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The Acropolis Restoration News

14-15 • November 2015

View of the Acropolis south wall. Photo T. Souvlakis, 2015

2014-2015, The progress of restoration works on the Acropolis

The west side of the Parthenon after completing the restoration intervention. Photo T. Souvlakis, 2015

The year 2015 marks the completion of the anastelosis programmes of the Acropolis that were in the context of the project "Culture" (2007-2013), as well as the planning of proposals for the next programme period.

Managing a difficult account, the YSMA successfully completed the objectives it had set during the past five years, despite the adverse general circumstances of the country, which braked many works. The scaffolding has still to be removed so that the west side of the Parthenon can regain its well-known symbolic image and the Propylaia can be given back, fully repaired, to the Acropolis visitors. The work on the south wall –the first systematic restoration by the YSMA in the area of the circuit walls– revealed the problems and particular requirements of a work that greatly differs from the interventions of the YSMA to date, which have been focused, rather, on the classical monuments of the Acropolis.

Yet another reason why 2015 marks a stage in the development of the works is the completion of 40 years from the establishment of the Committee for Conservation of the Acropolis Monuments (ESMA). The forming of an interdisciplinary committee for designing and monitoring the works of restoration on the Acropolis monuments was a determinative choice of the Greek State in the field of protecting cultural heritage. The ESMA participated in the establishment of principles in the framework of the international conventions which are applied in the management of cultural heritage and in the formation of the methodology that is followed in the interventions on monuments of classical Greek antiquity. The anastelosis works on the Acropolis monuments are models for many works throughout Greece, and the unflagging interest on the part of foreign representatives and educational institutions is evident in the frequent invitations we receive for presentation of the work. The ESMA at present is conducting research on finding suitable conservation materials and it places special emphasis on documenting the works and on managing the documentation. Given an evident need for carrying out analytical studies for the works of restoration, these are being published systematically, thus enriching a repository of studies available to researchers. International conferences of specialist scholars are being organized to present the studies for restoration of the monuments. Reports on the programmes that have already been completed are tabled for international expertise and criticism. From its very beginning, the ESMA has supported the diffusion of information through publications, informative leaflets, movies and especially through educational programmes. During recent years, digital activities and applications have been much emphasized, making use of contemporary technology.

The admirable collaboration of the members of the ESMA with the scholarly personnel of the YSMA assures the continuation of the works with the same high quality, thus justifying the function of a special service of the Ministry of Culture for the Acropolis monuments.

During the period 2014-2015, works continued on the Parthenon in accordance with the approved programme. Head of the work is the architect R. Christodoulopoulou, and the scholarly team of the work comprises the architects V. Manidaki, A. Papandropoulos and K. Skaris, the civil engineers A. Vrouva, Z. Konteas, E. Tavouktsi, S. Sourtzi and L. Palaiologos, and the archaeologists E. Karakitsou and Dr E. Mimidou. The architect L. Lambrinou was absent on maternity leave. G. Angelopoulos and S. Kardamis headed the marble technicians team.

In 2014 a great effort was made to replace the old Derrick crane, which had seen 30 years of service, with a new crane with a greater range of access. The specifications of the work were studied by R. Christodoulopoulou, D. Zois and Z. Konteas and occupied the ESMA in several meetings. Unfortunately it was not possible to proceed with the work because of a fruitless process following the announcement of an international tender.

The programme for restoring the corners of the entablature of the west side was completed in the autumn of 2015. Apart from the re-setting of 63 marble blocks in the northwest corner and 50 blocks in the southwest corner, initiated in April 2014, restoration work proved necessary in the neighboring areas, and it was performed *in situ*. The blocks were re-set course by course, alternatively, in the two corners. In the time that elapsed the elements of reinforcement (clamps and dowels) were measured and the cuttings were sealed. Documentation accompanied the work (graphic and photogrammetric surveying). Structural studies of the architrave blocks were undertaken by Z. Konteas, of the frieze blocks and cornices by E. Tavouktsi, L. Palaiologos and S. Sourtzi. In addition to the removal of the rusted iron reinforcements, the benefit of the intervention was the strengthening of the area of intervention against earthquakes by repairing the open cracks, by resetting the architectural members closer to their initial position and by lessening the range of deformation on the horizontal level of the architrave.

The restoration of the two lintel beams of the west cella wall was an exceedingly difficult operation because of their great length –6.00 and 6.30 m. respectively. The new marble blocks were transported from the quarry to the contractor's workshop for finishing and there, with continuous monitoring by those responsible for the work, the blocks were formed so as to be suitable for insertion of the ancient fragments. The making of casts, which is part of the process of preparing the blocks, was not limited to the broken surfaces of the sections to be filled in, as is usual. Casts were also made of the preserved ancient parts of the lintels so that the joining of new and ancient surfaces could be fully controlled. The joins were strengthened in accordance with the structural study of V. Papavasileiou. These two beams as well as the wholly new beam –which has been in the Parthenon since 1983, thanks to the efforts of M. Korres– will be set on the monument in the near future, thus replacing the heavy cement construction of N. Balanos' intervention (1930).

To accelerate the works of restoring the cella north wall, it was deemed necessary to construct and install a new bridgecrane along the length of the north pteron. Thus, from the beginning of the present year, the works of resetting the blocks of the orthostate and the 1st course are being achieved without having to coordinate them with other works on the monument that are implemented by the use of the Derrick crane. In the course of the programme, adjustments to the approved study were needed that required bringing it up to date. This was

Parthenon, restoration works. Upper left: resetting of the SW column capital. Upper right: Transporting the architrave block of the west side. Lower left: trial setting of the orthostate blocks of the cella north wall. Lower right: making a cast for the lintel block of the west wall. Photos V. Eleftheriou, V. Manidaki, T. Souvlakis, 2014-2015

The south wing of the Propylaia from the N after completing the intervention. Photo K. Karanasos, 2015

written up by K. Skaris and approved by the ESMA in January 2015. Basic adjustments to the study comprise the identification of fragments of the 8th block of the exterior layer of the orthostate, formerly thought to belong to the 7th, and the need to fill in with new stones the empty spaces left in the positions of the 7th and the 9th. Fragments were identified, moreover, that come from 3 blocks of the interior layer of the orthostate. These were filled in with new marble and placed in the corresponding positions, whereas the sequence of a number of wall blocks of the 1st course was reconsidered. The application study for assembly of the architectural members was carried out by E. Tavouktsi. The implemented programme includes a total of 12 blocks of the exterior and 10 of the interior layer of the orthostates and 25 wall blocks of the 1st course. K. Skaris and A. Vrouva undertook the study for restoration of the entire north wall of the cella (17 courses). This includes both documentation and examining of theoretical issues as they were presented in the 6th International Meeting for the restoration of the Acropolis monuments.

The carving of flutes in the fillings in the 6 restored columns of the north side was completed in the spring of 2014 and by the summer of 2015 the corresponding work on the two northernmost columns of the Pronaos had been finished as well. The result justifies the re-examination of the subject by the Central Archaeological Council (KAS) and the decision to render the fillings of the columns in their original form so that the fluting of the columns is continuous. Carving of the remaining 3 columns of the Pronaos will be undertaken as part of the next programmed period.

The restoration of the ceiling of the west pteron was included in the current programme with the resetting of the beams and interbeam slabs, in accordance with the earlier study of P. Koufopoulos. This was a challenge we decided to take up at the beginning of 2013. Re-examination of the material, however, revealed the special difficulties of the operation. The new architectural members that had been prepared in the days of A. Orlandos required strengthening, but also a great deal of time would be needed for working them so as to obtain their final dimensions. In addition, placing them correctly on the monument required structural monitoring and study of the strengthening needed by the columns both of the Opisthonaos porch and of the west side. The application study, written by R. Christodoulopoulou, K. Skaris, A. Vrouva and Z. Konteas, was approved by the KAS in September 2014 and special structural behaviour studies followed. At the end of 2014, the crown blocks of the west side were dismantled and the works of restoration began. In accordance with the study, which is to be found in another article of the present issue, 6 of the 7 beams are being restored, so as to set the two southernmost before the year's end. A prerequisite to this was the strengthening of the backers of the frieze, horizontal cornice blocks and blocks of the 1st course of the tympanum backing wall, which were performed *in situ*, as required in study of L. Palaiologos, who also supervised the works. It was necessary also to restore some and to reposition all of the crown blocks. The works are continuing and the programme includes consideration of the final resetting of the coffered slabs of the ceiling.

In the Propylaia works in the south wing of the monument have been completed and in the northwest corner of the central building completion is in sight. Head of the work is the civil engineer D. Michalopoulou. The scholarly group comprises the architect Dr K. Karanasos, the civil engineer V. Papavasileiou and the archaeologists E. Petropoulou and Dr C. Koutsadelis. The team of marble technicians is headed by G. Desypris.

In accord with the study by T. Tanoulas, the south wing has been restored up to the level of the cornice, under the supervision of K. Karanasos and V. Papavasileiou. A total of 64 architectural members were set, 40 of which had not been set in the earlier anastelosis and 9 of which had been incorrectly placed. For the architrave blocks to carry the load required in the study, their structural restoration was considered necessary on the basis of a study by M. Ioannidou and

Propylaia, restoration works. Upper left: setting a triglyph in the south wing. Upper right: carving a cornice block of entirely new marble. Lower left: dismantling a block from the north wall of the central building. Lower right: joining a filling to an ancient drum fragment of the west porch. Photo K. Karanasos, 2014-2015

V. Papavasileiou. The solution called for removal of the stainless steel armature of the Orlandos anastelosis and the introduction of titanium rods. The new intervention revealed the peculiarities in form of this part of the monument, such as the continuous taenia of regulae and guttae that runs along the architrave of the west side. The setting of the cornice completes the outline of the monument and it also clarifies its special relation to the neighboring temple of Athena Nike. It is worth noting that the completed intervention restores the original image of the monument in its entirety, making use of authentic material to an amount approaching 90%.

The second programme in process in the Propylaia, is in accord with the study by K. Karanasos and M. Ioannidou and is being supervised by K. Karanasos and V. Papavasileiou. It involves repairing the damage in the capital of the northwest column and in two architrave blocks of the northwest corner. The process of installing scaffolding and a bridgecrane in order to carry out the work proved to be so time consuming that the work was not started until September 2014. The dismantling of 11 architectural members, including the column capital, followed immediately. The dismantling revealed a piercing crack in the anta capital, repair of which was carried out *in situ* without further dismantling. The discovery of characteristic dowel sockets made a limited amendment of the study necessary in connection with the measurements of the uppermost wall blocks of the north wall. In the context of the same study, the proposal was made to restore the four Doric drums on the ground, to the west porch of the monument. The study called for the filling in of one ancient column drum, located in position AI.K.5.8 and the construction of an entirely new drum for position AI.K.3.8, in order to make use of yet another ancient drum. The intervention, as was expected, altered the fixed image of two centuries of the west view of the Propylaia, in a way that promotes its artistic values, while totally respecting its historical importance.

A limited number of new architectural members and marble fillings, the measurements of which prohibited their being carved with the equipment of the Parthenon and Propylaia worksites, were assigned to an outside collaborator, after competitive tender. The work ran from May 2014 to June 2015.

In 2015 the study for arranging the area of the Brauronion was completed. This

Proposal for backfilling the foundations and constructing a new floor in the interior of the Erechtheion. View from W. Photorealistic imaging: K. Mamalougas, 2015

is to facilitate access for visitors to the area near the Mycenaean fortification wall, which provides the best view of the Athena Nike temple. The position of the Athena Nike temple makes access to it particularly difficult. In the future direct access to the monument will probably be possible from the north side, as it was in antiquity. For now, however, the only realistic solution appears to be an approach from the east. The work in progress comprises a mild intervention in the area and includes moving and repositioning the Chairedemos dedication and removal of scattered architectural members and fillings left from the Balanos intervention. In addition it is planned to backfill an earlier trench and to construct a low terrace wall of stabilized soil creating the appearance of an excavated section. The intervention is part of the general design for the circulation of visitors to the archaeological site. In the next period of programming it is planned to join this with a pathway for visitors with special needs along the length of the south side of the archaeological site, in continuation of the one already existing. The study and supervision was conducted by the architect K. Mamalougas and the civil engineer D. Michalopoulou.

The same researchers studied and supervised the work of back-filling the foundations and constructing the new floor in the interior of the Erechtheion. The study was approved by the KAS in September 2014. The intention is not only to protect the foundations and the natural rock itself (bedrock), but also to enhance the early Christian basilica that provides especially significant evidence of that specific historical period on the Acropolis. Works of limited extent, such as the construction of supports in the form of pillars to hold the stylobate of the early Christian templum and the removal of scattered architectural members were completed as a priority, so as to achieve geometric documentation of the existing condition in collaboration with the Directorate of Topography Photogrammetry and Land Register of the Directorate for the Restoration of Ancient Monuments (DAAM).

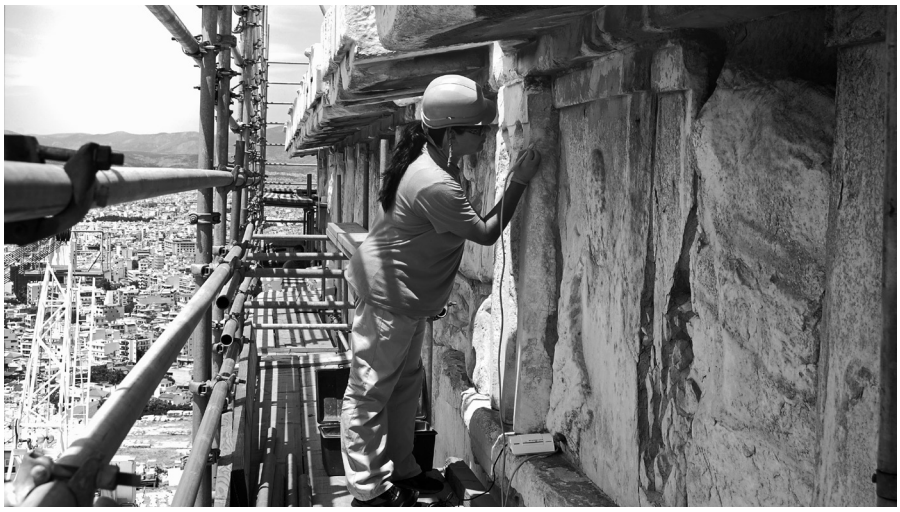
The back-filling of the foundations, in accord with the study, involves the construction of drainage filters of classified natural material. A system of three drainage layers composed of carefully chosen geo-material "filters" (soil and geosynthetic materials) are compressed, every 20 cm., by hand or using mild means of compression. A geofabric is placed between the layers of soil –of the core and final equalizing layer– so as to separate the two layers. Colour added in the south aisle to distinguish the final layer of fill in the location of the cross wall, marks an important architectural feature, now missing. In the north aisle the floor level is being formed at 52 cm. lower than the floor of the basilica so that significant evidence for the construction of the monument on the interior face of the north wall can remain visible. The classical doorway to the basement area of the north porch remains open, providing access to to the area where tradition says the marks of the competition between Athena and Poseidon are visible in the rock. The above works are being completed in 2015.

Restoration of the floor of the west part of the monument was considered necessary for access to the interior of the temple from the north porch. The study calls for a floor of marble slabs with the same dimensions as the ancient ones and supported by a metal grid. The proposal is that this part of the work, as a section of the study, be carried out in the next programme period.

Surface conservation of the monuments continued during the past period in accordance with the schedule of the work. The conservator A. Panou was responsible for the work in the absence of the head, Dr E. Aggelakopoulou, chemical engineer, on leave during 2014. In the middle of 2014, the works of surface con-

servation of the temple of Athena Nike were completed and at the end of the same year the programmed work on the Erechtheion as well. The surface conservation team of the Parthenon was thus reinforced for more effective handling of the parallel anastelosis programmes.

Systematic conservation interventions were completed in the Parthenon on the remaining architectural members that had been dismantled from the two corners of the west side (65), on neighboring members still *in situ*, and, in addition, on metopes, triglyphs and a number of horizontal cornice blocks of the west side, which will not be dismantled. Also completed was systematic conservation of the blocks of the orthostate and of the 1st course of the north wall of the cella. Sealing was applied to areas where the dressing of the flutes of the columns of the north side and the Pronaos had been completed. Dismantling of the crown blocks was approved and systematic conservation interventions are being completed on the surfaces of the architectural members of the ceiling of the west pteron (crown blocks, frieze blocks, horizontal cornice blocks, 1st course of the backing wall, beams and interbeam slabs). In the Propylaia, under the supervision of the conservator K. Frantzikinaki, systematic conservation was applied to the remaining architectural members of the south wing (24) before placing them again on the monument, and on adjoining members still *in situ*. The works of dismantling in the northwest corner of the central building were likewise supported and followed by systematic conservation of the lowered blocks. Conservation interventions are also focusing on the floor slabs of the north aisle of the monument's east stoa. For this specific area the possibility of filling in the worn slabs with cast material was researched, for which testings were carried out. In the temple of Athena Nike under the supervision of A. Tsimereki systematic conservation



Conservation of a triglyph block of the Parthenon west side doric frieze. Photo E. Aggelakopoulou, 2014

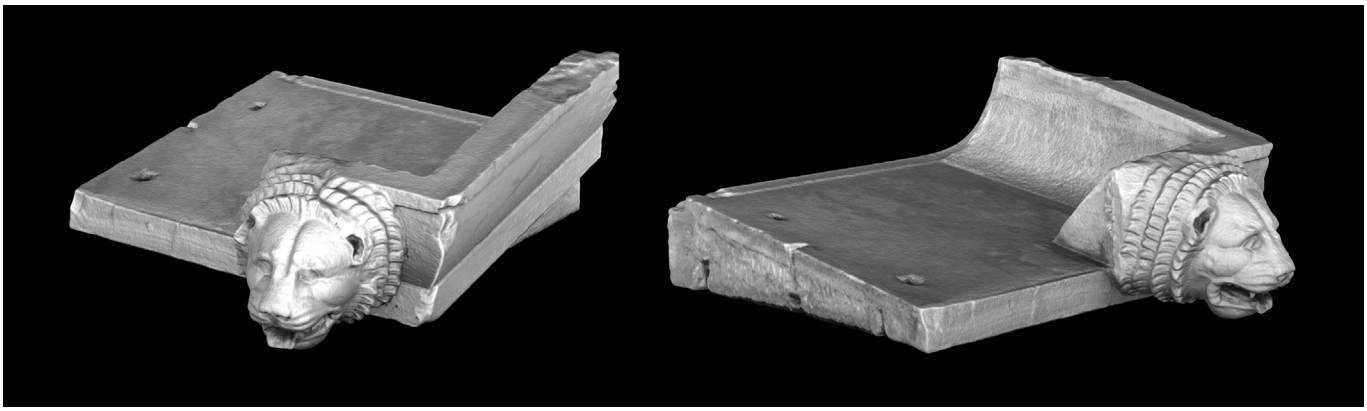
works of the interior side of the north and west walls and on the blocks of the stylobate of the west porch have been completed. In the Erechtheion, under the supervision of the conservator G. Fratzi, systematic surface conservation of the west wall was completed, and the joints in the ceiling of the south porch were sealed.

