, the walls and the Acropolis rock, documentation and surveying drawings archives using photogrammetric techniques and laser scanning, as well as archives including documents showing parts of the monuments before and after interventions.

The southwest part of the ground floor will house the collection of the photographic and audio-visual material. The photographic collection comprises: black and white negatives (120 and 35mm) and colour negatives (35mm), colour slides and digital photographs (about 250,000 shots). It also incorporates all the contact sheets of the shots and a large number of printed black and white pictures attached on special sheets, following a subject-based archiving system. The photographic collection contains also negatives (35mm) and printed photographs documenting the conservation and consolidation works on the monuments, the




*The listed property at 13, Polygnotou Street: Building 1, Ground floor plan. Architectural Study - Proposal - Drawing: K. Skaris, 2020*




*The listed property at 13, Polygnotou Street: Building 1, first floor plan. Architectural Study - Proposal - Drawing: K. Skaris, 2020*

rock and the slopes conducted in the 1960s and 1970s by the Athens Ephorate of Antiquities; in addition, it includes reproductions from other archives or third party donations documenting older interventions and the condition of the monuments before ESMA's interventions: photographic material from the archive of Balanos found in the Archaeological Society of Athens, photographic documentation of the conservation condition of the Parthenon west frieze in the 1950s and 1970s from the Archive of the Directorate for the Restoration of Ancient Monuments, photographs of the Acropolis and its monuments from the German Archaeological Institute at Athens, photographs taken by P. Sébah and S. Meletzis during the period 1959/60, and more varied material.

The collection of audio-visual material, which is featured in detail in issue 20 of the Acropolis Restoration News (S. Poulou, "The coding and the metadata of the audio-visual archive of YSMA"), comprises 1,772 documents (analogue and digital), these are negatives, video tapes BETASP and VHS, DVD discs and audio tapes. It includes original film footage that documents the interventions and films made by YSMA concerning the works and the monuments of the Acropolis.

Documents will be systematically arranged in the east part of the first floor of the building, whereas its central part, where the library will be housed, will be converted into a study area. Here the researcher of classical architecture, exposed to 3,905 items of studies, journals, prints from journal articles or collective volumes of scientific papers, will be able to explore matters concerning architecture, archaeology, and the restoration and conservation of the monuments of classical antiquity. Reading through the 47 volumes published by ESMA and YSMA will also allow the visitor to examine carefully all the restoration and conservation studies of the monuments: the first studies of the restoration works on the Erechtheion (1977) and the Parthenon (1983), including the twelve work programmes conducted on the monument that became the foundation of every study concerning the classical monuments in Greece, the ensuing studies on the Parthenon (volumes 2-9), the Propylaia (volumes 1-3), the Athena Nike temple, the proceedings of international meetings and many others. The library also contains a systematic bibliographic indexing of older articles about restorations of the Acropolis monuments, clippings from the daily Press and magazines discussing the interventions on the monuments, and informational material from international conferences and events organised by ESMA and YSMA.

What it is really important for conducting research in the history of the restorations is the opportunity given to study the history of the restoration works on the Acropolis, conducted since 1975, by examining the content of the documentation collected during the restoration process of the interventions. Researchers can have access to all this information after the final report on a restoration work is completed. Nowadays researchers can read through the digitised material –to protect the originals from wear and tear– of the first records for

the conditions of the monuments, original studies, proposals, hand-written work logs and reports that thoroughly present all the steps taken to conduct the works of the restorations on the monuments (about 2,700 documents), can familiarise themselves with the necessary institutionalised processes for the approval and regulation of current restoration interventions, to gather important information for the conservation condition of the monuments and search for information about every aspect of their conservation and restoration works. When required, access will be granted to the original material; in designated areas in the west part of the floor researchers will be allowed to scan and print.

As documentation process concerns not only every monument as a whole, its specific structural areas and the sections that have undergone restoration interventions, but also distinctive individual parts, the Data Base of the documentation archive of the interventions, compiling 203,000 entries until today, makes access easier and faster through a system where the monuments are clustered under a hierarchical analysis scheme –in the case of the Erechtheion also through a three-dimensional model of the monument– inside a separate coded and classified file. These archive files (12,700), because of the systematic digitization and consistent entry of the documents, are updated from relevant interconnected archives with photographs, drawings and audio-visual material which display the condition of the monuments before their dismantling and separate restoration phases during the intervention. Scanning or digging through the above-mentioned documentation material in every appropriate way, the researcher can have access to the form and construction details of every individual area, element or part of the monument that has undergone restoration interventions, see traces of degradation and human interventions over time, draw a large quantity of information about their conservation state, look through the history of older restoration interventions and recompose its dismantling, conservation, structural reconstruction and its final repositioning.

Access to the application developed especially for recording and managing the documents will be immediately given to the researchers for the Erechtheion, whereas for the Propylaia, the Athena Nike temple, the Parthenon, and other monuments on the rock, where restoration interventions are being conducted, will be given the moment the final report on the relevant works will be completed.