The work of inventorying, recording, documentation and classification of the scattered architectural members, given the lengthy absence of the head archaeologist Dr E. Sioumpara, was limited to arranging the fragments from the stone pile of the Arrephorion, giving priority to the completion of the project. The spring of 2014, saw the three-dimensional drawings of the archaic temples of the Acropolis completed, under the supervision of E. Sioumpara. The team of the scattered architectural members then assisted in the project of the Ephorate of Antiquities of Athens, completing the transfer of the inscribed stones that lay scattered in the area so that a total of 145 inscriptions are from now on protected in the old Acropolis museum.

The question of applying patina to the new architectural members and fillings was reexamined by the research section. The difficulty involved in applying the material proposed by the late T. Skoulikidis, together with the strict timetables required for the works, meant that the application of patina was postponed during recent years. The question, however, is still pertinent and after a relevant decision of the ESMA, new research is being done by the Surface Conservation Section under the supervision of Professor Emerita V. Kaselouri.

Revaluation of the mortar used for sealing and filling, has been completed, with laboratory trials and from 2014 on new compounds have been applied with lime hydrate, metakaolin and a mild calcareous mixture, instead of lime hydrate, white cement and silica sand (see the relevant article in "The Acropolis Restoration News", issue 13).

In the Erechtheion, research was done on the best way to protect the ancient metal clamps in the walls of the monument. The materials studied were an aqueous emulsion of wax, water-based polyourethane dispersion, acrylic resins unaltered or with the addition of alumina nanoparticles and a combination of the above materials. Their effectiveness was evaluated in both laboratory and practical terms and a



Three-dimentional model of the northwest corner raking sima of the Parthenon, with photographic texture. Three-dimentional scanning: A. Valani. Texture rendering: E. Kalisperakis

trial application was made with metal clamps from the Balanos anastelosis. The programme is continuing.

Recent years have seen technical research of the polychromy on the classical monuments of the Acropolis organised on a systematic basis. This is research that was initiated by the Surface Conservation Section in 2008. To date we have results from research on the coffered ceiling slabs of the Porch of the Maidens in the Erechtheion and for the northwest raking cornice-sima of the Parthenon. A plan was devised, in connection with methodology, for the technique of research on polychromy, and 33 places on the monuments were listed preserving traces of pigment of interest for research. In accord with ESMA methodology, modern imaging methods of recording are applied initially, for evaluation *in situ* without having to take samples. The YSMA has the necessary equipment. This is followed by non-destructive portable techniques for evaluation, likewise accomplished *in situ* without needing samples (XRF for element analysis and portable microRaman spectroscopy for analysis of the molecular structure of the materials). This was accomplished with outside collaboration. The next and final phase, involving microsampling and the application of analytical techniques in the laboratory (SEM/EDX, infrared spectroscopy with Fourier transformer [FT-IR] and Raman Spectroscopy), will be determined in the next stage, assuming the concurrence of appropriate conditions.

Included in the field of research is also the choice of suitable accelerograms for conducting antiseismic studies for the Acropolis monuments. The object was to choose ten accelerograms, from international databases, that cover the oscillation span of the various characteristics of a possible ground movement and are consistent with the expected seismic ground movements in the historical centre of Athens. The programme was carried out by the Laboratory of Earthquake Engineering of the School of Civil Engineering, NTUA, under the direction of Professor I. Psycharis.

For the purpose of experimental controls that confirm an increase in the index of fracture resistance in commercially available titanium, the civil engineer team of the Parthenon worksite, consulted by Dr M. Chronopoulos, civil engineer, Professor of the NTUA and member of the ESMA, reexamined the measurements of the Π-shaped clamps of the architectural members, with the aim of reducing their depth of anchorage in the marble.

In the framework of documenting the anastelosis, the project "Topographical and Photogrammetric Survey" was completed under the supervision of the rural and surveying engineer, D. Mavromati. Beginning in January 2014 in the Parthenon, the plans of the layers of entablature blocks in the northwest and southwest corners were surveyed photogrammetically at a scale of 1:20, after being reset. The final plan of the two corners was plotted at a scale of 1:10. In the Propylaia, the photogrammetric survey (on a scale of 1:25) was focused on the plan of the south wing.

The rural and surveying engineers of the Service, D. Mavromati and Dr E. Kalisperakis, carried out the photogrammetric survey study of the plan of the toichobate of the north side of the Parthenon, at a scale of 1:25. The shots were made by the photographer of the DAAM, S. Gesaphidis and the measurements of the ground control points were made by an outside collaborator. The designing of 3D models of the members of the northwest and southwest corners of the Parthenon was continued, in combination with the techniques of 3D scanning, by E. Kalisperakis, for a reliable recording of the geometry and photogrammetry, and to render the correct photographic texture.

The project "Three-dimensional laser scanning and production of a digital model of the temple of Athena Nike", was assigned with the process of tender-

ing the study in accordance with the law 3316/2005. The objective of the work was full three-dimensional point scanning (3D scanning) and the imaging of the temple of Athena Nike (interior and exterior). The final result is a full, unified and without blind spaces, three-dimensional model of triangles with realistic texture, which has been made with appropriate processing from the digital scan, but also from good photographs. In areas where it was impossible to make a scan, the point cloud was completed by the use of photogrammetry.

In the context of documentation and promotion of the work being done by the YSMA Documentation Office, with the archaeologist Dr E. Lembidaki as head, information relevant to the anastelosis interventions continued to be entered in the Archive and database of the Service: for the Parthenon by the archaeologists E. Karakitsou and E. Mimidou, for the Propylaia by the archaeologists E. Petropoulou and C. Koutsadelis and for the Arrephorion by E. Mimidou, including the works of conservation as well. Photographic documentation of the Athena Nike temple for the period of 1979-1998 was likewise entered in the database by E. Lembidaki and E. Mimidou has begun entry of the data from the anastelosis interventions on the circuit walls. Entry of the lists of scattered members by the archaeologist Dr E. Salavoura ended in May 2014, with the material from the period 1977-2001 covered. In February 2015, E. Karakitsou began the recording of casts in the Cast Laboratory. Work in the main office of the YSMA Archive, staffed by the archaeologists Dr M. Katsianis and Dr A. Sofou, as well as by G. Alexopoulos who is in charge of the network, continued with the objective of monitoring the functioning of the database, the entry of new writings and studies in the library catalogue, the inclusion of the day-books, the digitization of conventional material of the period 1969-1975 that has come into the ESMA archive, the incorporation in databases of earlier audio-visual material in data sets, including the films of 2014. A digital catalogue of YSMA drawings was also entered as well as a database for retrieval of "remaining documentation" of the Archive, digital or not, and their updating initiated.

Photographic documentation of the restoration interventions was continued by the photographer T. Souvlakis. Film recording of the works of 2014-2015 was entrusted to an outside collaborator following a contract tender.

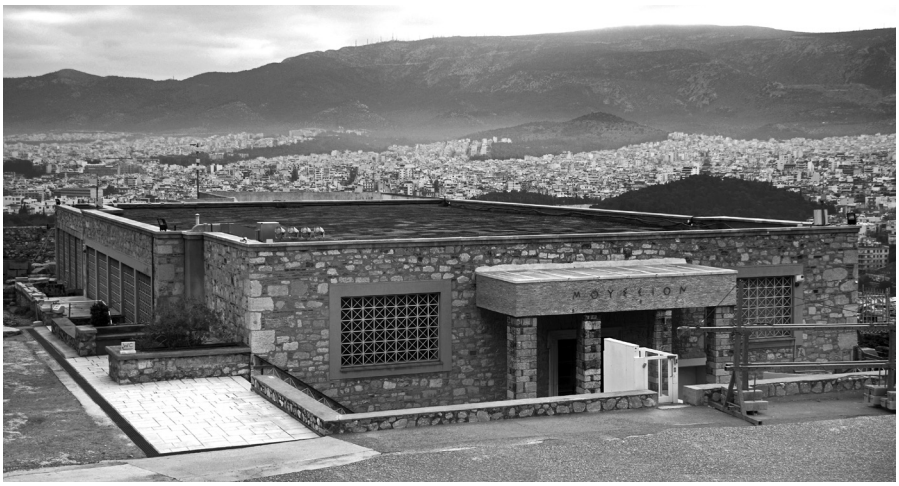
Special photographing of the SW triglyph of the Parthenon. Photo T. Souvlakis, 2014

Promotion of the Acropolis works to the general public likewise continued. In December 2014 the signs directing visitors on the rock to the various restoration works were revised. In the framework of digital measures for furthering the activity of the Service on the internet, work continued on the YSMA website, while, in March 2014, the application of a virtual tour of the Acropolis rock was upgraded and expanded. The work was supervised by M. Katsianis, G. Alexopoulos and C. Koutsadelis. Direct access to the network address of the application through a tablet or mobile phone is now possible through a direct response signal (QR code) in areas where the signal has been set up, such as the Acropolis Museum, the El. Venizelos Airport and the Athens Ephorate of Antiquities. YSMA films and video shots are also now in the process of being accessible on the internet through the creation of an YSMA profile on Youtube.

Publication of the "Acropolis Restoration News", in Greek and in English, is being edited by the archaeologist E. Petropoulou, who also keeps the minutes of the ESMA meetings.

In July 2014, a framework of collaboration was signed between the YSMA and the National Documentation Centre (EKT). Collaboration between the two agents calls for the development and distribution to the Service by the end of 2015, of digitization services, safe storage and repository services of classified access in standardized form, on the basis of international prototypes, utilizing the technical expertise and electronical infrastructure of the EKT. Included also is the designing of a repository on the platform SaaS, the formation of a digital catalogue of the YSMA library for incorporation into the library system ABEKT of the EKT and the production of a backup copy of the material of the YSMA database at the EKT. In 2015 the material processed for the repository comprised the scanning of texts, the processing of a terminology thesaurus of the database, processing of documents for transfer etc., prepared in the Documentation Office by the EKT librarian, P. Kamatsos. The work is being monitored by M. Katsianis, G. Alexopoulos and E. Lembidaki. In addition, the necessary preparations were made for linking the YSMA-EKT through high-speed networking, so as to acquire linkage in the National Network of Research Technology.

The Section of Electromechanical Support of YSMA, headed by the electrical engineer D. Zois during the past year also coordinated the worksites of all the projects with supervision and monitoring of the electromechanical installations.



View of the old Acropolis Museum from the NW. Photo V. Eleftheriou, 2014

The Information and Education Department of the YSMA continued its activities, which are reported in another article of this same issue. The scholarly team of the Department comprises the archaeologist E. Kaimara, Head of the Department, as well as the archaeologists A. Leonti and S. Paraschou, while the contribution of the former Head of the Department, C. Hadziaslani, is always in evidence.

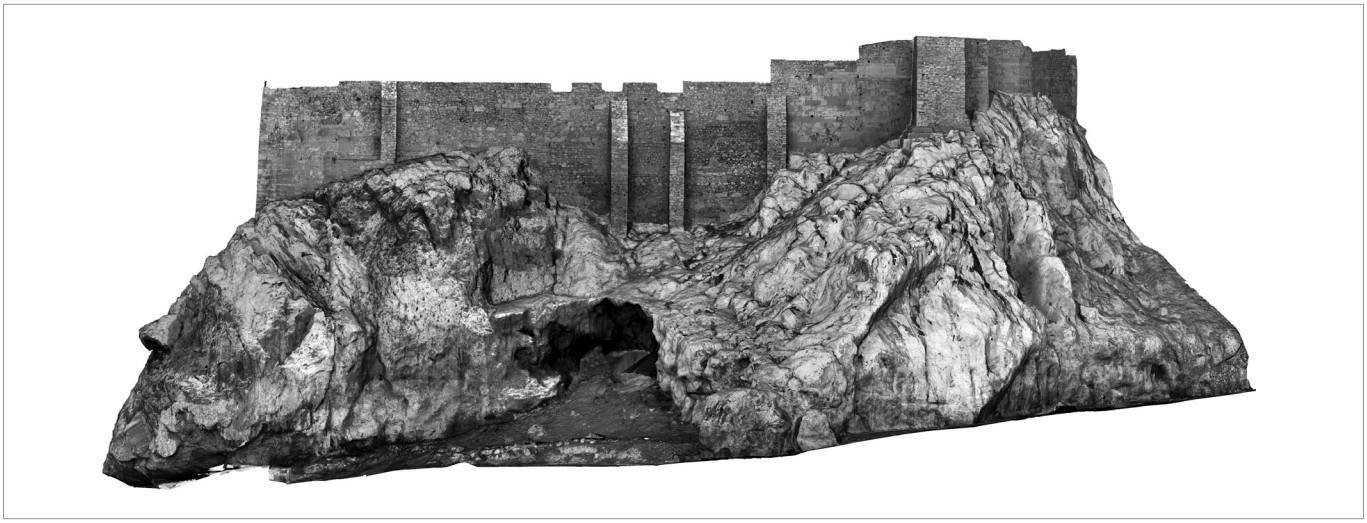
The contribution of the YSMA Accounting Office, headed by P. Katsimichas, was substantial during this past year, in the particularly demanding process of managing and monitoring the community funds. Significant too was the contribution of the Secretariat, with C. Papanikolaou in charge, and the Office for the Management of Materials, headed from June 2014 on by P. Karabetsou. As the property on Thrasyllos 20 street, where the worksite equipment of the Service had been kept, was sold, another property was requested and obtained at 21-25 Asomaton street, owned by the Ministry of Culture. After the property will be securely fenced the material will be transferred.

An act that will have a determinative effect on the future condition of the Acropolis, is the reuse of the building of the old Acropolis museum. At the request of the General Secretary of the Ministry of Culture, Dr L. Mendoni, YSMA in collaboration with the Athens Ephorate of Antiquities made a proposal that was approved by the Council of Museums in January 2015. The proposal was to use the west section of the building, designed in 1875 by P. Kalkos, to store archaeological material with the possibility of controlled visiting. The east section, which was added in 1956 by P. Karantinos, would house functions of the YSMA worksites so as to relieve congestion in the existing worksite sheds. The arrangement of the proposals for storage and the method of displaying the archaeological material is the responsibility of the Athens Ephorate of Antiquities. The organization of the remaining area is to be assumed by the YSMA work team, staffed by the the architect K. Karanasos, the conservator A. Tsimereki and the undersigned. The work is scheduled for the next programme period and the YSMA will coordinate the relevant services of the Ministry of Culture, since of itself it cannot be an agent for implementing the work.

The YSMA has composed proposals for the new programme period, which it has placed for consideration by the political leadership. Two are the basic considerations. The first has to do with limitation of parallel anastelosis interventions to be carried out on the monuments. The policy of interventions that are implemented simultaneously on different fronts, require regular funding so as to meet the scheduling for the works as a whole. The uncertainty of funding during recent years obliges us to be more conservative in our proposals and to proceed in stages, completing each programme before embarking on the next. The second consideration, which stems in part from the first, involves the priority given to the works of restoration of the Parthenon for completion of programmes already under way, and to the circuit walls, parts of which require immediate intervention. These actions, which are of course connected with research, documentation and information, will continue in the next programme period, together with the anastelosis programmes.

The success of the YSMA in completing the programme of 2011-2015 is due, to a determinative degree, to the efforts of the permanent personnel and unquestionably to the enthusiasm and constancy with which the temporary staff met the requirements of the work. This applies to 57 employees of different specialties, who were recruited gradually from May 2011 on, and whose contracts ended automatically with the termination of NSRF. The problem of a lack of specialized personnel after the completion of the activities programmed, has been repeatedly called to the attention of the political leadership of the Ministry of Culture, both by the President of the ESMA and by the undersigned. It is to be hoped that suitable adjustments will be made in the future that will help to improve conditions for bringing the works to fulfillment.

Vasiliki Eleftheriou
Architect
Director of the YSMA



Three-dimentional model of the east part of the rock and the circuit walls with photographic texture. Project "Development of Geographic Information Systems on the Acropolis of Athens", 2009

In the summer of 2014 a series of critical articles appeared in the foreign press –particularly of Great Britain– about a supposed collapse (!) of the Acropolis rock and the Parthenon, which was attributed to the inability of the Greek state to handle the problem effectively. It is not by chance that these publications coincided with the new cycle of activities of the Ministry of Culture and the claiming of the Parthenon sculptures, through legal channels.

Just what, however, is the truth about the condition of the circuit walls and the Acropolis rock ?

Works on the rock and the circuit walls during the period 1975-2010

Both the circuit walls and the rock on which the Acropolis monuments were built, comprise a monumental unit, which together with the classical monuments has been the concern of the Committee for Conservation of the Acropolis Monuments (ESMA) since its very inception. Among the first actions of the ESMA was to assign a geological-geotechnical study and to investigate the possibilities of an accurate graphic infrastructure for the monuments and the rock using photogrammetric methods. The "Geological-geotechnical study of the area of the athenian Acropolis" was conducted by V. Andronopoulos and G. Koukis of the Institute of Geology and Mineral Exploration (IGME) in 1976. During the period 1977-1993, under the direction of the civil engineer D. Monokrousos, areas of the east and north rocky slopes were stabilized, after preliminary studies showed that, while the general condition of the rock was satisfactory, 22 locations had problems of stability. Thus, in the decade of the 1990's, the major problems of the rock had been confronted. Works on the rock, of a limited scale, continued during subsequent years, such as the stabilization of the rock south of the temple of Athena Nike and the southeast slope.

For the circuit walls, instead, even in those areas where problems of deformation, erosion of inferior building material or washout of joint mortar have been observed, immediate intervention was not considered necessary. Contributing to this, of course, was the fact that the works on the Parthenon, the Propylaia and the temple of Athena Nike took priority and, until 2009, were being carried out under the pressure of time. Yet work continued on documenting the form and on recording the state of preservation and the deformations in specific areas of the walls where there was reason for concern, such as the southeast corner and the section of the north wall in the area of the Arrephorion. Recording continued with mechanical systems and with advanced digital systems of instrumental monitoring during the period 2001-2009 under the supervision of V. Manidaki and Dr D. Englezos. These included a non-destructive electrical resistivity tomographic survey at the south wall of the Acropolis, systematic monitoring of the deformations and shifting in the south, east and north walls using optical fiber sensors and measuring ground control points with topographical instruments of high precision. Simultaneously, a network of accelerometers was installed at selected locations on the rock and in the Parthenon, thus launching the recording of seismic activity on the Acropolis (see "The Acropolis Restoration News", issue 10).

The project "Development of Geographic Information Systems on the Acropolis of Athens" which was completed in 2009, is a valuable tool for surveying and fur-

thering the study for interventions on the circuit walls and the rock. It concerns the production of raster products of high geometric accuracy, following the topographical and photogrammetric survey of the plan of the Acropolis and of the elevation of the walls, as well as a three-dimensional scanning of the walls and the rock itself.

Activities programmed for the period 2011-2015

The initial conservative programming of the present anastelosis work, which was limited to a continuation of monitoring the deformations and shifts in the circuit wall, was amended in the middle of 2012, when a problem emerged in the south part of the wall. Incorporated directly into the programme with funding from the National Strategic Reference Framework were actions such as rescue measures in the area between the 6th and 7th buttresses of the south wall, the carrying out of studies ("Study for the restoration of the south Acropolis wall in the span between the 6th and 7th buttress" and "Preliminary study for rainwater management on the the Acropolis plateau"), geophysical investigation of the ground of the Acropolis and geotechnical research for determining the mechanical properties of geomaterials and so forth.

Early in 2014, a heavy rainfall brought about the fall of a small piece from the southwest slope of the rock, in the area of the schist layers. Twenty years after the previous stabilizing interventions of the Service, in a context of worsening climatic change, it is evident that a new programme of interventions is needed in other areas of the rock, as well as the actuation of intervention on the circuit wall. In a general meeting of the relevant services of the Ministry of Culture it was decided to entrust the work to the YSMA. A three-year programme was approved with a budget of 1,000,000€ to implement the actions necessary to resolve successfully the problems of the rocky slopes and the Acropolis circuit walls.

View of the south wall of the Acropolis. Visible is the work scaffolding between the 6th and 7th buttresses. Photo T. Souvlakis, 2015

New programming for studies and works (2014-2016)

The project "Stabilization of the Acropolis slopes and its circuit walls" comprises:

- As part of documentation, monitoring and measures for immediate action the project provides for instrumental monitoring of the existing condition, improvement of the graphic infrastructure on the basis of photogrammetric surveys and of laser scans and a study of temporary means of stabilizing the walls and rock, by area.
- As part of research and study, the first phase is to be devoted to updating the geological study of 1976, to conduction of geotechnical research, hydrogeological and hydraulic studies and a microzonic study-supplementation of seismological data. A second phase calls for the elaboration of rainwater management taking into account the future final levels of the ground surface around the Acropolis monuments. It also includes geotechnical studies for the stabilization of the rock and the wall by area. For areas of the walls where there are problems of stability, it is planned to elaborate an architectural study and a conservation study for the restoration of stones and mortars for the circuit wall.
- Included in the planned works is stabilizing the rocky slopes and restoring of the walls, in certain areas, according to the priority set by the studies.

A serious note in respect to the above is the fact that the activities of the Service up to now have not included geotechnical works. Therefore the carrying out of these works requires the collaboration of specialists.

Works during the period 2014-2015

The contribution of the Emerita Director of the YSMA, M. Ioannidou, was exceedingly valuable in the phase of organizing the work. As a civil engineer she has deep knowledge of its requirements and the research programmes that must come first. According to her full report, 13 areas of the walls were found that need to be dealt with to a greater or lesser degree. We had as collaborator in research on the pathology of the rocky slopes Dr E. Kambouroglou, Head of the Section of Archaeological Works and Studies, Geology and Paleontology of the Ephorate of Paleoan-

View from above the area of intervention on the south wall, after archaeological cleaning. Photo S. Gesaphidis, 2014

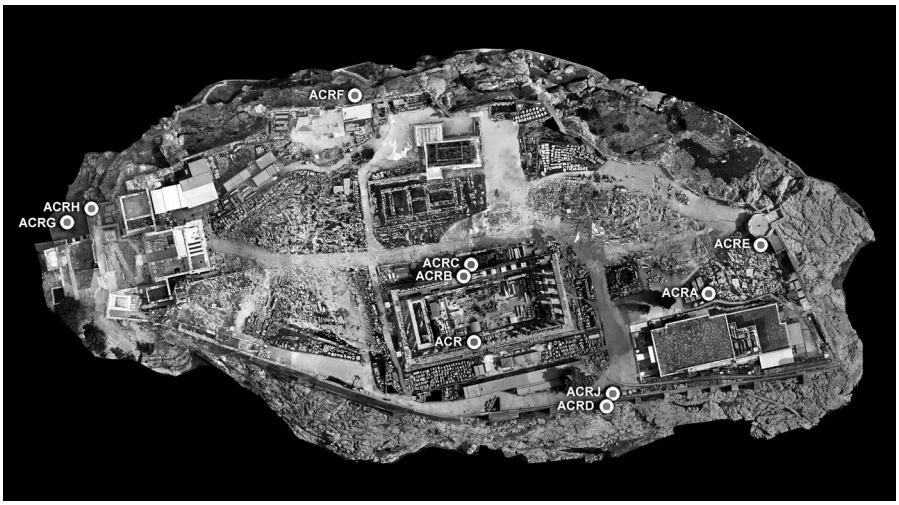
thropology and Speleology. With the prospect of a more general design for the interventions, a work team was assembled including A. Hatzipapa, architect, responsible for the works on the wall, D. Michalopoulou, civil engineer, D. Mavromati, rural and surveying engineer, and the undersigned. The team was expanded by N. Ninis, civil engineer, employee of Directorate of Prehistoric and Classical Antiquities (DIPKA), appointed on a part-time basis to YSMA and by F. Petsi, geotechnical-engineer, on a fixed term contract. A small team for monitoring the condition, recording events and collecting data in general, as well as for small scale interventions includes, for the time being, G. Vasdekis (in charge) and two more marble technicians from the Propylaia worksite, with the possibility of increasing the numbers as needed, after the completion of the works on the Propylaia. Correspondingly, a team for the conservation of the wall has been formed that is under the direction of the conservator A. Tsimereki.

Following approval by the Central Archaeological Council (KAS) of the relevant study, conducted by A. Hatzipapa, restoration of the south wall of the Acropolis between the 6th and 7th buttresses was completed in July 2015, the work awarded after a preliminary tender. The project included archaeological cleaning which revealed the state of preservation of the upper part of the wall to a full width of 6 m. Also included was the placement of a bituminous material and the formation of a drainage system for carrying off rainwater in the contiguous channel, the replacement of crumbling building material and the filling of gaps with poros stone from Pitsa (Corinth) and conservation of construction mortars. The Wall construction and its state of preservation were examined in the course of the work by means of endoscope, thermocamera etc. The use of scattered ancient material for repairing the walls is indeed well known and is always investigated with interest. Some 20 spolia were identified, the most significant of which is part of a Roman inscription that was subsequently removed from the wall. This work is considered to be a pilot project and the problems that emerged, both in the monument itself, and in the very process of stabilizing it, have provided valuable information for their more successful confrontation in the interventions to come.

Apart from stabilization in the area of the Klepsydra and the Cave of Zeus, carried out by the Athens Ephorate of Antiquities, in 2015 the YSMA assigned, by tender, the stabilization of the schist slopes of the southwest incline of the Acropolis. Direct measures had already been undertaken in 2014 by a Service team. The relevant study, conducted by D. Englezos, geotechnical engineer, was approved by the Central Archaeological Council in October 2014. It includes removal of flora and sections of the rock that are loose, use of anchors, supporting the rock in areas of negative slope with walls, strengthening the rock slope by the use of metallic mesh and so on. The study also includes a series of similar interventions on the steep limestone slopes southeast of the temple of Athena Nike, the assigning of which is planned for the very next period.

Geophysical research with electromagnetic prospection V.L.F. implemented over a total length of 2,300 m., did not yield the expected results. It did, however, increase our knowledge of the variation in depth of the fill in the Acropolis area and the discontinuities of the rock.

Geotechnical research was carried out for studying the geotechnical characteristics of the fill of the Acropolis terrace, as well as on the supplementation of the physical and mechanical characteristics of the limestone geological substratum. Specifically, cores were drilled in separating parts of the limestone substratum, soil samples were taken of both fill and limestone substratum. Two shafts were opened by the Service, the first in the excavated section left visible south of the Parthenon next to the wall, and the second in the north wall near the Belvedere tower. The nature of the fill of the Acropolis terrace, a result of the great excavation at the end of the 19th century, did not allow the taking of undisturbed samples, so the laboratory tests were limited to reconstituted samples.



The network of accelerometers on the Acropolis rock.
Photogrammetric survey: "Development of G.I.S. on the Acropolis of Athens", 2009

In 2013 it was decided to include three more accelerometers to the national network that has been established by the National Observatory of Athens. The work, as assigned, entailed monitoring, informing, up-dating the now 10 instruments, their conservation and recording the results to the end of 2015. The software used for processing the data was installed in an YSMA computer server. To date, over 600 recordings from 70 earthquakes have been made, and a database has been created that serves the archiving, the correlation of parameters and the export of filtered data. Despite the fact that no sizeable seismic event has been recorded, recording of the peculiarities of the earthquakes and the response of the rock and the monuments has started.

The recording of seismic activity on the Acropolis and the processing of the results so as to draw useful conclusions about the response of the monuments to earthquakes and to asses the restoration interventions is the object of a collaboration between the YSMA and the National Technical University of Athens (research responsible: Associate Professor Ch. Mouzakis), and the MIE University of Tokyo (research responsible: Professor T. Hanazato), which started in 2009. In 2014, the memorandum of cooperation was renewed for a three-year term funded entirely by the Japanese government. The new programme comprises extension of the instrumental monitoring system by installing an accelerometer in the Parthenon, in addition to the two already deployed and the processing of the seismic records to be expected from all three accelerographs. In addition, research is to be carried out on the mechanical properties of the Dionysos marble that has been affected by exposure to high temperatures from fire. In the framework of instrumental monitoring of the present condition and probable minor movements in the wall, topographical measurements of predetermined ground control points were repeated in the south section of the wall.

The OSMOS-HELLAS company has sponsored, in June 2015, the installation of four optical fiber sensors, including monitoring of the recordings for one year, in the west wall of the foundation of the Pinakotheke of the Propylaia (two on the outer surface and two on the inner surface).

The "Preliminary study for rainwater management on the Acropolis plateau" conducted by A. Hatzipapa, was approved by the Central Archaeological Council in May 2014. A study of smaller extent, on the stabilization of the interior face of the southeast corner of the wall by the same author has been approved by the ESMA. The designing of scaffolding and its installation on part of the north wall above the cave of Zeus, is under way, so as to carry out the study for its restoration. For this purpose the scaffolding to be used will be taken from the south wing of the Propylaia, where works of anastelosis have been completed.

The beginning of work on the walls takes the activities of the YSMA and ESMA a step further. Despite the fact that the classical monuments, the walls and the Acropolis rock together form a single monumental unit, actual differences in their construction and form demand a different methodological approach and confrontation. The dry masonry of the classical monuments is the field that the Service is familiar with and will continue to apply itself. The restoration of the walls, extensive parts of which represent later constructions because of constant repairs, requires research and the use of building materials entirely different from marble, as well as compatible mortars. The stabilization of the rock indeed is a very specific undertaking, best performed with technical support by specialists, since its scale cannot be handled by the YSMA, on the basis of its structure and operating regulation. Yet in every case the Service will seek to respond to whatever need arises and to the requests of the ESMA, just as it always has, successfully, to present time.

Vasiliki Eleftheriou
Architect
Director of the YSMA

The restoration of the ceiling over the west wing pteroma of the Parthenon: Summary of the predicated proposal

Introduction

The question of covering the west wing of the Parthenon has occupied scholars and qualified authorities for more than a century. In July 2014 the subject was raised again by the ESMA, given the completion of the Opisthonaos restoration to the level of the crown blocks and replacement of the sculpture of the west frieze with copies and, in addition, the general development of the work of restoring the west side. The transportation of the west frieze to the museum (1992-1993) and its replacement by copies (2003-2004) has removed the need for including protection of the ancient sculpture in any proposal. Yet concern remains for completion of A. Orlandos' anastelosis programme, begun in the decade of 1950 with the aim of protecting a significant part of the monument and displaying the quality of the ancient plan.

The updated study presents in a new light the alternative anastelosis proposals, so that a definitive decision on restoring the ceiling can be made, given that still on the ground there are architectural members that had been dismantled in order to take down the west frieze. With these in addition are ancient members and fragments of members already identified as belonging as early as 1976 (M.Korres). The study also presents the total course of the works relevant to 106 architectural members, with a volume of 105 m.^{3} and weight approximately 290 tones.

The subject of the study

The restoration of the ceiling of the west pteroma depends directly on completion of certain preparatory works either because parts of the adjacent areas are concealed during its reconstruction, or because of their over-loading by the additional weight of its courses when these are reset. These works require corresponding studies, relevant to the following:

- restoration of the interior face of the entablature of the west side and of the blocks of the horizontal cornice,
- restoration of the first course of the backing wall of the west tympanum,
- structural investigation and probable structural reinforcement of the columns of the porch of the Opisthonaos,
- structural investigation and probable structural reinforcement of the columns of the west side,
- study of the interaction in static behaviour between the colonnade of the Opisthonaos and the colonnade of the west side, under severe stress.

Included in the main study of the architectural members of the ceiling to be restored, were analytical features of the architectural construction, evidence of historic phases, identification of scattered members and analysis of the pathology of the architectural members, with references to previous studies and publications. Presented in detail are supplementary evidence and proposals for restoring the allocated architectural members both on the ground and *in situ*, anticipating, as far as possible, all the problems that may arise during its application.

The material available for anastelosis

The members prepared in new marble by A. Orlandos in the decade of the 1950's, with the aim of restoring the ceiling completely, are to be found in all levels and they can be fully utilised in the proposed anastelosis. Specifically, there are 3 crown blocks of the west peristyle still on the ground, 3 beams, 2 of which had been partly formed by N. Balanos (1931-1935) and were completed by A. Orlandos, 4 interbeam blocks, 2 of which had been set in the monument,

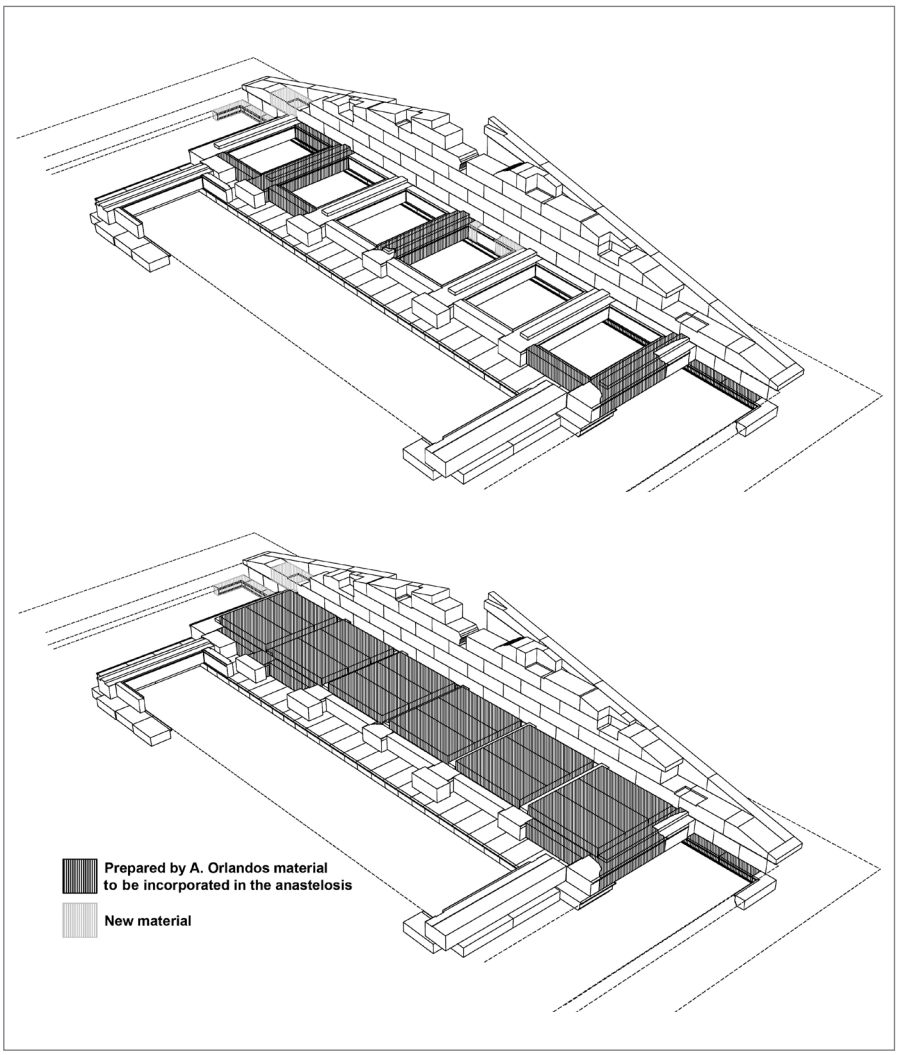
View from above of the material available for anastelosis (interbeams and new crown blocks). Photo R. Christodoulopoulou, 2015

General view of the ceiling coffers prepared by A. Orlandos. Photo K. Skaris, 2015

and 18 coffer slabs, 3 of which had been set experimentally in the 2nd space of the grid frame (eschara).

The ancient members that were dismantled from the monument in 1992-94, where they had remained after the Balanos interventions (1900), comprise 3 beams (Δ.ΕΔ2, Δ.ΕΔ3, Δ.ΕΔ5), 6 interbeams (Δ.ΜΔ2, Δ.ΜΔ3, Δ.ΜΔ4, Δ.ΜΔ9, Δ.ΜΔ11 and Δ.ΜΔ12) –one of which (Δ.ΜΔ2) had been replaced by Balanos– as well as 1 fragment of the beam Δ.ΕΔ4 and 1 fragment of the interbeam Δ.ΜΔ10. Available in addition is the southernmost beam, already lowered, which had been made and set by Balanos as a replacement for the ancient block, at that time preserved *in situ*. This, however, will not be used.

The scattered fragments and members that have been attributed to the monument consist of 1 crown block of the west side Δ.Θ17 (by K. Skaris), 2 stones at the edges of the northernmost beam Δ.ΕΔ1 (by M. Korres), and the interbeam Δ.ΜΔ8 (by M. Korres). In addition the ancient block Δ.ΕΔ7 already lowered and restored by N. Balanos, will be returned to the monument after necessary structural restoration.