An area on the 2nd floor of the Building will be converted into a lecture hall (accommodating up to 15 people); there temporary exhibitions will also be held. The same area will house the extensive archive of the proceedings of ESMA's meetings, conducted since 1975, and it will also be the place where ESMA will carry out its meetings. This archive reflects the progressive development of the works on the Acropolis, from rescue interventions to the restoration of its monuments, in a period decisive for the recent history of the restorations in Greece. This development was made possible by the foundation of the Acropolis Restoration Service which accelerated the works and modernized the way they were carried out. This archive includes information regarding the serious challenges ESMA had to meet in order to come up with the best solutions, and also the fact that its members were highly scientifically trained, responsible, daring and totally devoted to their duty to achieve enduring preservations on the monuments. Moreover, it presents the Committee's contribution, especially during the thirty years presidency of the late Professor Charalambos Bouras, to research and the construction of restoration ethics that ensured during the long-standing operation of ESMA the implementation of modern research and technological instruments in the interventions.

The exterior spaces of the building complex, such as the outdoor corridors on the north and east of the building and the elevated garden found on its north, an ideal position as it is adjacent to the Panathenaic Way that leads to the rock and offers a magnificent view of the Ancient Agora, will be cleverly exploited by organising exhibitions and information events and providing educational programmes to the public, all inspired by selected archive material from the interventions. These events, exhibiting through multiple descriptions the wealth and diversity of the archive collections, will enlighten with their subject matter many and varied aspects of the history of the restoration works and so give the opportunity to experts and non-experts to get to know the monuments and their history. During the events the public will be able to look through the publications of the Service by visiting the accessory building found on the northeast of the garden.

Within the context of relocating the documentation archive of the interventions to the areas of the restored and especially converted listed building of 13, Polygnotou Street, it is expected, with the funding provided to YSMA by the Public Investment Programme of the Ministry of Culture, to equip it with archive equipment and materials, prepare a study for its maintenance and transfer, and make a complete proposal for the organisation and management of its archival collections.

The aim of The "Charalambos Bouras" Documentation Centre for the Acropolis Works is to ensure, through the long-standing preservation and access entitlement to the archive that contains the history of the restoration of the Acropolis monuments since the 19th century, the preservation of the collective memory for the architecture, the history and the principles the most complete monumental complex of classical antiquity conveys, all of which the man behind it had served with his vision and dream.

***Dr Evgenia Lempidaki***
*Archaeologist*
*Head of the*
*Documentation Office*

** Translation by A-M.H.*

# Inclusion activities of the Acropolis Restoration Service for students with disabilities

YSMA's Department of Information and Education started designing and implementing activities for students with disabilities as far back as 1991. The central theme of all the activities is the Acropolis, its history, its monuments, and the recently conducted restoration works. A thorough presentation of previous activities can be found in the book "Acropolis and Education", published by the Acropolis Restoration Service (YSMA), and also in the Repository of the Acropolis Education Resources (http://repository.acropolis-education.gr/acr_edu/), where all the relevant previous school projects carried out in collaboration with Special Education Schools are posted.

What follows is a brief presentation of the educational programmes implemented in the recent years and designed for groups of students who have different types of disability problems. These are diverse groups that differ according to the type of disability (visual, hearing, mental, mobility), its severity (mild, moderate, marked) and its extent (total, partial, permanent, or temporary), and also groups where various types of disabilities co-exist (multiple disabilities). Yet, what all these students share and face is the existing barriers to their access and participation in various social sectors and public goods. What is revealed in this context is the multidimensional role of cultural institutions that ought to be "open" to all citizens by including in their activities the philosophy of universal design or design for all. The aim of such planning is to allow a much broader range of people to have the highest possible access to these areas limiting the need for subsequent adjustments. Undoubtedly, knowing the specific characteristics and needs of every group that visits the monuments is necessary during the development of every activity of educational or communicative character. However, in order to have the intended results, people with disabilities should be approached not only as disabled, but also as different.

In this context, the educational objectives of the Department focus on the fact that students with disabilities should have equal access to cultural goods and be included in the audience of cultural sites. In addition, their daily school life and the teaching practices must be enriched with new incentives that can facilitate the perception and understanding of various concepts. Furthermore, what can help the students further develop their social skills is the development of new attitudes and behaviours such as self-esteem, strengthening the relations between the students and developing alternative means of communication.

In order to achieve these goals, the Department has worked together with the teachers of the students to identify and exploit suitable educational tools and the necessary supplementary materials. The children are provided with simplified information paying attention to its quality and quantity while the vocabulary is also adapted. Moreover, objects are added to assist tactile examination, and audio stories or other visual teaching aids, depending on the group, can strengthen the experiential character of the visit and contribute to the attainment of the educational and museum objectives.

Over the years these activities have been designed and implemented by the Department either at the students' schools, or at the Centre for the Acropolis Studies during the earlier years; and since 2009 at the Acropolis Museum. In 2017, such an activity was carried out at the Acropolis Museum for students of the 4$^{th}$ and 5$^{th}$ grade from Kallithea's Special Primary School for the Blind. The students were partially sighted or had only peripheral vision. The programme was organised in collaboration with the 4$^{th}$ Athens Directorate of Primary Education and the Acropolis Museum. The students visited at first the educational centre of the Acropolis Museum where they examined various three-dimensional objects such as models and sculpture copies, and then, using their imagination, reconstructed the magnificent temple where the Athenians worshipped their patron goddess. The children's experience concluded with their tour in the Parthenon Gallery, where the partially sighted students had the opportunity

*Educational programme for Kallithea's Special Primary School for the Blind. Photo T. Souvlakis, 2017*

to realise the size of the temple and the richness of its sculptures.