Perspective drawing of proposed restoration of the ceiling. Top: full restoration of the resting ledges of the beams (proposal B). Bottom: addition of all the coffered slabs (proposal D). Drawing K. Skaris

The alternative proposals and theoretical speculation

The alternative restoration proposals that the study presented for discussion were:

A) to reset on the monument only the lowered blocks that were ancient,

B) to restore only the grid frame with all the beams with the introduction of all the available newly made architectural members,

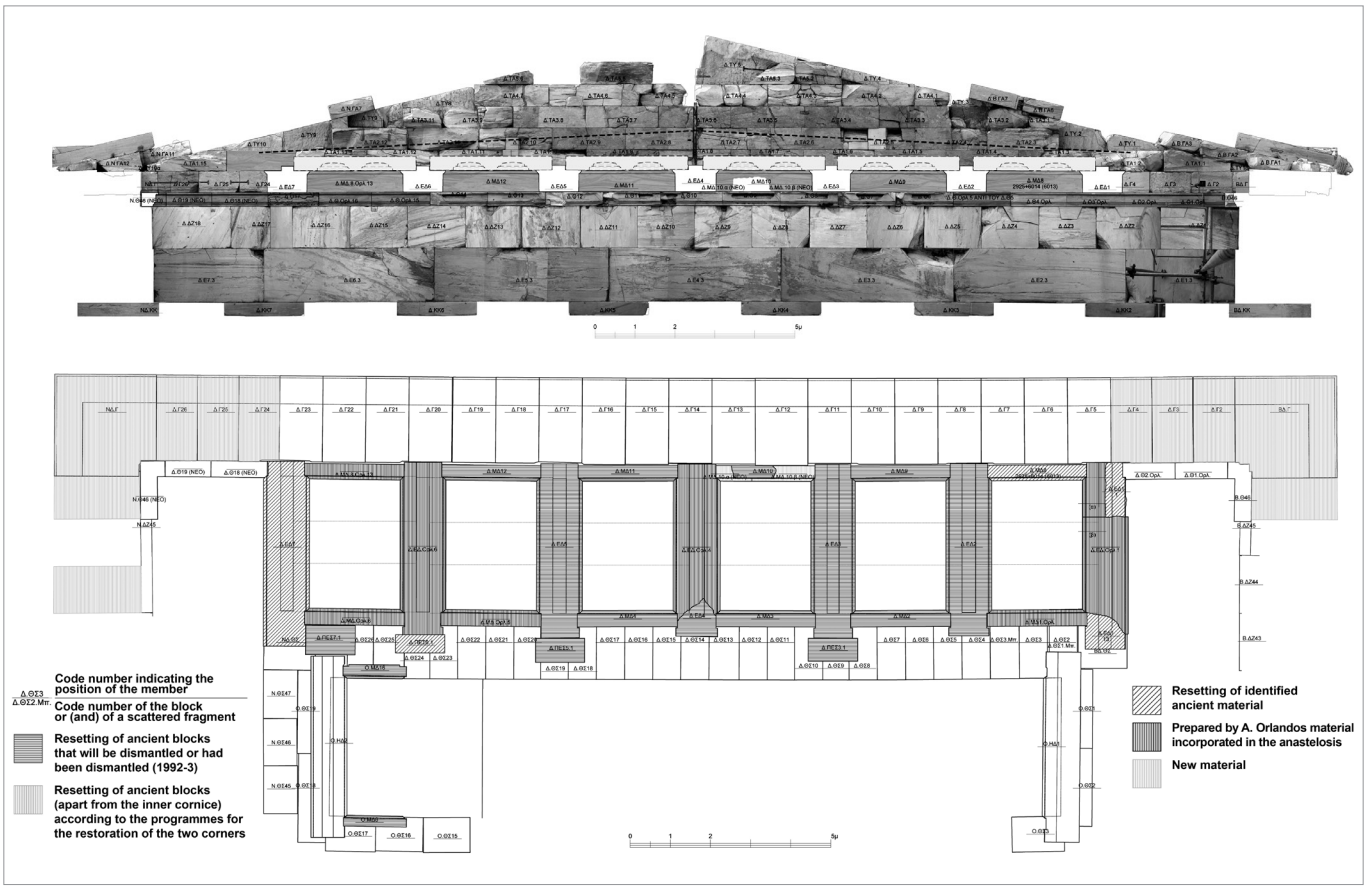
C) to restore the grid frame with all the beams and to set some of the newly made coffer slabs in the two southernmost spaces and

D) restoration of the grid frame with all the beams and addition of all the available coffer slabs for full covering of the ceiling.

The first proposal is termed not as anastelosis but as minimal action, left from the work on the Opisthonaos. It does not include the re-setting of the west interbeam that had been placed by Orlandos and the newly made southernmost beam, which will be replaced by ancient beams attributed to these positions. The next three proposals had been presented briefly in the "Study for the restoration of the Opisthonaos and the ceiling of the west colonnade" (Kouphopoulos 1994), where the percentage of new material proposed –mainly that prepared by Orlandos– ranged between approximately 25% in solution (B) and approximately 60% in solution (D).

In the presentation and evaluation of the alternative proposals, researchers and members of the ESMA, took into consideration the following parameters:

- The effect of their application on successful protection of the west part of the monument from the influx of water and ice, on its static efficiency and on its seismic behaviour.
- Its effect on the didactic quality and on the comprehensibility of the architecture of the ancient monument.



Proposal for full restoration of the ceiling. Top: interior view of the west side and horizontal section of the ceiling of the west wing. Drawing and synthesis of photographs: K. Skaris. Interpretation of relief: D. Mavromati. Bottom: plan of the layer of ceiling beams and the horizontal cornice blocks of the colonnade. Drawing: K. Skaris

- The effects on the picture of the monument as a ruin and on the degree of its authenticity from the standpoint of preservation of ancient material.
- The effects on the use of historically known anastelosis material.
- The consequence for the principles and practices of the ESMA in their anastelosis works on the Acropolis.

At the meeting of the ESMA on 10.7.2014, the second proposal (B) for restoration was accepted, with the possibility of applying the fourth proposal (D) in a second stage, comprising full restoration of the grid frame using the architectural members of Orlandos, while taking into consideration in the partial restoration of the architectural members –ancient and new– the possibility of setting the coffer slabs in the future. This proposal was also approved by the Central Archaeological Council (KAS) in their meeting, with the number 30/9.9.2014.

Issues of filling and utilization of new material

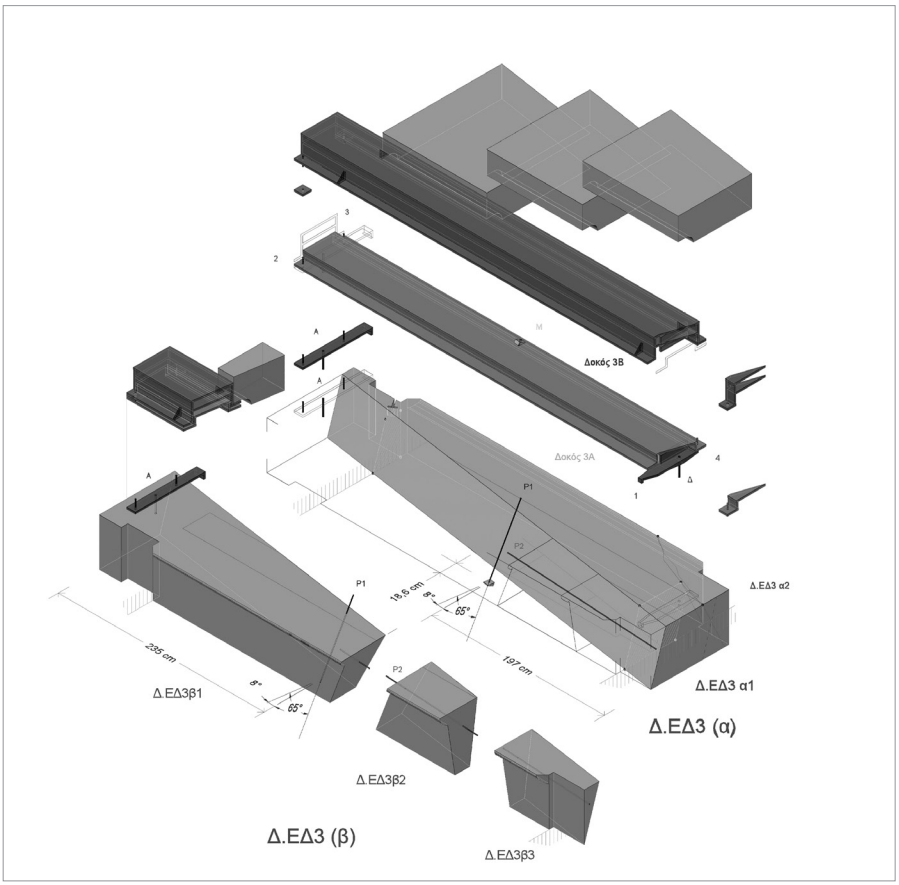
The proposal for restoring the ceiling is governed by the basic principle of minimal supplementation with new members that have to be made in the present or of filling in with new marble the architectural members that are *in situ* or on the ground. Thus, filling with new marble is not programmed for the blocks of the architrave, the frieze, the cornice and the first course of the backers of the west side, as in the characteristic case of the fragmented sections of material in front of the dowels between the crown blocks and frieze. For the members of the ceiling, the only utilization of new material will be for filling in the interbeam Δ.MΔ10, and completing the row of crown blocks for the full length of the west side with the addition of new members in its south part, for morphological completion and, correspondingly, for filling in the north end with the four new stones placed by Orlandos. One more new architectural member being proposed is the wall block of the backing wall in the position Δ.TA1.14, in order to complete the row of wall blocks in the first course and to display the beam-socket that was formed in the north end of its upper seat, judging by the preserved trace in the adjacent wall block to the north.

A matter that was tabled for approval is the transportation to the museum of a crown block (Δ.Θ5), so as to preserve the traces of painted decoration still remaining on the face. The stone, moreover, has very serious structural problems. It can be replaced by one of the new blocks prepared by Orlandos, in continuation of the four new blocks that had been set at the north end. This would reduce the visual annoyance caused by inserting a new member between ancient stones. In this specific case, a further theoretical question is the setting of a member from the same group, in continuation of the others, after, however, a lapse of six decades. Clearly the date of setting must be inscribed on the member and also on the other architectural members prepared by Orlandos, which will set on the monument a long time after they were made.

No additional work to improve the existing chiseling or to complete the decoration is planned for the architectural members prepared by Orlandos, such as further carving of the bead and reel decoration on most of the coffer slabs where they are rendered as a projecting strip around the coffers. Apart from the fact that the crumbling surface of the poor-quality marble would be difficult to carve, the members provide evidence of the form they took when they were made in the decade of 1950-60, as an example of a complete work made by that specific generation of marble-masons.

Structural issues

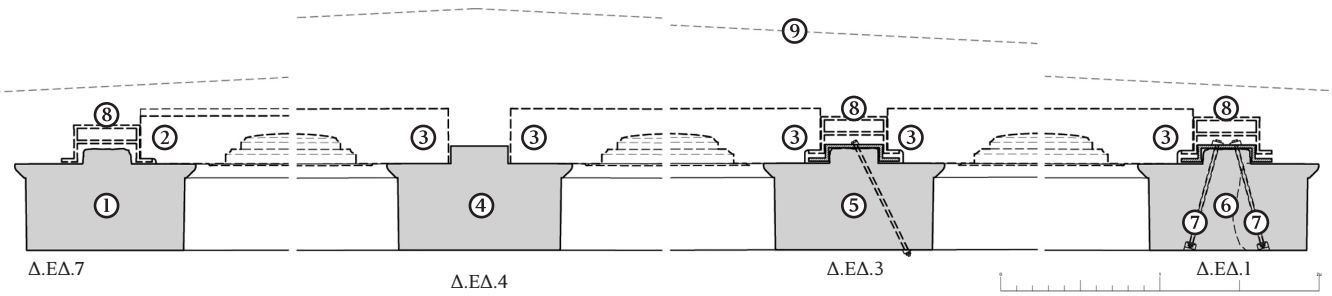
The resetting on the monument of all the ancient beams and interbeams of the ceiling of the west wing that will be structurally restored on the ground, cannot be assured if they are not set on a fully restored support. The original planning, however, did not call for the beams to be joined with the crown blocks of the west side and of the Opisthonaos, but only for their free cradling on them.



Theoretical axonometric sketch of the structural restoration of beam Δ.ΕΔ3. Drawing: Z. Konteas.

The most serious structural problems for restoring grid frame are the damages evident in the ancient beams Δ.ΕΔ3 and Δ.ΕΔ7, and the problems of joining the ancient fragments to beams Δ.ΕΔ1 and Δ.ΕΔ4 prepared by Orlandos. To insure these same beams from further stress and fracture, requires their strengthening with reinforcements inside their mass and in some cases their topical support by stainless steel beams of special section, in their upper seat, as in the ancient beam Δ.ΕΔ3, so as to strengthen an area with many cracks, and in the beam prepared by Orlandos for position Δ.ΕΔ1 so as to insure an attributed ancient fragment that will be incorporated in it. The ancient beam Δ.ΕΔ7, to be reset on the monument, is judged to be capable of supporting its own weight, without special structural reinforcement, despite the problems that have appeared in the process of removing the pieces mended by Balanos.

It will be possible to set the coffer slabs in place in the future if stainless steel metal beams of composite section have previously been installed above the marble beams Δ.ΕΔ1, Δ.ΕΔ3 and Δ.ΕΔ7, so as to assure the transfer of load to the supporting positions. Even so, a theoretical problem is the cancellation of the static function of the seat (eschara) of the beams, as an efficient carrier of the coffer slabs, and the need for sub-assistance by an additional system of metal beams to be inserted into the ancient building voids. Presented as an advantage of the proposed independent systems of support for the beams and seating of the coffer slabs, is the possibility



1. *Ancient beam*
2. *Coffered slab reworked by A. Orlandos*
3. *Coffered slab reworked to its theoretical thickness*
4. *Beam prepared by A. Orlandos into which an ancient fragment will be inserted*
5. *Ancient beam preserved in situ and needing structural reinforcement*
6. *Beam prepared by A. Orlandos in which two attributed ancient fragments will be incorporated*
7. *Suspension of ancient fragments by stainless steel structural components*
8. *Setting the ceiling coffers on stainless steel beams so as to shift the load to the supporting beam*
9. *Nominal boundary of a metallic cover for diverting rainwater from the ceiling*

Compacted lengthwise section of the ceiling showing structural reinforcement of the problematic free beams. Drawing: K. Skaris. Structural study: Z. Konteas

of their gradual application, according to the decisions likely to be made each time in the future for setting all or only part of the coffer slabs.

In accord with the structural assessment to reset the beams demands as the only accepted solution that the crown blocks be joined with the frieze, inserting titanium rods so as to attain unified solidity, as opposed to the ancient dowelling with especially large dowels which were expected to fail. This intervention conflicts with the principle of respect for the structural independence of each architectural member, since essentially two layers will be united (crown and frieze backers). It does, however, resolve a demonstrated weakness in the original construction that emerged from the change of the initial plan of the Parthenon during its construction, so as to add the Ionic frieze, bringing it back to its original conception of crown in one piece with the frieze. It is, moreover, reversible so that the eventual removal of the reinforcements (by drilling) would be possible without damage to the marble.

The pathology of the columns of the Opisthonaos requires that we allow as little strain as possible from horizontal load. As emphasized also by previous scholars (K. Zambas, M. Korres), for this reason it is considered necessary to insert a metal plaque in the seat of the beams on the crown of the west side and of the Opisthonaos as well. The metal insertion will reduce the factor of grinding, so that the horizontal load will be significantly reduced in case the beams slide during an earthquake. In the west side, the small factor of sliding will lessen the large reinforcement armature joining crown and frieze backers.

The special static questions investigated in the structural study or likely to emerge while the work is being carried out (for example, adequacy of columns in porch or peristyle colonnade, faults in the column capitals, etc.) can delay the setting of a number of architectural members of the ceiling until a suitable technical solution is found. An example is the case of the second from north column capital of the west side, which according to what is known to date cannot carry securely the load of beam Δ.ΕΔ1, let alone the additional load of the corresponding coffer slabs.

Kosmas Skaris
Architect
Rosalia Christodoulopoulou
Architect, Head of the Office
Zannis Konteas
Civil Engineer
Antigone Vrouva
Civil Engineer

Technical Office for the Restoration of the Parthenon

** The alternative proposals for restoration of the ceiling of the west wing were first presented at the 6th International Meeting for the restoration of the Acropolis monuments, in a poster entitled "Restoration of the coffered ceiling in the west pteroma of the Parthenon" by K. Skaris and Z. Konteas.*

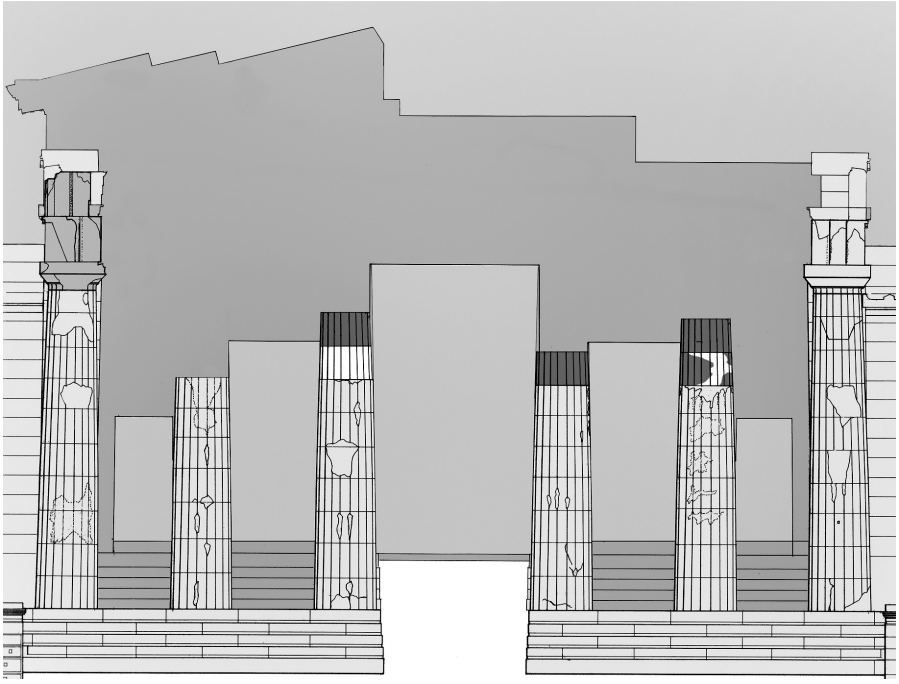
Proposal for intervention on the northwest corner of the central building and anastelosis of the west façade of the Propylaia

In September 2011, during conservation work on the lower drums (3rd, 4th and 5th) of the first column from the north in the colonnade of the Propylaia west façade, a fragment of the east side of the abacus of the column capital was observed to be in danger of falling. It was decided to assemble suitable scaffolding for repairing the area, both to remove the loose fragment and to investigate from close-up the problems in that part of the monument. After disengaging the fragment, the east part of a joining clamp from the time of the Propylaia's construction, was found to be especially corroded. The penetrating crack in the east side of the column capital was also clear to see, as were the cracks near the west edges of two of the three blocks of the overlying architrave, that is, the outer block and the inner block. In the south side of the capital of the northwest anta, another crack was found that runs through the top of the member. The ancient double T clamp that was discovered in the northwest column capital was found to be one of the three clamps placed in the upper seat of the abacus when the Propylaia was being built so as to strengthen the architectural member structurally. It was evident that the marble mass of the column capital had a dangerous fault from the moment of its quarrying, in the form of interior weaknesses or interruptions in the continuity of its crystalline fabric. The setting of the three clamps in an east-west direction –the northernmost and the middle one are still in their original positions– resulted in the excellent static behaviour and stress resistance of the marble mass. The problems in the column capital, for the most part, are thought to have started when the three clamps ceased being functional. This happened following the catastrophes suffered by the architectural member in the course of the Propylaia's vicissitudes. These include the shelling –traces of which are seen not only on the column capital but also on the shaft– the great explosion of the mid-17th century that destroyed much of the monument, and various seismic strains as well. The result of all this is that the southernmost of the reinforcement clamps in the column capital has come off entirely, while much of the north clamp has corroded, after its exposure to atmospheric conditions for a long time. The crack in question, running along the full length of the marble fabric, was a result of all the above combined. It is notable that the upper drums of the column, from the fifth drum up, were displaced in addition to the capital. Displaced from their original positions for the above reasons, are also most of the stones of the overlying entablature, architrave and frieze blocks which appear with the thrust joints open and in most cases not joined together because the iron clamps in between have not survived.

The west façade of the Propylaia. Photo T. Souvlakis, 2012

The inspection made it clear that there was serious and immediate danger of the larger fragment in the east part of the column capital coming loose, and that the oxidation of the clamp in question would spread. At the same time this would have adverse consequences for the seating of the architrave blocks. It was therefore decided that a study was needed to determine how best to resolve these problems.