Another educational activity for children with sensory impairments was organised in 2021 at the Acropolis Museum and targeted students of the 3rd grade of Argyroupolis Primary Special School for the Deaf and Hard of Hearing. Its theme was "Olympian riddles: searching for the ancient gods in the Acropolis Museum". The students were looking for the ancient Olympian gods in the exhibits of the Acropolis Museum with the help of visual material relevant to the characteristics, myths, and favourite symbols of the gods. The oral language used was simple and brief as the schoolteachers had to translate it into sign language. What helped this "transcription" of the oral language was the fact that the students had the opportunity to examine a small number of tactile materials and also take part in motor activities and games.

During the school year 2022-23 the Department designed and implemented for the first time at the archaeological site of the Acropolis educational programmes for students with reduced mobility. This had become possible after installing the new slope lift and constructing new walkways for the visitors of the Acropolis Rock, limiting as such the existing obstacles for physical access for all. Many special schools were thus able to express their wish to exploit this opportunity for their students, who could not until then visit the monuments except through their schoolbooks or virtual tours. The students who participated in these specific programmes came from the Special Secondary School-Lyceum of Ilioupolis and from the Special Comprehensive Vocational Secondary School-Lyceum of Agios Dimitrios. The difficulties of those students were not of sensory nature, but included mild learning and behavioural disabilities, mental retardation, autism spectrum disorders, and (in the case of the school at Ilioupolis) reduced mobility problems.

All educational activities should be carefully planned and designed starting with the synergy of two bodies – a cultural organisation and a school. This is a sheer necessity for students with disabilities. Thus, in the case of the educational programmes for these two Special Schools there was a collaboration with the teachers from the beginning in order to decide on the subject of the programme, the school class and the number of the participating students. The Department suggested that the students should be prepared in advance by looking into its educational material relevant to the theme of the specific visit. In addition, the teachers from the school met the archaeologists of the Department at the archaeological site beforehand to identify the route the students would follow on the Rock, the areas where they would stop and the duration of the activity.

*Educational programme for the Argyroupolis Primary Special School for the Deaf and Hard of Hearing Photo T. Souvlakis, 2021*

In the first educational programme the participant students were 12 from the 1st grade of the Agios Dimitrios School, while in the second 13 students from the 1st and 3rd grade of the Ilioupolis Lyceum. In both cases the students were divided in two smaller groups that were accompanied by a large number of teachers. In cases where students used wheelchairs there was a teacher for every student. Moreover, two archaeologists-museum educators accompanied each group. During the tour the students saw the four more important monuments of the Acropolis, starting from the Erechtheion, then the Propylaia, the Temple of Athena Nike, and finally the Parthenon. Using printed material (posters and leaflets) and also small copies of columns of the three orders that they could examine on the spot and answering simple questions through a guided dialogue the students discovered the function of each building, and recognized the different architectural orders. They were particularly impressed by the size of the monuments, asked many questions about the restoration works and were really enthusiastic with the modern equipment, the cranes and other machinery they saw at the site. Moreover, they were really interested in both the original shape of the monuments and in how they will look when the restorations are completed. What also fascinated them was the very large number of visitors and the fact that all those people had come from so many different countries.

The students from the General Lyceum of Ilioupolis were so happy and satisfied that after the completion of the programme they asked for another visit, this time at the Acropolis Museum. However, due to the limited time until the end of the school year, the teachers took the decision to accompany students from the 2nd grade of Secondary

*Educational programme for Special Secondary School-Lyceum of Ilioupolis. Photo T. Souvlakis, 2021*

School, who similarly faced learning, behavioural and mental difficulties, autism spectrum disorders and reduced mobility problems. Yet, they eagerly wanted to participate in the programme. Since during that period there is a large number of visitors in the Museum, something that may have caused difficulties to the students' tour, we were led to opt for an educational programme that would be conducted only on the third floor, in the Parthenon Gallery. The topic was "The Parthenon sculptures. Six short stories of separation". With the help of a leaflet, the students tried to discover six famous sculptures that have been separated in Athens and the British Museum, learnt the story of their removal and what themes they depict, observed their details and tried to act out in pantomime scenes from them. In the workshop that followed, when the students visited the Educational Centre of the Museum and saw the buildings created by other students, inspired by the Acropolis monuments and made up from Lego bricks, they were so enthusiastic that we ended up changing the programmed educational workshop; it was an activity where they would have to describe by paintings and words the feelings a student could have from the separation of the Parthenon marbles. As all educational activities should be flexible and allow for improvisations and alterations of the initial programme, we therefore decided to divide the children in small groups and let them make their own Lego constructions.