There have been no previous interventions in this area of the monument. The sealing of the joint openings and the spaces between the members of the entablature with mortar are probably to be attributed to the period of A. Orlandos' interventions in the Propylaia because of their similarity to the sealings in the south wing and at the southwest corner of the central building. The structural problems of the members of the entablature at the northwest corner had already been located in 1984 by the architect T. Tanoulas and were subsequently recorded in the first volume of the Propylaia study (1994). To keep fragments from falling from the westernmost triglyph of the north side, a wooden splint had been set which was removed during the restoration work on the ceilings of the central building (2002-2009). In the autumn of 2011, immediately following



Restoration proposal of the west façade of the Propylaia.
Study and drawing: K. Karanasos, 2012. Background drawing: T. Tanoulas

diagnosis of the problems, the area was supported until the intervention was started.

The study was carried out by the undersigned in collaboration with the civil engineer M. Ioannidou. We investigated the possibility of consolidating the column capital and working on the problems of the corrosion of the north reinforcement clamp *in situ*, thus retaining the existing deformations and the undisturbed condition of this section of the monument. Yet the mediocre state of preservation of the overlying members of the entablature reduced to a minimum any possibility of applying that solution.

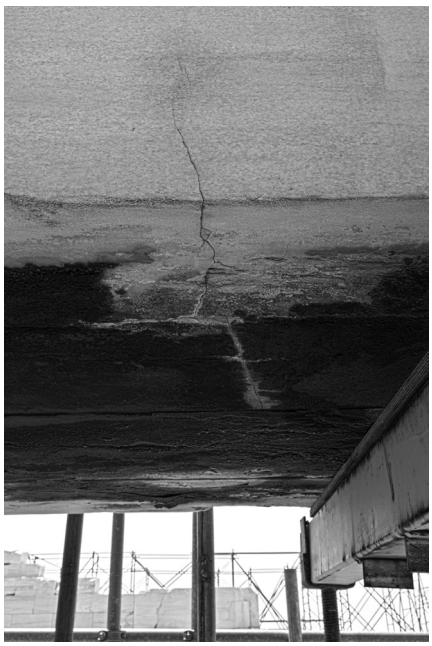
The proposal that was submitted to the Committee for the Conservation of the Acropolis Monuments (ESMA) and was approved by the Central Archaeological Council (KAS) in the autumn of 2012 aimed at solving the structural problems not only of the column capital, but also of the overlying blocks of the architrave and frieze. It was also considered worthwhile in the study to propose that architectural members from the groups of scattered members of the Acropolis monuments that are connected with the area of the intervention, be included in the structural fabric of the Propylaia so as to better preserve that material in the future. The proposal for restoration of the northwest corner of the central building thus comprises two parts. The first part concerns the handling of the structural problems of the architectural members of the northwest corner, while the second is devoted to restoring the six-column Doric colonnade of the west façade of the Propylaia, using preserved authentic material. For the first part, the solution chosen was to dismantle the column capital and its overlying members, so as to remove the rusting clamp and subsequently to carry out a structural restoration of the architectural member on the ground. At the same time the two architrave blocks will undergo the necessary work of structural restoration on the ground. The study calls for the dismantling of a total of eleven architectural members. These members will be returned to their initial positions and they will be joined to each other with new titanium clamps. In the first part of the study it is proposed also to reset on the monument three scattered wall blocks of the west end of the north wall. They comprise two blocks from course 20 and one from course 19. In the first from west position of course 19 there is a stone that is shorter in length than the typical wall blocks of the Propylaia. This stone, as also the one set in the third from west position, are not available and they will be cut from new marble since they are needed for seating the two ancient blocks of the overlying course. Identification of the original position of the three blocks was on the basis of correlation of the positions of their vertical and horizontal clamps. The original position of at least one of the three blocks is indisputable. Re-setting these blocks is expected to contribute to increased cohesion between the members of the northwest corner. Thus a total of 16 architectural members of the northwest corner will be restored: two of these will be cut completely from new marble, and one requires new marble fillings.

The colonnade of the six-column west façade of the Propylaia is not fully preserved. The two end columns –the northwest which we have already mentioned and the southwest the upper drums and column capital of which were replaced by A. Orlandos in the decade of the 1950's– are preserved for their full height. During the past two centuries, the other four columns have survived up to a height of the seventh drum. Research among the scattered architectural members of the Propylaia showed that the material of the four Doric capitals and twelve missing drums preserved in

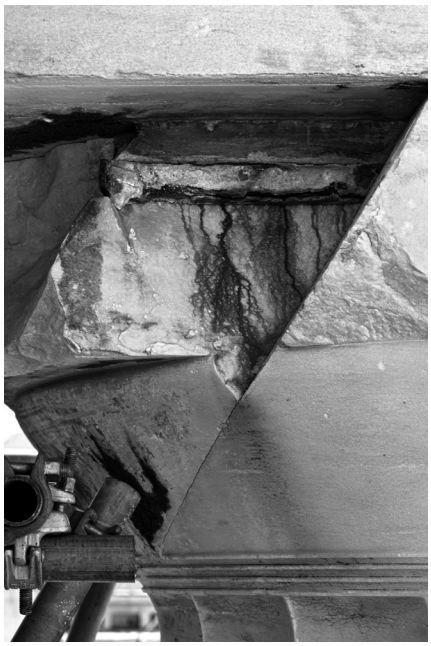
good enough condition to be returned to its original position is minimal. Preserved in good condition are four Doric drums, three of which are lying inside the west hall with other architectural members of the Propylaia. The study for the restoration of the northwest corner included also research on the possibility of restoring preserved authentic material to its original position.

The diameters of the upper and lower resting surfaces of the four drums were investigated together with the traces of natural wear on the marble, damage from catastrophes and later cuttings in the surfaces of the architectural members. The state of preservation of the four columns of the façade which are not preserved complete was investigated at the same time and, following that, their heights and the diameters of the upper surfaces of the (seventh) *in situ* drums were measured. The results of this investigation showed that the drums can easily be restored to their original positions. It was ascertained, however, that they do not belong to the four columns, since two drums come from the eighth series and two from the ninth. The drum from the ninth series, which has a later cutting in its surface, is connected with the Ionic colonnades of the west hall and in accordance with its diameter its position is on the third from north column. The two drums of the eighth series belong on the two columns south of the central passage and the second drum of the ninth series is positioned on the column south of those. The filling in of the underlying eighth drum was considered necessary to assure its better seating. Finally, it was considered necessary to reconstruct the eighth drum in new marble, since it is not available for seating the drum identified as the ninth drum on the third from north column which was transferred to the Acropolis from the basements of the National Archaeological Museum (Δ 438). In reference to the orientation of the drums to be restored, conditions were considered such as surface breaks, traces from the impact of missiles, or damage to the surface such as later cuttings. Thus a total of five column drums will be restored in the colonnade of the west façade of the Propylaia, one of which will be of new marble.

View of the capital of the NW column, from west. Photo. T. Souvlakis, 2012



View from N of the architrave block of the NW corner. Visible is the crack running through the entire width of its resting surface. Photo. T. Souvlakis, 2012



View of the NE corner of the column capital. Visible is the crack in the east side and the corroded ancient clamp. Photo. T. Souvlakis, 2012

For the anastelosis of the sixteen architectural members of the intervention in the northwest corner, scaffolding with a bridgecrane system was investigated by the civil engineer V. Papavasileiou and

its installation was completed in the autumn of 2014. The solution chosen for the restoration of the west façade of the Propylaia with the re-setting of the five drums, was the use of a hoisting system on a single fixed track, so as to have as little aesthetic interference as possible. The works on the northwest corner and west façade of the Propylaia began with both the dismantling of the eleven architectural members and the restoration and surface conservation of the drums and blocks that are on the ground. In accordance with the timetable of the authorized study, the work will take fourteen months.

The necessity for intervention on the members of the northwest corner of the central building of the Propylaia required that a study be made. The revealing of the entire upper seat of the column capital after dismantling the overlying blocks, verified the stress suffered by the marble mass of this architectural member from antiquity to now. It was thus clear that the intervention was purely rescue in character and requisite for structural reasons. Even if with the proposed intervention the existing deformations will disappear, it is thought that the establishment of its static resistance will constitute a significant advantage for the monument. Dismantling the eleven architectural members will allow secure consolidation of the column capital after the rusted clamp is removed. It will also enable the structural restoration of all the members on the ground. Following this, when the members have been restored to their original positions, the open joints will be closed and their seating restored. The anastelosis of the blocks in the west end of the north wall will contribute to the restoration of the ancient structure and to improvement of its behaviour under seismic load. The appearance of the monument at its northwest corner will not change, given that it will preserve the big surface break in the west side of the column capital as evidence of the constructional hazards it has undergone during its centuries-long history.

View from NE of the entablature members preserved in the NW corner of the central building. Photo K. Karanasos, 2014

The drum of the 8th course after its filling in with new marble. Photo T. Souvlakis, 2015

The drum of the 9th course with the later cutting on its surface. Photo T. Souvlakis, 2012

Although the restoration of the five drums in the west side of the Propylaia will somewhat alter the image of the monument that has remained settled in our consciousness for two centuries, it will contribute to better preservation of the authentic material and it will help to make the architecture of the central building easier to understand. With the completion of the intervention, the west façade of the Propylaia will retain its character as a ruin. It will also be enriched by new historical evidence in the form that is impressed on the authentic material that is to be returned to its original positions.

Konstantinos Karanasos
Architect, Ph.D.

Technical Office for the Restoration of the Propylaia

The demolition of the mediaeval tower of the Propylaia: Re-approaching an old dispute

The beginning of the work of anastelosis in the south wing of the Propylaia brought to the forefront again the question of the mediaeval tower of the Propylaia. The present intervention necessitated removing the few remains of the tower – which were still preserved in the southeast corner and the west end of the south wall of the wing. Thus, the last traces of a monument, which had predominated the archaeological site of Athens through the ages, were eliminated. The building, which had been distinguished as a landmark of the entrance to the Acropolis, was degraded and finally torn down in 1875, but not without resistance from both the academic community and public opinion of the time.

View from SE showing the mediaeval tower of the Propylaia. Photo P. Sebah, ca 1875

The mediaeval tower: form and function

Various proposals have been made for the chronology of the tower. It has been attributed to Burgundian dukes of Athens and Thebes, the de la Roche family (1204-1311) (Gregorovius, Buchon, Lock), to the Florentine Dukes of Athens, the Acciaiuoli (1388-1456) (Burnouf), even to the Ottomans (Kaftantzoglou, Gennadios). While there is no firm archaeological or historical evidence, recent research attributes it to the Acciaiuoli, a view supported by the architect T. Tanoulas (*The Propylaia of the Acropolis in Mediaeval Times*, in Greek).

Tanoulas, connecting architectural indications with evidence from early travellers, reconstructs the form of the tower as a rectangular building measuring 7.80 m. (N-S) and 8.77 m. (E-W) with a height of 26 m. and crowned by crenellations. The south wing of the Propylaia was incorporated in the mediaeval construction, leaving the marble blocks of the east and south sides visible on the exterior. The west column and the free pier of the north colonnade as well as the pier of the west side were taken down together with the overlying members because of the needs of the new plan. It appears that right after being dismantled, the ancient members were incorporated in the wall structure of the mediaeval building, which comprised mainly re-used material (marble and poros) and mortar, as well as fired bricks at intervals. The tower, with its entrance in the west across from the temple of Athena Nike, did not communicate with the mediaeval palace in the Propylaia. Morphologically, the building is similar in many ways to the tower at Brauron in Attica, as noted by the mediaevalist P. Lock (*The Frankish Tower on the Acropolis, Athens: The photographs of William J. Stillman*) and with the mediaeval towers of central and north Italy.

The tower strengthened the fortification of the Acropolis, affording the possibility of surveillance of the fortification walls and monitoring of the wider area. During late Ottoman times, the tower served as a prison, and indeed during the Greek War of Independence the freedom-fighter Odysseus Androutsos was imprisoned therein.

From romanticism to "clearance"

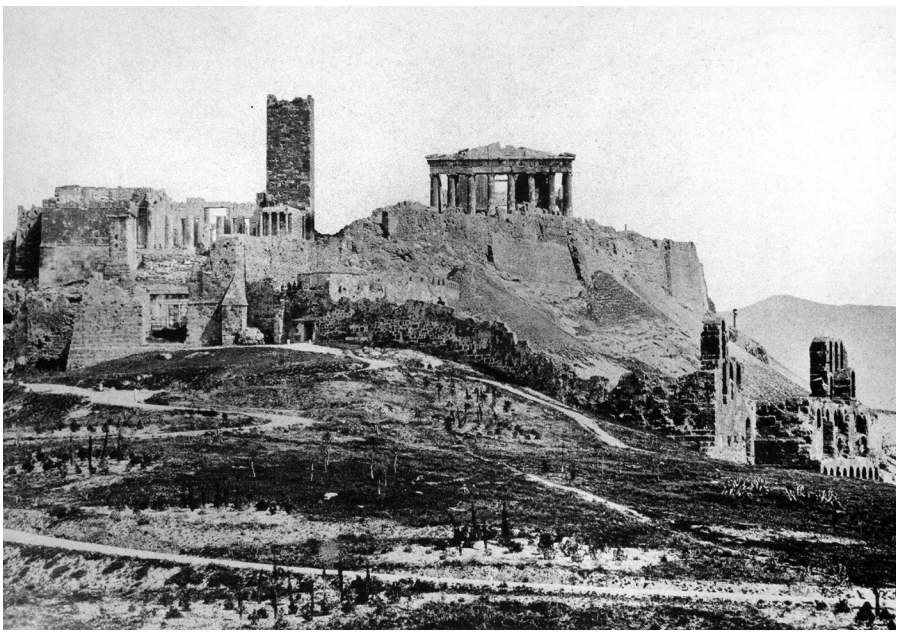
The demilitarization of the Acropolis and its declaration as a monument in 1835, a few years after the foundation of the Greek state and by decision of Leo von Klenze, advisor to the regent, shows a new perception of the antiquities during the time of Otto. As explained by F. Mallouchou-Tufano (*The Anastelosis of the Ancient Monuments in Modern Greece,* in Greek) the common denominator of the interventions of the period of Otto is the attempt to connect modern Greece with its ancient past by protecting, restoring and displaying its monuments. Among the monuments in the centre of interest, special significance was attached to the Acropolis of Athens, the symbolic monument of the newly formed state.

This is the context in which the systematic dismantling of the later buildings of the Acropolis took place. Paradoxically, the systematic clearing of the period 1835-1838, in the first phase, left the mediaeval tower of the Propylaia intact. Klenze had proposed its conservation, arguing that the monument enhanced the scenic aspect of the Rock, a

View of the south wing from the SE. Visible are the architectural remains of the mediaeval tower in the SE corner and the south wall of the monument. Photo T. Tanoulas, 2012

view that accorded with the prevalent romantic outlook of the time. Moreover, the form of the tower had dominated as a "visual habit" that had coalesced in the consciousness of Greek and European minds through the multitude of representations of the Acropolis by travellers. Characteristic, indeed, is the comment by the French poet Th. Gautier in 1852 that "this tower, despite its barbaric appearance, is in a way an inseparable part of the Athenian landscape".

The issue of removing later additions from the Propylaia surfaced again in 1875 when, during the ephoreia of P. Eustratiades in the General Ephorate of Antiquities, the decision was made to demolish the "Frankish" tower. Its demolition was carried out between the 16th of July and the 20th of September 1875, under the aegis of the Archaeological Society –when S. Koumanoudes was Secretary– and with the supervision of the sculptor Napoleone Fellice Martinelli. The operation was funded by H. Schliemann. The architectural members of the classical monument freed by the demolition were used in the subsequent anastelosis interventions in the Propylaia, while poros blocks from the tower were used in a restoration of the retaining walls west of the Pinacotheke, in 1878.



General view of the Acropolis from the W, in which the medieval tower is visible. Photo D. Konstantinou, ca 1860

The dispute about the tower

The demolition of the tower triggered a variety of reactions and rekindled the argument about the purpose of retaining monuments of later historical periods. The arguments of those who supported and directed the demolition were organized and methodical. The views of S. Koumanoudes are indicative in three of his articles in the journal "Athenaion" (1875) in which he explains the conceptual basis for the decision "to make visible a formerly invisible part of a brilliant ancient building and to add its own good harmony" (in Greek). The finding of architectural blocks of the Propylaia, inscriptions and sculpture was considered a collateral, though significant, advantage of the whole operation.

In opposition, those in favour of conserving the tower emphasized its historical value, detecting serious ideological motives for the decision to demolish it. In a letter to the journal "Athenaion" (1877), the historian E. Freeman notes that "A Latin duke had a mansion in the Propylaia of Pericles. A Latin bishop supplanted the orthodox worship (...). However, the dissolute barbarism of classical exclusivity tolerates neither the memory nor the monuments of such

days" (in Greek). He himself does not hesitate to characterize those who proceeded to tear down the tower as "devastators".

The architect L. Kaftanzoglou, replying to Freeman in the same fascicle, defended the demolition with arguments corresponding to those of S. Koumanoudes, and employing the question of the date of the tower, which he attributes to the 17th century. As a remainder of the Ottoman period, the tower was further degraded with the argument that "in this sacred place it is lacking in respect and incongruous to retain obscure monuments of the negative currents of barbarism" (in Greek). Thus he justifies the intervention ethically and shows once again the ideological/symbolic extent of the question.

The fight about the tower reached the general public and constantly resurfaced for years, as seen in the daily press. In an article in the "Ephemeris" (8.7.1884) it is held that "the many friends of the antiquities hoped to see the site of the Acropolis excavated and, above all, its wonderful ancient buildings freed of any Byzantine and Frankish and Turkish addition (...) it has just now been possible through the German persistence of H. Schliemann to demolish one only, the Frankish tower" (in Greek). Those opposed to this approach were not convinced by the argument "that these additions had nothing of the august about them, as they are badly made works of inglorious times, or of military need all ordinary and temporary defenses, but they defaced those incomparable ancient wonders that are admired by all humanity" (in Greek). The opposite opinion appears in an article in "Ephemeris" (31.3.1889), with a republication of the comment of a "knowledgeable critic": "Shame... that the most insignificant remain from the period of Agrippa is judged more worthy of conservation than the most picturesque and historically important Frankish tower" (in Greek).

The south wing of the Propylaia before the beginning of Orlandos' restoration intervention. In the colonnade area, visible are the remnants of the medieval tower, which support part of the architrave and its backer. Photo DAI Archives

It is thus apparent that not only archaeological but also deeply ideological reasons led to the demolition of the mediaeval tower. The demolition of the mediaeval remains had as its purpose both the study and promotion of the monuments of classical antiquity, which had become component of the Greek national identity and the erasure of later historical periods from collective memory, since they were perceived as periods of occupation and decline. Consequently, in this case archaeology appears to be intrinsically tied to the ethnic ideology then prevailing.

The removal of the last remains of the tower

The last notable architectural remnants of the mediaeval tower were preserved in the southeast corner of the south wing of the Propylaia. Immediately after World War II, A. Orlandos had proceeded to remove the remains of the mediaeval tower in the area of the colonnade of the south wing. This intervention took place in the framework of restoring the west column (*Anastylose des monuments de la Grèce*), while the poros blocks of the mediaeval construction were used in the restoration of the façade of the Herodeion loggia – as observed by F. Mallouchou-Tufano (*New scholarly requirements versus established practices: the cases of the Sanctuary of Samothrace and the Odeion of Herodes Atticus*, in Greek).

In the area of the southeast corner all the blocks of the classical construction are bevelled because they abut on the Mycenaean fortification wall, which in the classical period must have been preserved to a significantly greater height, at least some 5 m., compared to the pre-

sent or even mediaeval times. When the tower was built, it was evidently considered necessary to strengthen the corner of the building structurally so that it could support the overlying load of the new construction. To this end they used primarily ancient members coming from the superstructure of the south wing, which were founded on the remains of the Mycenaean fortification wall.

The study by T. Tanoulas *(Study for the supplementation of the anastelosis in the south wing of the Propylaia,* in Greek*)* called for the removal of this mediaeval intervention so that the ancient members incorporated in it could be reset in their original positions in the monument. The work of dismantling began on 5 September 2012 and was finished on 23 November 2012, under the supervision of the architect K. Karanasos.

In the context of removing the remains of the mediaeval tower a total of 16 architectural members and fragments of members were dismantled from the area of the SE corner. Of these, ten were marble, six were limestone (poros) and conglomerate. All the marble pieces come from the classical structure of the Propylaia. During the anastelosis of the south wing seven of these pieces were identified and reset in their original positions on the monument. These are three wall blocks (ΑΑΔ 15598, 15600, 15603), part of an architrave backer (ΑΑΔ 15602), part of an interior stone of the frieze (ΑΑΔ 15606) and two frieze blocks (ΑΑΔ 15607, 15608). Three more marble members were dismantled from the west end of the south wing: specifically part of the frieze (ΑΑΔ 15609), part of a frieze backer (ΑΑΔ 15611) and part of a wall block (ΑΑΔ 15610). These too were restored and reset in their initial positions. These architectural members, having served previously as ordinary building material, have again become structural and morphological elements of the south wing of the Propylaia, enhancing the aesthetical values of the building.

The work of dismantling provided an opportunity for the detailed recording and documentation of the building techniques of the mediaeval tower. The marble members, which comprised the main bulk of the building material, were joined with mortar and the spaces were filled in with smaller stones and fired bricks. Worth noting is the use of double-T iron clamps for better joining of some of the marble members. In the case of the member ΑΑΔ 15606, which

Triglyph blocks numbered ΑΑΔ 15607 and 15608 had served as ordinary building material to strengthen the SE corner of the mediaeval tower. Photo K. Karanasos, 2013

Triglyph blocks numbered ΑΑΔ 15607 and 15608 are reset in their original positions, in the north side of the south wing of the Propylaia. Photo K. Karanasos, 2014

View of the SE corner of the south wing before removal of the mediaeval tower. The remains of a clamp between stones AAΔ 15606 and N.N.12.1 are visible. Photo T. Tanoulas

Iron connectors of the mediaeval period were used for better connection of marble members that had been incorporated in the tower. Visible are part of a clamp in the upper surface of stone N.N.14.1, and the connector between stones AAΔ 15606 and N.A.13.8. Photo K. Karanasos, 2013

was 2,44 m. long and had been set vertically to fill in the bevelled southeast corner, four such clamps had been employed: one in the south side (join with N.N.12.1), one in the east side (with N.A.11.8) and one in the upper surface of the stone (with N.A.13.8), while one more clamp had been used in order to reinforce the same block. A corresponding clamp joined the blocks N.N.14.1 and AAΔ 15604. These mediaeval clamps are very similar in form to the ancient clamps of the Propylaia and lead was used in order to set and protect them from oxidization just as in antiquity. Thus, although the ancient articulated system of construction had been abandoned for centuries, it is likely that the use of metal clamps and dowels had survived sporadically both in the early Byzantine period (for example in Aghia Sophia) and later on, as for example, in the use of metal clamps to stabilize marble cornice blocks on the base of the tholoi of Byzantine churches, according to R. Ousterhout (*Master Builders of Byzantium*). It is also likely that the technicians of the mediaeval tower tried to copy the ancient reinforcements of the Propylaia, which were revealed when the marble members were dismantled and to adapt them to the structural needs of the new construction.

Although the demolition of the remnants of the mediaeval tower contributed in many ways to the anastelosis, enhancement and study of the south wing of the Propylaia, the question may still be raised as to what extent such an intervention was ethically correct. In contrast to the 19th century, when there was a predominant tendency to purify the classical buildings of later interventions, today the widely accepted position is that all the historical phases of a building should be preserved and enhanced. In the case of the mediaeval tower, however, its few remains, incorporated as fragments in the classical structure of the south wing, were probably simply confusing to the visitor. Their removal, therefore, according to the anastelosis programme under way, was justified and accords with the Charter of Venice (article 11), since they could offer minimum information to the visitor, whereas the gain from restoring the classical form of the monument is unquestionably great. In the last analysis, the decisions of the 19th century to restore the classical monuments of the Acropolis to the detriment of the mediaeval phases and the drastic measures taken at that time in this direction, in fact defined – and continue to define– the basic aims of all subsequent interventions in an irrevocable way.

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Agknowledgements
We would like to express our gratitude to the President of the ESMA, Prof. Ch. Bouras, the Director of the YSMA, V. Eleftheriou, as well as to T. Tanoulas, K. Karanasos, F. Mallouchou-Tufano and S. Mamaloukos for their invaluable comments and remarks.

The tympanum of the west pediment before beginning the present restoration programme. Photo S. Mavrommatis

The regulatory framework of the restoration interventions on the monuments of the Acropolis –the Charter of Venice and the supplementary princliples introduced by Professor Ch. Bouras specifically for the classical buildings– can only roughly define the extent and methodology of the accepted interventions on the monuments of the Rock. Within that theoretical framework of principles and consequent commitments, the practice of restoring the Acropolis monuments swings between purely rescue intervention and their actual display, frequently encountering the difficulty of boundaries. The question of limits to the restoration intervention, of ethical, aesthetic and ideological boundaries is common ground for scholarly concern in all the proposed works of anastelosis.

The Committee for the Conservation of the Acropolis Monuments (ESMA), applying the principle of transparency to the decision process through interdisciplinary dialogue, organises regular International Meetings on the restoration of the monuments of the Rock. As in the Meetings of 1989 and 1994, the participants of the International Meeting of 2013 were given a questionnaire on some of the programmed restoration interventions, so as to gain the opinion of as many specialists as possible. The results of the answers given by 66 participants are summarised as follows.

Programme 4: Restoration of the west side of the Parthenon
Sub-programme 4: Restoration of the central orthostates of the pedimental tympanum

Thirty of the 66 participants (appoximately 45%) tend to favour full restoration of the pedimental orthostates (solution C), with complete restoration of the missing seventh orthostate in new material. The supporters of this proposal place a higher priority on the aesthetic value of the Parthenon than on its other well-known values.

This view of the morphological reconstruction of the tympanum is in almost complete agreement with the restoration practiced by the ESMA , that is, to restore the original geometry, form and construction of the architectural members. This contributes to the elimination of artificial indentation at one of the most distinguishing and characteristic views of the monument and it offers the visitor coming through the Propylaia a picture that is in harmony with that of the north side. At the same time it improves its comprehensibility and educational value in accordance with the canons of the Charter of Venice. The significance of the pedimental crown as a feature in the recognition of classical architecture, the ideological burden of the Parthenon as symbol of western culture as well as the prospect of eventual return of the Parthenon sculpture are given as additional reasons for restoring the aesthetical integrity of the tympanum. Application of this proposal, moreover, is considered to be advantageous from the static and structural standpoint: it will improve the static efficiency of the monument, it will conceal the backing wall of the pediment, invisible during antiquity, and it will restore the joining system of the tympanum in accordance with its ancient structure.

Interpreting the Charter of Venice as if it were a contract is thought to underlie concern about the eventual change in the degree of the monument's authenticity, which would reduce the predominant artistic value of the Parthenon. As an additional and necessary parameter for choosing the best plan for restoration, it is proposed to make a comparative evaluation of the cost –relevant to authenticity– and the aesthetical benefit. With this in mind, some argue that

improvement of the aesthetical quality of the monument increases its authenticity. Indeed one opinion holds that the principle of the Charter of Venice dictating the use of new material for filling an empty space only in a case where it is to support an ancient member, is to be applied even more flexibly. In cases of restoring structural areas that are determinative for the general picture of the monument or constitute prototypes or pronounced architectural features, such as the pediment, it is considered necessary to evaluate together facts such as the size of the open space in relation to the size of the monument, and the existence or not of authentic material on either side. It will be remembered that the ESMA has already adopted solutions in the past, in this same spirit, in the Propylaia and in the Erechtheion. Positive results for the picture of those monuments came from the decision to add –with strict criteria and in limited cases only– more new material, even whole members of new marble, without always having authentic supporting material.

The change in the picture of the monument is viewed as an expected sequel to the restoration interventions. It is considered compatible with the principles and practice of restoration by the ESMA, since it is far from a philosophy of extensive rebuilding and does not lessen its aspect as a ruin. The speculation as to whether the picture of the Parthenon consolidated in collective memory will perhaps change, elicits a response in which the opinions even of supporters of more conventional proposals tend to coincide. The memory of the international community about the degree of ruination of a monument is weakened and is probably changeable, both because of the downpour of icons inflicted by the spread of digital technology and because of the bi-directional relation of collective memory and restoration policy.

Programmes 7 & 8: Restoration of the side walls of the cella

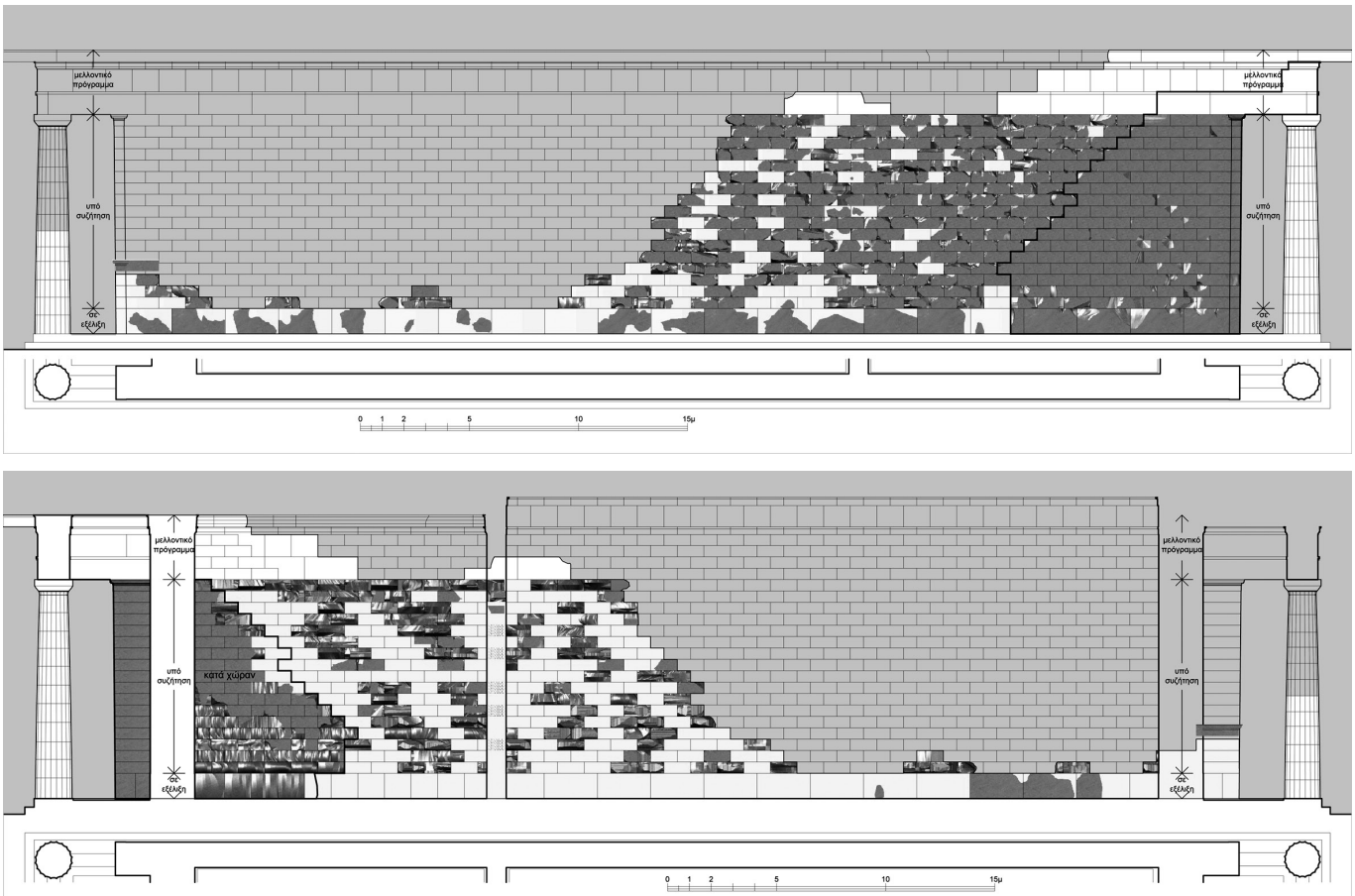
For the programme of restoration of the north wall, 38 of the 66 participants (about 58%) prefer the solution of filling in the interior face of the wall undergoing restoration, while retaining parts of the groups of wall blocks without fillings where feasible, on the basis of preliminary structural monitoring (solution B).

Resetting 252 identified wall blocks in their correct positions or in similar positions is considered to be the most appropriate way to protect and to make use of them. In most replies it is considered that the authenticity of the monument is not decreased by the use of new material in up to around 30% of the total number of blocks to be set and that it is compatible with the ESMA's restoration principles. Furthermore the proposal is viewed as advantageous, since the proportion of new material being incorporated, apart from being absolutely necessary in structural terms, reduces the cost of the restoration intervention in comparison with the proposed alternative solution. In addition, the partially filled-in interior face of the wall will harmonise better with both the sections of the north colonnade already restored and with the west parts of the Pronaos columns when their restoration has been finished.

In this proposal the evidence of the historical phases of the building remains visible, that is, the marks of the ancient fires and consequent thermal stress of the marble. Simultaneously, the aspect of the building as a ruin is assured, since the intervention is confined to the interior. Some draw attention to questions of an aesthetic nature that will emerge from the adjacency of new wall blocks to those damaged by thermal stress: on one hand the blocks that are not filled in will produce recesses and strong shadows, on the other hand the structurally necessary blocks to be added must be set in such a way that they are graduated according to height, so as to transfer the weight to the orthostates. This will supposedly cause some confusion in "reading" the restoration. Experience from reconstructing the walls of the Erechtheion, where the application of an analogous methodology justified the ESMA's intervention, is considered to be valuable for the resolution of these problems.

The restoration of the north wall makes the construction of a buttress inevitable for structural reasons and justifies an intervention that does not coincide with the principles of the ESMA. The buttressing of the north wall is assumed by the cross wall, the segmentary reconstruction of which to the height of the orthostates for a length of 4.20 m. is approved by 49 of the 66 participants (around 74%). Given that both the proposed solutions provide for reconstruction to a greater or lesser extent, this proposal has the advantage of being a lesser intervention. It calls for the use of a smaller amount of appropriate new material, in agreement with the ESMA practice of restoration. This distinctive restoration of the interior of the cella displays its division into two apartments –prototypical plan for classical architecture– without undoing the form of the wall as it was during the Byzantine and Ottoman periods, when there was a monumental entrance there and probably also windows.

A number of the participants emphasise the need for a more inclusive planning that would include in addition the restoration of the south wall. It is noted that, with the restoration of the south wall as well, solution B will give the faulty impression that there was an opening in the middle wall. A number of variations to solution B were also



Proposal for restoration of north wall of the Parthenon. Above: exterior view. Below: interior view partially supplemented. Drawing: K. Skaris, 2013

proposed. These pertain to the wall blocks that would project at the south end of the buttress, a review of the form and size of the buttress, the distinctive indication of its continuation, the division of the area during the initial phase of the temple, and the restoration together of different phases of the cross wall, since there is enough evidence for its formation in periods later than the antiquity.

Programme 11: Restoration of the west pteron ceiling of the Parthenon

On the question of restoring the west pteron ceiling, 45 of the 66 participants (approximately 68%) are in favour of full restoration, with the addition of all the members (beams and coffers), both ancient and new from the decade of the 1950's (solution B).

Provided that the studies of static efficiency and seismic resistance will have fully and exhaustively explored this solution, the replies are focussed on the aesthetical advantage that setting new coffer slabs in the better preserved side of the temple would have. It is considered that covering the ceiling would restore some of the original space perception of the ptera and, to a degree, the lighting conditions in the west side and visibility of the frieze in antiquity. It will also increase the comprehensibility of the architectural form and educational value of the Parthenon. It is argued in particular that covering the ceiling will provide weather protection for the casts of the frieze, the underlying members and the inscriptions and cuttings that form valuable evidence of the Parthenon's history from Byzantine to more recent times.

There are reservations about the anticanonical gradation of light in the west part of the monument, as the opisthonaos, the north and south ptera will remain uncovered. A few of those supporting solution B propose limiting the number of coffers to be set, an alternative proposal expressed as well by some of the supporters of solution A.

Concerning authenticity, the use of new material up to an amount of 62% of the total to be set is considered of minor significance in relation to the benefits of the intervention, given that the new members will not be directly visible and the picture of the monument as a ruin will not be altered.

The utilisation of coffer slabs, ready-made and of high-quality stone-cutter's

workmanship, is perceived by the overwhelming majority only as an incentive for full restoration of the ceiling at low cost. Instead, the argument about the value of the coffers as evidence for the history of the restoration, elicited only a limited response. The bond between this proposal and the ESMA philosophy of anastelosis occupied a very small percentage of its supporters, who, however, correlated it with a similar intervention in the Propylaia.

To recapitulate, in the responses to the questionnaire regarding the programmes for restoring the central orthostates of the pedimental tympanum and the restoration of the ceiling in the west pteron of the Parthenon, a more flexible application of the principles of the Charter of Venice is favoured, in so far as the percentage and conditions of use of new material obtain, while emphasizing display of the building as opposed to simple rescue intervention for the monument's protection.

APPENDIX

Programme 4

In favour of solution C: Benvenuti, Boletis, Charalambous, E. Delinikola, N. Delinikolas, Eleftheriou, Fytos, Giovanetti, Hadziaslani, Holtzmann, Ioannidou, Kaimara, Kokkinakis, Koufopoulos, Kyriaki, Leonti, Mamalougas, Manidaki, Ninis, Oikonomopoulos, Palaiologos, Papademetriou, Paraschou, Petropoulou, Seki, Skaris, Theocharaki, Touloupa, Vrouva, Zivkov.

Programmes 7 & 8:
Anastelosis of the side walls of the cella
North wall

In favour of solution B: Aslanidis, Benvenuti, Boletis, Chairi-Papayiannakou, Chlepa, Conforto, Coulton, Eleftheriou, Filetici, Fytos, Hellner, Holtzmann, Hufschmidt, Ioannidou, Kalligas, Karagiorga, Karanasos, Kienast, Koutsadelis, Kyriaki, Machaira, Mentzini, Moraitou, Oikonomopoulos, Papandropoulos, Papantonopoulos, Papayiannakos, Petropoulou, Samara, Seki, Sourtzi, Tanoulas, Tavouktsi, Terrapon, Theocharaki, Touloupa.