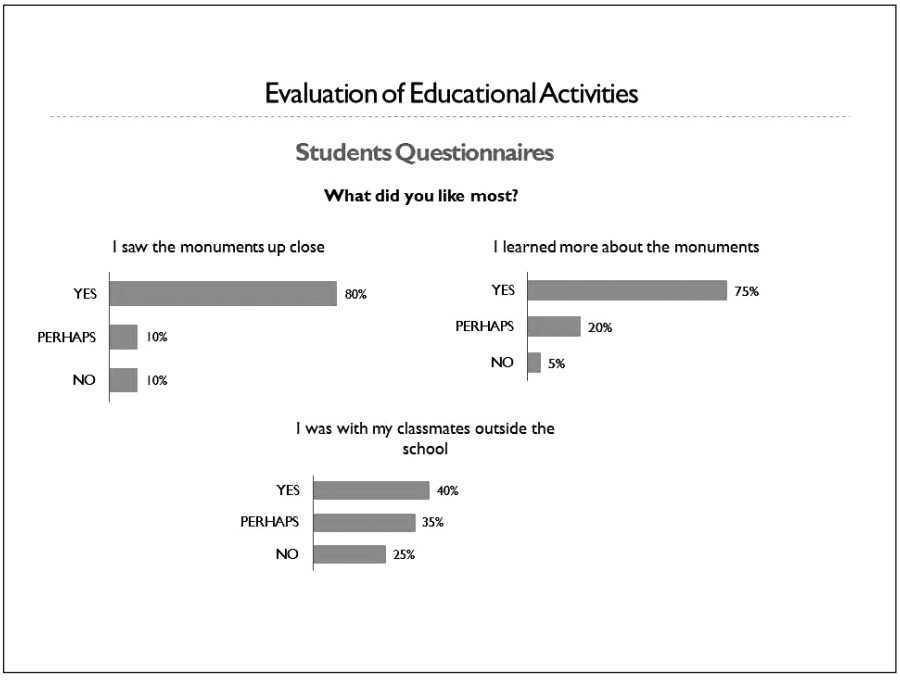
After completing these two educational programmes on the Acropolis we carried out a limited research to evaluate them. Its aim was to examine whether the goals of the educational programme were achieved, to investigate the students' and teachers' experience and record their comments and suggestions for similar future programmes.

The research tools were two questionnaires, one for the teachers and one for the students, containing open and closed questions. The questionnaires were given at the end of the visit in order to be completed at the schools; thus, the students and teachers could have enough time to answer, and the students could ask for help and support when needed. The main questions were the following:

- What was their previous experience from similar visits?
- What were the students and the teachers' expectations?
- What were their impressions from the visit?
- Which qualitative characteristics of the programme did they find successful?

In total 29 questionnaires were completed, 20 from students and 9 from teachers.

The results of the analysis showed that only 7 students (35%) had visited the




*A graph from the students' evaluation – "What did you like most?"*

Acropolis before the day of the educational programme, whereas the remaining 13 (65%) had not. It must be noted here that from the school whose students had mobility problems only one had previously visited the Acropolis.

Responding to the question whether they liked the educational programme 70% said that they liked it a lot or very much. All students with mobility difficulties who have never gone to the Acropolis before are part of this percentage.

Answering the question relevant to what they liked most, the majority said that it was their actual visit to the monuments (80%) and then that they had the chance to learn more about them (75%). Fewer students (40%) said that they liked being outside the school with their classmates, while some said that they liked the elevator and the guided tour. Generally, it seems that they enjoyed the programme and that it met their expectations.

Most students expressed their happiness (80%) for being able to see the monuments on the Acropolis, and also their enthusiasm (80%) to see the city from above after using the elevator. On the other hand, half the students (50%) said that having to move on the Acropolis had caused them some concern, yet, it was quite surprising to hear that the large number of visitors did not make any of them uncomfortable.

Looking into the responses of the teachers to the question referring to what they believe the specific programme offers to their students, the most common and expected answer was their chance to physically visit the monuments (89%) and the next most common answer (76%) was that it enriched their knowledge. These answers coincide exactly with those of the students. The third most common answer is entertainment (67%), while 45% of them said that the visit increased the awareness of the children towards matters concerning the protection of the monuments.

Discussing the whole experience and specifically what the visit meant to the children, most of the teachers said that they were impressed and happy and that they would like to come back, whereas no-one mentioned that they got tired or bored.

Finally, evaluating these programmes we can certainly conclude that the initial objectives, of both the schools and the Department, have been mainly achieved and the collaboration of the two bodies was quite successful. At the same time, we were able to identify some factors that should be further considered when organizing similar activities in the future. It is therefore clear that YSMA's Department of Information and Education responding to the multifaceted demands of the modern era develops outreach educational activities addressed to a heterogeneous audience with diverse needs and expectations; an audience that claims for equal access to all cultural goods and for its active involvement in cultural life and the learning process.