Cross wall

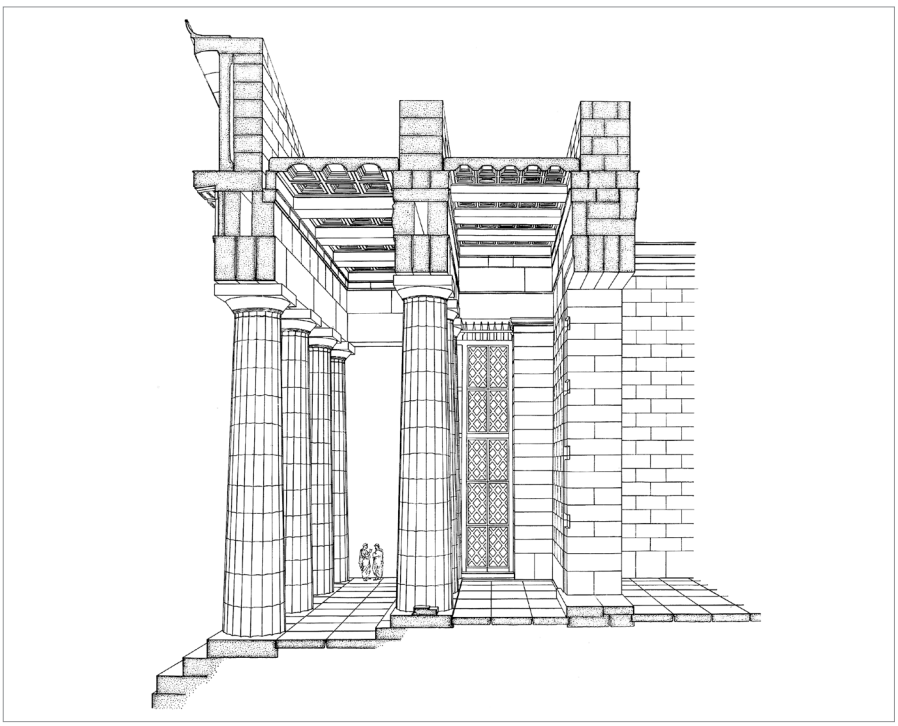
In favour of solution B: Aslanidis, Benvenuti, Boletis, Chairi-Papayiannakou, Christodoulopoulou, Conforto, Coulton, E. Delinikola, N. Delinikolas, Eleftheriou, Filetici, Fitton, Fytos, Hadziaslani, Hellner, Holtzmann Hufschmidt, Ioannidou, Jenkins, Kaimara, Karagiorga, Karanasos, Kienast, Kokkinakis, Koufopoulos, Kyriaki, Leonti, Machaira, Mamalougas, Manidaki, Mentzini, Moraitou, Ninis, Oikonomopoulos, Papantonopoulos, Papayianakos, Paraschou, Pedersen, Petropoulou, Pinatsi, Samara, Schmid, Skaris, Tanoulas, Terrapon, Theocharaki, Touloupa, Zivkov.

Programme 11: Restoration of the ceiling of the Parthenon west pteron

In favour of solution B: Biris, Boletis, Charalambous, E. Delinikola, N. Delinikolas, Fitton, Fytos, Giovanetti, Hadziaslani, Holtzmann, Ioannidou, Jenkins, Kaimara, Karanasos, Kienast, Kokkinakis, Konteas, Koufopoulos, Koutsadelis, Kyriaki, Leonti, Mamalougas, Manidaki, Mimidou, Nakasis, Ninis, Oikonomopoulos, Palaiologos, Papademetriou, Papandropoulos, Papantonopoulos, Paraschou, Pedersen, Pinatsi, Samara, Schmid, Seki, Skaris, Tavouktsi, Tanoulas, Theocharaki, Touloupa, Voyatzis, Vrouva, Zivkov.

Alternative proposal for setting a limited number of coffers: Koufopoulos, Kyriaki, Mamalougas, Manidaki, Papandropoulos and supporters of proposal A: Eleftheriou, Mentzini, Petropoulou, Sourtzi.

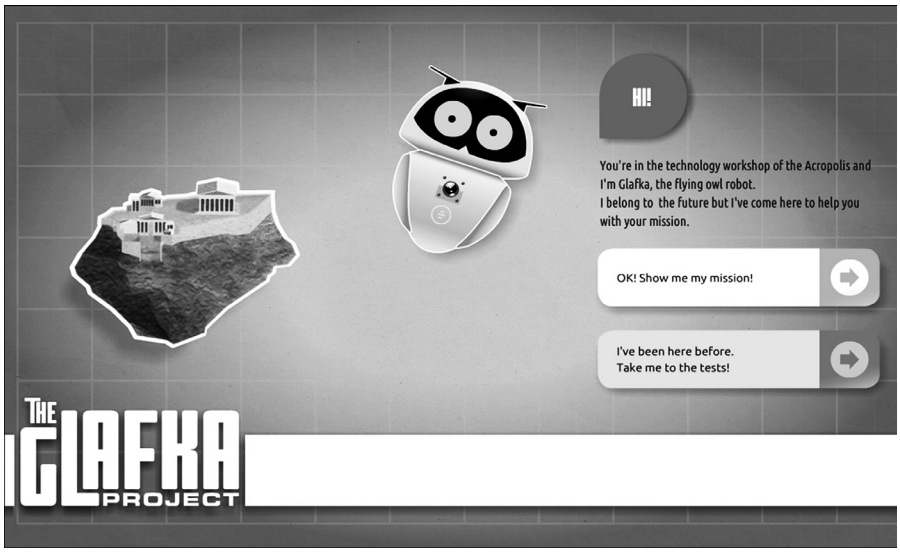
Athanasia Sofou
Archaeologist, Ph.D.
Documentation Office



Perspective section along length of Parthenon Opisthonaos. Drawing: A. K. Orlandos, 1978

Introduction

In March 2013, the Information and Education Department completed the online educational application “The Glafka Project”, in Greek and in English. Designed for children over 12 years, the application refers to the restoration of the Acropolis monuments and follows the hollistic and multi-dimensional approach that we implement in all our projects. Thus, after the organization of an educational programme and the issuing of a relevant Teacher’s Pack, we proceeded with the designing of a web application. As is evident in all our projects, the Department places special emphasis on the evaluation of our activities, a process followed also with this new application and presented in this paper.



The “GLAFKA project”, an online game about the restoration of the Acropolis monuments

Presentation of the application

The theme of the application is presented with the help of Glafka, a flying owl-robot mascot. It is based on a scenario with five thematic units combining characters, roles, missions and the awarding of the child-user. Each unit includes the *preparation*, that is, a brief presentation of the theme, and the *test*, a game in which knowledge of the entire unit is summarized.

- “The Journey”, the first thematic unit, has as a theme the problems of the monuments and the reasons for the interventions. In the game the children are invited to “guide” a digital model of the Acropolis in its virtual voyage through time, avoiding the obstacles that cause the damage.
- “The Help” is the unit that presents the types of interventions, the structural restoration and conservation of the surface of the monument. In the game the child has to place the steps of structural restoration in the correct order.
- “The Crew”, the third unit, refers to the various specialties of the restoration group who carry out the restoration works. In the game the child recognises the professions of the restoration group.
- “The Action” presents the restoration work carried out on each one of the monuments with the help of numerous images giving examples of actual practice. The game emulates the reassembling of the temple of Athena Nike, which was dismantled and put back together during the restoration project.
- In the last unit, “In the Future”, the theme is the machines and the new technologies used today in the restoration project. During the game, children are asked to find where and how the new technologies are now being used in the restorations.

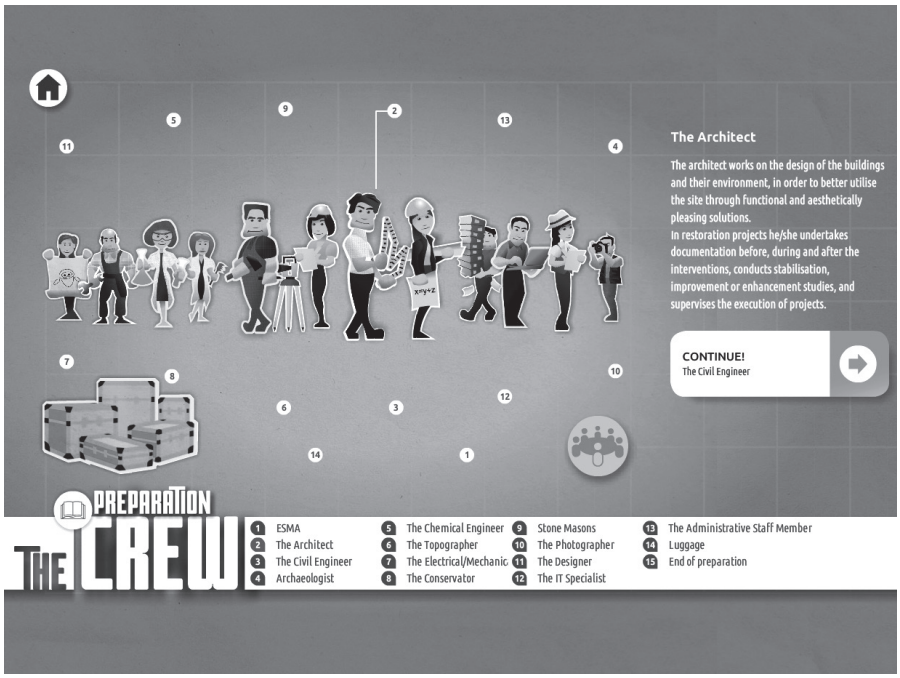
When the children-users have gone through all five tests, they have completed their mission and can now proceed to the final stage: to design the robot, to colour it and, of course, to receive their prize.

The aim of the application is to familiarize the children with the restoration works carried out on the Acropolis Rock, a subject that is not well known either to the pupils, or to the general public. It is an application that works independently, even if the children do not visit the archaeological site. It can also be used as a supplement in order to re-enforce the experience of their visit. The information is combined in a pedagogical way, with several goals for the children:

- to have a pleasant interactive experience and to enjoy themselves,
- to be stimulated to process the information through the scenario,
- to comprehend significant and possibly difficult concepts making use of the multimedia presentation and
- to be encouraged to visit the archaeological site of the Acropolis or another site where comparable restoration works are being done.

The designing, development and artistic editing was done by the web designer Y. Koutsoukos. Professor K. Antoniades was the consultant for the application. During the designing phase, we defined the technical specifications and the features of the application, taking into consideration the principles of contemporary standards of cultural information. There was general agreement on:

- the high aesthetics of the graphic environment,



"The Crew" is the unit that presents the various specialties of the restoration group who carry out the restoration works

- user-friendly navigation and clear menu,
- comprehensible presentation of the contents and
- interactive approach of the contents both in the units of presentation and in the several games.

In particular, for the implementation of the scenarios of the games, the following criteria were followed:

- limited extent of the games (mini-games) so that as a total they can be finished in a short time (for example a school hour),
- easy launching and then gradually more difficult and
- the evident progress that is presented and identified in the course of the game.

In the course of designing, the application was evaluated by various users, especially by High School pupils. The formative evaluation was an ongoing process and did not follow any strict or specific methodology. It was especially helpful for the language, the contents, the navigation and in general the designing of the interface.

Evaluation of the online application

After the first year on the internet, we tried to find out how the application affected school groups. A systematic evaluation of the application, which would include detailed statistical analysis, observation and interviews of various groups of users together with the use of questionnaires, would have been ideal. This, however, was not feasible within the resources of the Information and Education Department. Despite the objective difficulties, with the process of feedback as a priority, we conducted a pilot evaluation by means of a questionnaire. The evaluation was aimed at testing the extent to which the application meets the aims and specifications set during the designing phase and to ascertain that the contents fulfill its goals.

Three hundred and sixty pupils (15-16 years old) from 18 schools in Attica took part in the evaluation, in addition to the 38 teachers who escorted them in the open-day educational programme "Acropolis and Restoration" in March 2014. Prior to the programme, in a special preparatory seminar organized for the teachers the application "Glafka" was presented. The teachers were advised to navigate in the application at school or to urge their pupils to navigate at home and then, whoever wanted, to evaluate it. Two forms of questionnaires, one for the pupils and one for the teachers, were returned to the Information and Education Department before the programme. A particularly large number of questionnaires was collected: 347 from the students and 37 from the teachers.

The questionnaire for the pupils comprised closed type simple questions that would not discourage the pupils to answer. Predefined replies to the questions, YES, NO and PERHAPS, were set for the pupils to indicate what they liked in the application, with the possibility of adding clarifications or comments.

The questionnaire for the teachers included both open and closed type questions. The teachers graded predefined features of the application on a scale of 1 to 4, with 4 being the best. From the teachers we principally wanted to draw suggestions and ideas as to how the "Glafka" could be utilised in the educational procedure.

Analysis of the results of evaluation

Of the 347 pupils who participated, 62% were girls and 38% were boys. The educators were mainly philologists (81%). By assessing "Glafka", we have tried to check if the application features such as a) the technical characteristics, b) the concept and process of navigation and c) the contents of the application, are applied in accordance with requirements.

"Glafka", the flying owl-robot mascot, designed by Y. Koutsoukos

The technical characteristics of the application

Analysis of the questionnaires shows that only 3% of the pupils had a technical problem, without specifying it.

In terms of the graphic environment, around half of the pupils (53%) replied favourably that they liked it, whereas only 15% replied negatively and 32% "PERHAPS". It is of interest that out of the total number of pupils who replied favourably, 68% were girls and 32% were boys. A few pupils commented that the addition of sound was needed (8%). Some pupils (12%) asked for more interaction in the games. The comments about interaction came from pupils who had visited "Glafka" in the classroom and will therefore have wanted a team involvement apart from an individual one.

Of the 37 teachers, 31 visited the application at school and remained for an average of one hour, without reporting any technical problem connected with the functioning of the programme. Two of the other 6 replied that they had a problem with the infrastructure (probably the lack of IT labs or a weak internet access) and 4 noted lack of time because of having to complete the curriculum. To the request to grade the colours and graphics of the application, 4 marked it excellent, while most of the teachers asked, graded it with an average of 3.3.

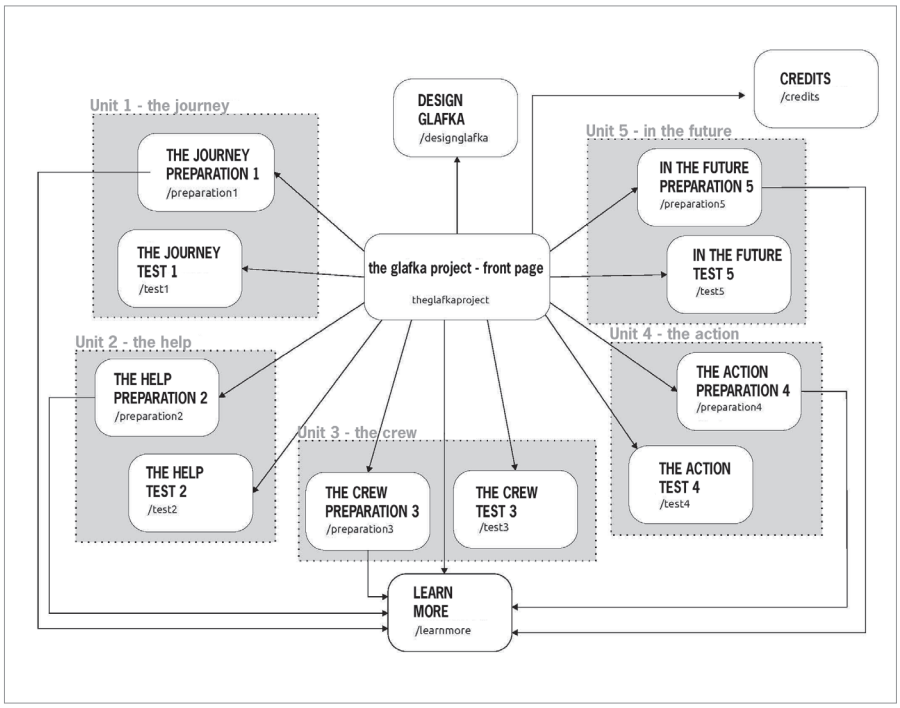
Navigation of the application

The navigation was based on the following scenario: the young user meets "Glafka" in the technology lab where he/she has to prove through 5 tests that he/she is a specialist in the subject of the Acropolis restoration. Before each test the user is prepared with the help of Glafka.

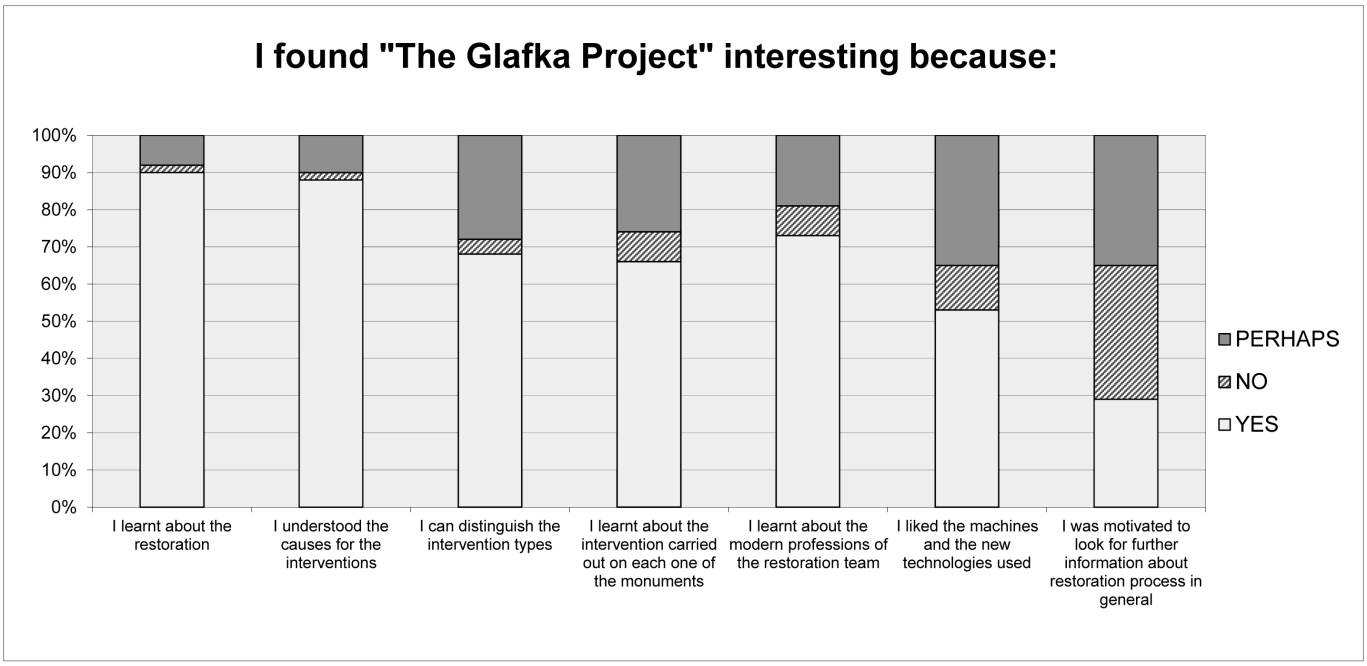
Seventy percent of the pupils spent 10-45 minutes on the application and the rest was divided between a span of less than 10 minutes (14%) and over 45 (16%). Around 30% needed to enter more than once to complete the tests. The majority of the pupils finished all the tests of the application (86%). Most of the pupils who did not enter at all or who broke off their navigation noted that they did not have available free time. Only 3% of them met with with difficulties or got tired.