***Irene Kaimara***
*Archaeologist*
*Head of the Department*

***Asimina Leonti***
*Archaeologist*

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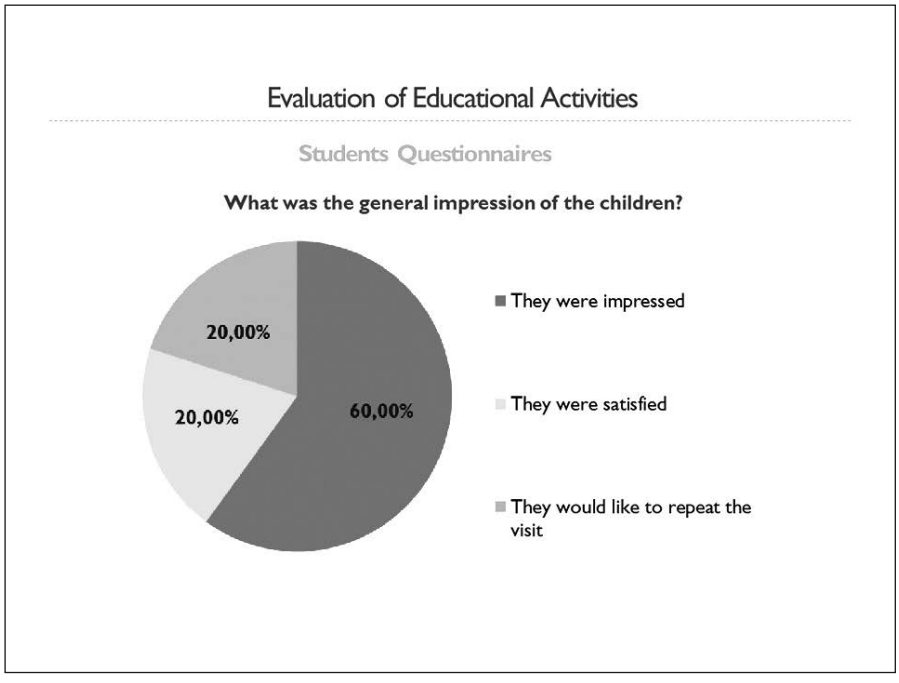



***A graph from the teachers' evaluation presenting the students' impressions***

** Translation by A-M.H.*

*** The following articles were used in the text: Χ. Κανάρη (2020) «Θεωρητικές αρχές σχεδιασμού και εφαρμογές διαφοροποιημένων εκπαιδευτικών προγραμμάτων σε μουσεία για άτομα με αναπηρία», Επιστήμες της Αγωγής, 1: 149-170 and Β. Αργυρόπουλος – Σ. Κατσαντώνη (2020) «Μουσεία, καθολικός σχεδιασμός και άτομα με αναπηρία όρασης: μια οικολογική προσέγγιση», Πολιτισμός για όλους. Μουσεία χωρίς αποκλεισμούς (Αθήνα) 1-9.*

This issue of the Acropolis Restoration News covers the years 2021 and 2022 when YSMA progressively returned to its regular operation after the restrictions imposed by the Covid pandemic. The Service exploiting the experience gained from previous years was able to respond to new challenges. Undoubtedly, the most important event of those two years was the organisation by YSMA's Documentation Office and YSMA's Information and Education Department of the 7th International Meeting for the Restoration of the Acropolis Monuments. The Service though organised and hosted short-span workshops and other activities. Before presenting these events, we would like to express our grief for the loss of two important personalities.

On 10.10.2021 Evi Touloupa, former Curator of Antiquities of the Acropolis and member of ESMA, passed away. An archaeologist of known authority started her career at the National Archaeological Museum and then after working at the Ephorates of Ionian islands, Phthiotis, Epirus and Evia, carrying out important excavation work, she was appointed Curator of Antiquities of the Acropolis in 1982 where she worked until 1990. She was always very enthusiastic, working diligently for the protection of the Acropolis monuments, the creation of the Acropolis Research Centre and for implementing her vision for the construction of the new Museum. During her tenure in the Ephorate she was always friendly, loveable, democrat and militant, expressing her progressive ideas and supporting young scientists. Even after her retirement she continued her active role as an Emeritus Curator of Antiquities of the Acropolis by participating in ESMA, and also from her post as the General Secretary of the Friends of Acropolis Society until she stepped down in 2006. People who worked with her will remember her for her freshness, acute mind, and her unquench passion for the protection of the monuments.

On 14.9.2022 we were deeply saddened by the death of the President of the Board of the Acropolis Museum. Dimitrios Pantermalis was Professor of Archaeology at the Aristotle University of Thessaloniki and supervisor of the excavations at the archaeological site of Dion. His name was inextricably linked with the new Acropolis Museum where he diligently worked from the time of its construction to the beginning of its operation when he became the President of the Board. Being at this position he always watched with great interest the restoration works on the Acropolis Monuments which he actively supported. He had a close and diverse collaboration with YSMA, especially in relation to the educational programmes which he embraced from the very beginning as he believed in the educational value of the monuments. The profound relation of trust and mutual respect between YSMA and Dimitrios Pantermalis is a model of cooperation and an inspiration source for the future.

*Evi Touloupa and the then Minister of Culture, Melina Merkouri in the 1980s*

**Educational Activities**

In 2021 YSMA's Department of Information and Education restarted after the Covid-19 lockdown to progressively provide and implement educational activities. During the last two months of 2021 the first educational programmes resumed, without though the accompanying art workshops, which restarted in the second semester of 2022 together with all the activities organised by the Department, such as the opportunity to borrow museum kits and the provision of training seminars for teachers. All educational activities are very popular among the educational community, a natural consequence after the conditions created by the pandemic.

In particular, during the second semester of 2022, Primary and Secondary school students from 33 schools, a total of 1950, attended in the Acropolis Museum 83 educational programmes whose subjects were the ancient temples, the Parthenon sculptures, and the Olympian gods. In addition, the Department participated in the "European Heritage Days" by designing and implementing the educational programme entitled: "Short stories of restoration" for the students of the 6th grade of the 70th Primary School of Athens. As part of the Museum's Christmas events in 2021 the children took part in the educational programmes titled "Sound-stories for strange divine births" where they learnt about the myths and births of divine children by creating their own soundscapes, while in 2022 in the educational programme entitled "Goblin... mix-up" they had to find out the mess the goblins had caused inside the museum and restore order. Both the ac-

tivities were conducted in collaboration with the museum educators of the Acropolis Museum.

The Museum kits of the Department, during the same period, were loaned to 47 schools around Greece and used by 2,100 students. The increased demand, both from Greece and abroad, led the Department to produce more museum kits compared to previous years, and also to create one more copy of the museum kit "Ancient Greek Dress".

Sixty teachers from various schools of Attica attended the training seminars on the "Educational material from the Acropolis". There they were exposed to the Department's educational material relevant to the Acropolis monuments, in printed and digital form, as well as to the way they could include it in their syllabus.

Throughout the pandemic the digital educational activities addressing both teachers and the general public saw a sharp increase in their popularity. In 2021 the number of visitors reached 31,500, while in 2022 the users were as many as 52,000. The increase in the number of users is, on the one hand, due to the general interest in digital applications during that period, and on the other, because the Department had made every effort to better its digital activities, mainly by enriching the Repository of Acropolis Education Resources (http://repository.acropolis-education.gr) with new lesson plans, activity booklets for school groups and presentation shows, and also with the creation of a new digital activity :"Let's learn, play and create", which explored a new thematic area about the entablature of ancients temples. An important event of 2022 was also to redesign in collaboration with the National Documentation Centre and the Acropolis Museum the website: "The Parthenon Frieze", a fact that compared to previous year tripled website traffic.

In 2021 a new educational booklet entitled: "A Greek temple...for kids" was added to the educational material of the Department where the function, design and construction of an ancient Greek temple is presented in a way easy to understand and enjoyable to read; the educational material for families created in collaboration with the Acropolis Museum was supplemented with a new booklet entitled: "The Parthenon sculptures: 6 short stories of separation".

Regarding the lectures and publications of the Department, its work was in 2022 presented to officials of the Italian Ministry of Culture through the Italian Archaeological School of Athens and the Fondazione Scuola Beni e Attivita Culturali, and to professors, researchers, archaeologists, and representatives of various institutions from Egypt and Europe within the programme "ReHeEd: Reframing Heritage Education in Egypt". In addition, the Department published the article: "New Educational Activities of the Department of Information and Education" in issue 19 of the Newsletter of the Hellenic Section of the International Council of Museums (ICOM).

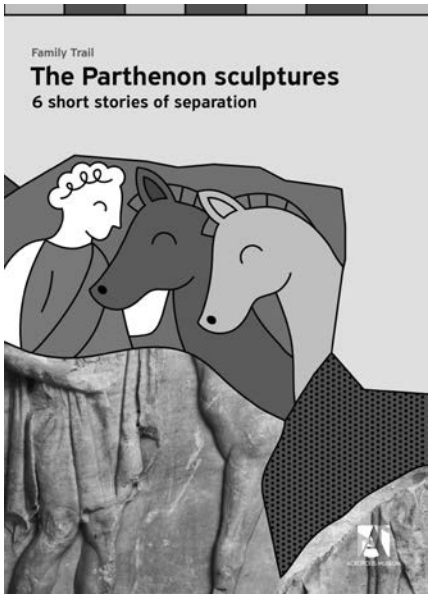
In June 2022, the Head of the Department, archaeologist Ir. Kaimara, and the archaeologist A. Leonti participated in the one-day conference "Museums and the senses: designing for all" organised by Canellopoulos Museum and the Museum of Cycladic Art, which was convened within the framework of the European programme Erasmus+ "ToMiMEUs: Towards a Multisensory and Inclusive Museum for Individuals with Sensory Disabilities", with the speech "Educational programmes on the Acropolis for students with hearing and visual impairments" (in Greek).

Finally, in October 2022 Ir. Kaimara gave a lecture in the Friends of the Acropolis Society on the subject of "The Acropolis and Education – a 35-year journey for old and young people" (in Greek), where she presented all the educational activities of the Department until today.

**Film production**

In an effort to reach a wider audience and make YSMA's archive known, the Documentation Office produced the film "Interventions on the Acropolis". The film was released in July 2022 and attempts to promote not only the large number of the archive's documents, but also the possibilities of their use. It firstly describes the kind of documents the archive includes, then it presents the International Meetings on the restoration of the Acropolis monuments, YSMA's publications and also the developed digital applications in order to cater for the needs of various audiences.

***Dimitrios Pantermalis and Charalambos Bouras supervise the dismantling of a metope from the SW corner of the Parthenon. Photo V. Eleftheriou, 2012***




*The booklet "The Parthenon sculptures: 6 short stories of separation"*


*The booklet "A Greek temple... for kids!"*

ESMA's database, YSMA's new website and the application "The Acropolis: a virtual tour" are presented in detail. The Head of the Documentation Office, E. Lempidaki wrote the script of the film, and K. Arvanitakis directed it. The eight-minute film is available on YSMA's channel on YouTube.

**Exhibition**

The photographic exhibition "Chisel and Memory: the contribution of marble craftsmanship to the restoration of monuments", developed on an idea of the writer of this article, was hosted at the Duchess of Plakentia Mansion, in Penteli. YSMA, responding to the invitation of the Municipal Authority of Penteli, accepted to put the exhibition on at the "1st Mount Pentelicus Festival". Thus, YSMA's photographic exhibition, having already toured many cities in Greece and abroad returned to Attica to be presented in an area of particular architectural character as it was near one of Penteli's quarries. Both the writer of this article and YSMA's photographer, T. Souvlakis, responsible for curating the exhibition, contributed to the organisation of the event. The opening was on Monday, 12.9.2022. YSMA's director gave the opening speech inside the pleasant garden of the Duchess of Plakentia Mansion. The exhibition remained open to the public during the Festival and after the end of it, until December 2022.

*Educational programme for children in the Acropolis. Photo T. Souvlakis, 2022*

**Receiving an award**

As it is known the Acropolis works are at the forefront of employing new technologies. In 2022 the Diario de Avisos Foundation presented the international TERRA award to YSMA for the restoration and conservation works on the Acropolis monuments. TERRA awards are a newly established institution that aims to support and promote unique initiatives all around the world for the preservation and enhancement of UNESCO World Heritage Monuments. The awarded cultural works should have been distinguished for their innovative nature and their exemplary character and have created a unique footprint on the environment, the culture, the economy, and the quality of life.

The awards are presented annually with the support of UNESCO. In the first year of the awards YSMA received a prize in the category "Innovation". The prize was received by V. Eleftheriou in a ceremony on 29.9.2022 organised at the Leal Theatre, in San Cristóbal de La Laguna (Tenerife). Besides YSMA awards were also presented to the Pre-Hispanic City and the National Park Palenque (Mexico), to María Reiche International Association for Art & Science (Nasca and Palpa Geoglyphs, Peru), to the monumental complex of Stonehenge (United Kingdom) and to the Group of World Heritage Cities (Spain).

**A guided tour**

In the context of the International one-day Conference "The Parthenon and Democracy" which was successfully organised by the ministry of Culture and Sports on 16.9.2022, at the Acropolis Museum, YSMA's Director V. Eleftheriou and ESMA's President, Professor M. Korres guided around the archaeo-

logical site of the Acropolis the Presidents of the International Association for the Reunification of the Parthenon Sculptures (15.9.2022). The honourable guests visited the Acropolis, admired the monuments as they had the chance to see them up close, and were informed about the progress of the restoration works which ensure their future conservation.

**Contribution to a programme of the Ministry of Culture and Sports**

On 24.11.2022 the Minister of Culture and Sports, Dr Lina Mendoni inaugurated the tactile route on the Acropolis to help people with visual impairment to access the holy rock and its monuments which can be now experienced through tactile tools and other aids. The programme was implemented by the Ministry of Culture and Sports and the Athens Ephorate of Antiquities in collaboration with Faros Tyflon Ellados and the financial support of Onassis Foundation. YSMA's contribution to the programme was the production and distribution of an information brochure for the restoration works. The brochure printed in Braille and large print, translated in 5 languages (English, French, German, Italian and Spanish) is a revised edition of the brochure YSMA published in 2011 in Greek and English. The new information brochure on the Acropolis restoration works is distributed at the entrance of the archaeological site to Greek and foreign visitors with visual impairment problems.


*TERRA Awards. The representatives of the awarded archaeological sites. Fourth from the left V. Eleftheriou*

**Lectures - publications**

In the last two years, as in the previous ones, the members of staff have been exceptionally active in promoting the work conducted by YSMA.

The Director, V. Eleftheriou, despite the burden of her workload she took part in conferences and gave lectures to inform the public about the Acropolis restoration works. In October 2021 (Athens, 25-27.10.2021) she participated in the 4th International Conference "Protection of Historical Constructions" (PROHITEC 2020) presenting the paper: "Restoring the Acropolis Monuments. Visible and invisible work". At the same conference, together with E. Aggelakopoulou, E. Adami. A. Tsimereki and E. Vintzileou she presented the paper: "Adhesive materials for the conservation interventions in the Acropolis monuments".

Later in the year she participated together with E. Aggelakopoulou, A. Tsimereki and E. Xinopoulou in the conference "Transdisciplinary Multispectral Modelling and Cooperation for the Preservation of Cultural Heritage" (Athens, 12-14.12.2021) presenting the paper "Conservation interventions at the Acropolis circuit wall". A day after this event (15.12.2021), she also participated in the online seminar organised by Earth Observation and Data Science

*Opening of the exhibition "Chisel and Memory" at the Duchess of Plakentia Mansion. Photo V. Eleftheriou, 2022*

for Cultural Heritage discussing the issue of "The restoration works of the Acropolis monuments. The problems and their treatment".

Eleftheriou discussing also the same issues gave a lecture at the University of Naples Federico II on 15.2.2022 entitled "The restoration of the monuments of the Athenian Acropolis. Consistent principles, changing practices". The Greek public had the opportunity to get an overall picture of the works progress in the lecture V. Eleftheriou gave to the Friends of Acropolis Society on 3.6.2022 where she spoke about "The restoration works on the Athens Acropolis. Past, present, and future".

In June 2022 she participated in the collective paper "How safe is Acropolis of Athens and its monuments to low probability earthquakes?"–together with K.Pitilakis, S. Karafaga and E. Riga– in the 3rd International Conference "Geotechnical Engineering for the Preservation of Monuments and Historic Sites" (Naples 22-24.6.2022). A similar paper entitled "How resilient are the monuments of the Athens Acropolis to low probability earthquakes?" was presented in the 6th National Conference of Restoration (Thessaloniki, 13-16.10.2022).

It has to be noted V. Eleftheriou's contribution to the educational seminar organised by NTUA entitled "Teaching and research at NTUA on the restoration and sustainable management of archaeological heritage" (Athens, 2-8.10.2022) where she presented the programme implemented on the Acropolis. Another important contribution was the presentation of the results from the programme SCIENCE in the 16th International Congress of the Geological Society of Greece (Patras, 17-19.10.2022). The paper of the work group (G. Loupasakis, P. Tsagarakis, I. Parharidis, V. Eleftheriou, D. Michalopoulou, R. Christodoulopoulou and D. Mavromati) was on "The SIENCE project at the Acropolis Hill of Athens, Greece - Developing an instability index model of the rock slopes using advance spatial analysis".

In addition to the above we should mention the long-term collaboration with the University of Bari that continued during the years 2021 and 2022. In the first year the seminar was delivered online because of the pandemic, while in the second year the lectures were in-person (Bari 25-27.10.2022). The participants in the lecture were V.Eleftheriou who discussed matters concerning the restorations of the Athens and Lindos Acropolis, K. Karanasos who spoke about the restorations of the Propylaia and the north wall of the Parthenon cella, and A. Vrouva who presented the structural study of the Parthenon north wall of the cella and its west colonnade.

*The President of ESMA, Prof. M. Korres, and the Presidents of the International Association for the Reunification of the Parthenon Sculptures. Photo V. Eleftheriou, 2022*

We also need to mention that during 2022 V. Eleftheriou's article "Das Restaurierungsprojekt der Akropolisdenkmäler. Jüngere Arbeiten und anstehende Programme" (The restoration programme of the Acropolis monuments. Current works and future programmes), was published in the collective volume Identität aus Stein. Die Athener Akropolis und ihre Stadt, edited by. U.Gotter and E. Sioumpara.

The architect K. Karanasos published the article "Il restauro dei Propilei dell'Acropoli di Atene tra teoria e pratica: il progetto di restauro dell'angolo nord-ovest e della facciata ovest" (The restoration of the Athens Acropolis Propylaia between theory and practice: the restoration work of the northwest corner and the west façade) in the collective volume "Realtà dell'architettura fra materia e immagine. Per Giovanni Carbonara: studi e ricerche", to honour Professor G. Carbonara.

The civil engineer A. Vrouva, in addition to participating to the abovementioned seminar, took part in two conferences whose proceedings were published earlier this year. The paper by A. Vrouva, E. Tavouktsi and I. Konteas: "The binding differences of the Parthenon architraves of the two west corners and their impact on their pathology and restoration" (in Greek) was published in the proceedings of the 5th National Conference of Restoration ETEPAM. Moreover, in 2022 the paper by A. Vrouva, I. Psycharis and V. Eleftheriou on "Parametric investigation of the seismic response of ancient masonry walls" was also published in the proceedings of the conference Protection

of Historical Constructions (PROHITEC 2021).

Finally, the Head of the Office for inventory, documentation and cataloguing of the scattered architectural members Dr E. Sioumpara gave a series of lectures on issues concerning the Acropolis monuments. On 10.6.2021 she gave a lecture on "Staatsordnung in Stein gemeißelt: die Chalkothek auf der Athener Akropolis als Präsentationsort der athenischen Demokratie" ("State regulation carved on stone: the Chalkotheke on the Athens Acropolis as a place for promoting democracy") in the University of Vienna, and on 13.7.2021 she gave the same lecture in the University of Augsburg. On 30.9.2021 she presented together with E.A. Chlepa a paper on "Eleusis and the Acropolis of Athens during the 6th century BCE. Parallel or crossing roads" in the conference on "Beyond Mysteries. The Hybrid History of Ancient Eleusis" at the University of Münster. In addition, on 8.12.2022 she participated in the international conference on: "Athens and Attica in the Early Iron Age and the Archaic Period" (Athens 8-11.12.2022) with a paper entitled: "The Mycenaean wall of the Athens Acropolis, its development until the Persian Wars and its contribution to defining the area surrounding the temple of Athena" (in Greek).

Finally, we should mention that in 2022, E. Sioumpara edited together with U. Gotter the collective volume "Identität aus Stein. Die Athener Akropolis und die Stadt" (Identity in stone. The Athens Acropolis and the city), already mentioned above, where she also published a paper entitled "Die erste Monumentalisierung der Akropolis und der Stadt Athen im 6. Jh. v. Chr." ("The first monumentation of the Acropolis and the city of Athens in the 6th century BCE"). The book was presented in the Acropolis Museum on 1.7.2022.

***Evi Petropoulou***
*Archaeologist*
*Documentation Office*

** Translation by A.-M.H.*

***From the presentation of the Acropolis works in Naples. Eleftheriou's lecture took place in Santa Donna Regina Vecchia. Photo F. Sirano, 2022***


***From the presentation of the volume "Identität aus Stein" at the Acropolis Museum. In the panel from the left are: K. Bourazelis, A. Papageorgiou-Venetas and P. Themelis. Photo V. Eleftheriou, 2022***

*Walking up the West Ascent during a guided tour of the Acropolis in the context of the 7th International Meeting for the Restoration of the Acropolis Monuments.*
*Photo T. Souvlakis, 2021*

*Visiting the Parthenon during a guided tour of the Acropolis in the context of the 7th International Meeting for the Restoration of the Acropolis Monuments.*
*Photo T. Souvlakis, 2021*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