It is interesting that the most popular method of navigation was the linear. Most of the pupils (75%) completed all the tests in turn, while some (15%) chose chance navigation or selective exploration. The rest did not specify.

Moreover, a big majority of the pupils (72%) replied positively that they liked the idea of separating each unit to preparation/game. The same proportion found the navigation from one unit to another user-friendly. The motivation to unlock the design section of the application after successfully completing the tests, appears to have worked well since 65% replied that they liked it. Finally, even if the pupils were 16 years old, only a limited number (7%) said they thought the application unsuitable for their age. Some specified that they would have preferred a gradual increase in difficulty in order to hold interest.



Application map: Y. Koutsoukos



The pupils' impressions. We set a list of 7 predefined replies related to what they liked in the application checking YES, NO and PERHAPS.

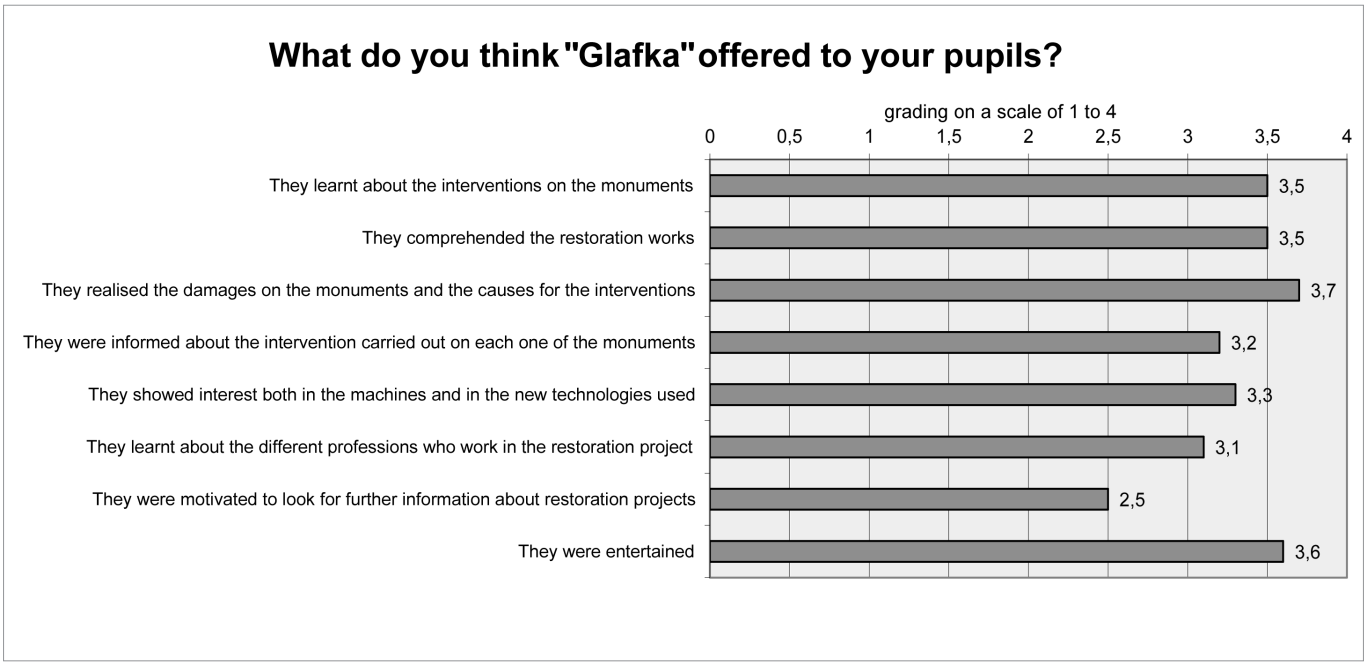
The teachers also evaluated the characteristics of the navigation in the same way. It is notable that they gave the best grade (3.8) to the concept of presentation of the theme. At the same time, it is apparent from the grades that they were satisfied with the menu and with the navigation from one unit to another (3.4). The division of each unit into theory and practice likewise met with their approval (3.6). Refering to the age to which the application is addressed (over 12 years), 27 teachers considered it suitable and 8 did not. Seven (7) of the 8, considered that it is also addressed to children under 12 years and one to children of 14 and older.

Contents of the application

The pupils in general, during the special programmes on the Acropolis restoration works, view the theme of restoration as interesting and captivating, since it combines antiquity with the new technologies and science. This precise feeling is what the application "Glafka" was intended to achieve. By evaluating it, we tried to ascertain if this purpose had been met.

The informative content of the application is evaluated positively, as seen also in the relevant graph above, since 90% of the pupils were in complete agreement that they had learned about the restoration interventions and understood the problems and reasons for the interventions. A slightly smaller number (70%) replied that they understood the specific information about the restoration such as the types of interventions, the works on each monument and the professional specialties of the personnel, while about half (52%) said that they were interested in the machinery and in the new technologies utilised in the restoration. In the statement, "I was motivated to look for further information about restoration process in general" 28% replied affirmatively, 37% negatively and the remaining 35% "PERHAPS". It is worth noting that in a similar question in the evaluation of the educational programme "Acropolis and Restoration" in March 2012 (see the relevant article in "The Acropolis Restoration News", issue 12), it emerged that the pupils who had visited the workshops on site were more motivated to seek information about restoration projects. The result of this reply is that the experience of the visit cannot be replaced by digital media, but it can be supplemented and extended.

The replies of the teachers were similar. As is evident in the graph of the next page, to the question "What do you think "Glafka" offered to your pupils?", the teachers considered that the pupils had become well informed about the restoration works and that they understood better the theme and process of restoration interventions (average grade 3.5). Their opinion was that the children had become aware of the problems and reasons for the interventions (average grade 3.7). Next, they graded around 3, their interest in the restoration work on each Acropolis monument, in the new technologies employed, and in the



The teachers grade on a scale of 1 to 4, with 4 being the best, the impact of the "Glafka project" on the students.

professions of the personnel. Finally the teachers graded 2.5 the possibility to spur the pupils to seek information about other restoration programmes for monuments.

Conclusions

This first evaluation offered valuable results both for the application itself and for similar activities in the future.

A general observation about the application that emerges from a question of the pupils' questionnaire, is that the majority (58%) found the application to be entertaining and that for 78% it was different from the usual. Moreover, despite the complexity of the subject, the pupils understood the content, since around 88% replied that they had learned about the restorations and understood the problems and reasons for the interventions. Based on a grouping of the pupils' proposals, the following improvements could be made:

- enrichment of the presentation of the content with media such as sound, video and photographs,
- creating more interactive games and
- improving the graphics.

From analysis of the questionnaires of the teachers, the pupils evidently had a pleasant experience and were motivated to become more involved with the subject of the restoration project. In a next probable phase of evaluation, it could be investigated whether this experience is shared equally by pupils with learning problems or special needs. It would also be interesting to compare the experiences of pupils playing in groups and individually. It is worth noting as well that 17 teachers report that they will make use of the application in the future research projects of their pupils. This use in turn means that the Information and Education Department should update and make regular additions to the content that will be a reason for the users to return. This involves further funding not included in the budget of the application. Even so, the difficulty of adding content is offset by the regular updating of the content available from the YSMA website and from the digital Repository of educational content for the Acropolis in the following address: **http://repository.acropolis-education.gr/** where the teachers can find the educational material produced by the Department.

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Head of the Department
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Head of the Department until 2011

Information and Education Department

** The web application "The Glafka Project" is available in the following address:* ***http://www.ysma.gr/theglafkaproject/***

During the two years that have passed since our previous communication (December 2013), the Acropolis Restoration Service (YSMA) has been very active in the field of education and information of the general public, thus adhering to one of the basic ethical tenets of the anastelosis.

Educational activities

The Information and Education Department of the YSMA carried out a variety of educational activities in 2014 and the first half of 2015 for educators, pupils, families and the general public.

Specifically, 252 educational programmes were held in the Acropolis Museum, attended by 4,983 pupils in the primary and high school of 138 schools. The subjects concerned the Parthenon sculpture, the ancient temples and the Olympian deities. Educational activities were also organised especially for the pupils of the Lykeion. This was a two-day educational programme entitled "Acropolis and Anastelosis" which was held at the Acropolis for 360 pupils of the 1st year of Lykeion from 18 schools in Attica. The pupils, assisted by the specialised personnel of our Service, learned about the extensive modern technical work under way on the Acropolis, by following a series of workshops in the monuments themselves and in the work-sites. The Department then took part in the celebration of "European Heritage Days, 2014" with the special educational programme "The faces of Time on the Acropolis monuments", arranged in collaboration with the Ephorate of Antiquities of Athens for a total of 75 pupils from the 2nd year of Lykeion. In the context of our collaboration in the programme DIAPOLIS (Education of Foreign and Repatriated Students) we worked together with the 2nd Lykeion of Aghioi Anargyroi and with the pupils of the high-school 2nd year we perused the subject of ancient colour, working both in the Acropolis Museum and on the Acropolis itself. To conclude, the Christmas and summer educational programmes held in the Acropolis Museum were attended by 260 children of 7-12 years in age.

The Department's museum kits were used by 14,590 pupils in 348 schools throughout Greece. The two loan packs entitled "A Day at the Acropolis Museum with the Goddess Athena" and "Ancient Colours", planned for families, were used in the Acropolis Museum by 4,888 families (3,366 from Greece and 1,522 from abroad), thus by some 14,665 children. The educational material for families was improved by the addition of four new study leaflets, two for the Acropolis and two for the Acropolis Museum. The first two, relevant to the Acropolis can be found by both families and educators in the Repository of Educational Material for the Acropolis online (**repository.acropolis-education.gr**). The first is entitled "Exploration map of the Acropolis for children". Through a coloured restoration-drawing of the Acropolis in classical times and a brief description of each monument, children of 9 and over explore the monuments, seeing what they look like today and their appearance at the time they were built. The second is entitled "10 questions about the restoration of the Acropolis monuments". This includes replies to the questions most frequently posed by pupils over 12 years in age, and by the

Pupils watching a workshop inside the Parthenon, in the framework of the programme "Acropolis and Anastelosis". Photo T. Souvlakis 2014.

Study leaflet for parents and kids at the Acropolis Museum

general public about the construction of the monuments and their restoration. The two leaflets relevant to the Museum can be obtained by families free of charge from the Information Office of the Museum. The first, entitled "From 1 to 10 at the Acropolis Museum" provides a first museum experience for the youngest friends of the Museum (ages 5-8 years). With the second, entitled "An invitation to the Olympian gods at the Acropolis Museum", the little visitors (8 to 10 years) investigate specific exhibits in the Museum illustrating the gods of Olympos. Evaluations show that 2,820 families toured the Museum adding to the experience of their visit with the two new investigation leaflets. Also published in 2015 is the Section's new catalogue of educational activities entitled "Educational activities for the Acropolis".

Seminars were held for 625 educators and students to whom educational material was distributed. Thematic seminars based on the corresponding educational material of the Department have been conducted since 2013. Educators receive information as to how they can utilize the material to prepare the pupils better prior to their visit.

The Department also participated in two Symposia with poster communications. The first poster was "Digital educational applications for the Acropolis", presented at the 1st Symposium on the theme "Information applications and quantitative methods in archaeology (CAA-GR)", held at Rethymnon (March 2014). The second, "Educational activities for conservation of the Acropolis monuments" was presented at the Symposium on the theme of "The conservation of cultural heritage: challenges and redefinitions" that took place in both the Technopolis of the Municipality of Athens and in the Acropolis Museum (May 2015). Finally, the Department participated in a one-day Conference at Alexandroupolis, where it presented its activities as a whole. The Conference was organized by the Department of Education Sciences in Early Childhood, of the Democritus University of Thrace, and was designed for post-graduate students in the context of "Museum Education". The presentation was accompanied by training workshops in which the students, using the Depatrment's museum kits, designed educational activities for archaeological sites and museums of their areas.

The YSMA director V. Eleftheriou with Professors D. Anglos (left) and Fred S. Kleiner during the presentation of the Acropolis works at University of Boston. Photo C. Griffin, 2014

Seminars and One-day Conferences on the Acropolis Works

In March and April 2014, the Director of the YSMA, V. Eleftheriou, accepting an invitation from the Onassis Foundation in the framework of their organization of a Programme of University Seminars, went to the USA to present the current restoration programme. The presentation was delivered at numerous universities in the USA, specifically the Graduate School of Architecture, Planning and Preservation of Columbia University (24 March 2014), Yale University, in the context of their Greek Studies programme (25 March 2014), the Department of History of Art and Architecture of the University of Pennsylvania (26 March 2014), the Department of History of Art and Architecture of the University of Boston (1 April 2014), the Department of Art Conservation of the University of Delaware (2 April, 2014) and, in the context of the Greek Studies Programme of the University of New York, at Stony Brook (SUNY) (4 April 2014). Participating in the same programme was Associate Professor D. Anglos, of the University of Crete and Collaborator at the Institute for Electronical Structure and Lazer of the Foundation of Research and Technology Hellas (FOURTH). He presented the technical cleaning of marble sufaces with lazer technology, which was developed for the first time by the YSMA and IESL-FOURTH in collaboration, for cleaning the blocks of the Parthenon west frieze.

The public responded warmly, showing the interest of the international scientific community in the important work being carried out on the Acropolis.

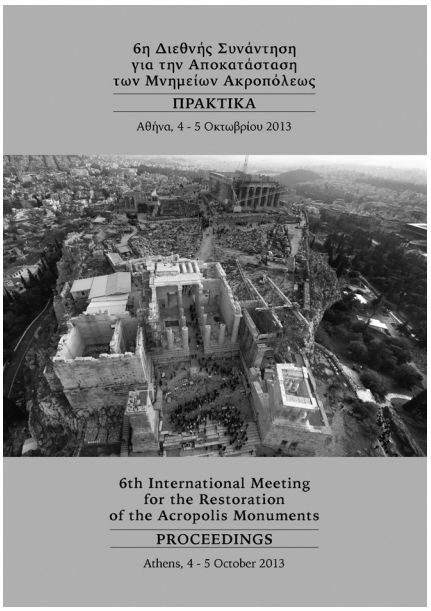
Between 3 and 5 June 2014, V. Eleftheriou and K. Karanasos, architect of the restoration of the Propylaia, were invited to participate as introducers in a seminar organized by the Polytechnic University of Bari in the framework of an educational programme entitled "Specialization in Architectural Heritage and Landscape". In a series of lessons, the introducers gave an extensive account of the Acropolis anastelosis programme and addressed general and specific theoretical aspects of anasteloses, in reference to the monuments of the Athenian Acropolis and the Acropolis of Lindos. K. Karanasos in collaboration with Prof. G. Martines arranged a workshop on the subject of the restoration of the south wall of the central building of the Propylaia. The seminar was followed with interest not only by students, but also by the teaching personnel of the Polytechnic University so that questions that arise in the course of a large work of anastelosis were discussed. The seminar was a success and the invitation was renewed for the next year, thus establishing a two-way channel of communication between the works of the Acropolis and the Polytechnic University of Bari.

The following year, from 9 to 11 June, 2015, the seminar was repeated and those carrying out the Acropolis works were again invited to take part. V. Eleftheriou and K. Karanasos addressed issues related to the anastelosis of the Acropolis monuments, in general, and the Propylaia in particular, as well as general questions of principles and methodology of the interventions. Invited in addition were the civil engineers of the Parthenon restoration, A. Vrouva and Z. Konteas. Specifically A. Vrouva participated with two lectures, the first one concerning work with the method of discrete finite elements, and the second concerning questions about the longitudinal walls of the Parthenon and designing the joins of the Parthenon's north colonnade. Z. Konteas likewise participated with two lectures, the first on the history and questions of statical issues of the temple of the Hephaisteion in Athens, the second on the principles and methods of earthquake design in monuments, with particular reference to the restoration of the west ceiling of the Parthenon. In addition, the two civil engineers jointly organised a workshop on forming design guidelines for restoration projects.

Students of the Polytechnic University of Bari observe laboratory work on the anastelosis of the monuments, supervised by V. Eleftheriou, K. Karanasos and F. Martines, 2014

Greek educational institutions expressed a similar interest in the Acropolis works. On 5 March 2015, the YSMA was asked to present the works at the interdepartmental programme "Protection of Monuments" (Direction B: Materials and conservation interventions). V. Eleftheriou gave a talk on "The work of the Acropolis Restoration Service"; R. Christodoulopoulou, head of the restoration work on the Parthenon spoke about "The current restoration programmes of the Parthenon"; D. Michalopoulou, head of the restoration work in the Propylaia, spoke on "The anastelosis work on the Propylaia and special interventions on the temple of Athena Nike"; E. Aggelakopoulou, head of the Conservation Department, gave a talk on "Conservation interventions on the Acropolis monuments". A few days later, the seminar was completed on the archaeological site of the Acropolis, where the students were guided to the worksites of the monuments.

The School of Civil Engineering of the Aristotle University of Thessalonike held a one-day Conference on 20 March 2015, on the theme "Contemporary interventions on the monuments of the Athenian Acropolis". V. Eleftheriou, R. Christodoulopoulou, D. Michalopoulou and E. Aggelakopoulou participated, developing subjects relevant to those described above. E. Tavouktsi, civil engineer in the Parthenon project, likewise participated with a talk on "Intervention for structural restoration and ques-



The Proceedings of the 6th International Meeting for the restoration of the Acropolis monuments

tions of the reinforcement of stones on the Parthenon".

Publications

Publications of the YSMA were numerous during the preceding period. They have been coordinated and implemented by the YSMA Documentation Office, headed by the archaeologist E. Lembidaki. June 2015, saw the publication of the Proceedings of the 6th International Meeting for the restoration of the Acropolis monuments, edited by A. Sofou, archaeologist of the Documentation Office. Apart from the reports of those participating in the works, the publication includes a full appendix with the posters, as well as an appendix with the replies to a questionnaire on future anastelosis programmes that was distributed to the participants.

Launched at the same time was the publication of the studies made during the previous years, which were already being applied to the monuments. These studies had been distributed in digital form to the participants in the 6th International Meeting. The graphic designer A. Pityrigka was responsible for the artistic editing of the studies. Published in November 2015 were the 8th volume of the Study for Restoration of the Parthenon, by V. Eleftheriou, V. Manidaki and A. Vrouva, edited by the archaeologist E. Karakitsou; the 9th volume of the Study for Restoration of the Parthenon, by L. Lambrinou and V. Papavasileiou, edited by the architect L. Lambrinou; and the 3rd volume of the Study for Restoration of the Propylaia (comprising studies by T. Tanoulas, M. Ioannidou, V. Papavasileiou, K. Karanasos, K. Frantzikinaki and E. Frangiadaki), edited by the archaeologist E. Petropoulou.

The increased interest of the public in the YSMA publications led to the decision to give the stock of old publications (period of 1990-2010) free of charge to the Association of Friends of the Acropolis (EFA) for distribution to those interested. The EFA has already held two successful bazaars (16 January 2015 and 27 March 2015), where the YSMA and ESMA publications were distributed for a symbolic price. It was a most successful enterprise.

Awards

In December 2014 the pertinent European Group of Specialists announced its decision to confer the European Heritage Label on the Acropolis and its surrounding archaeological sites. The Ministry of Culture had submitted its candidacy in March 2014 under the title "The heart of ancient Athens: the Acropolis and its surrounding archaeological sites". The award of the label was indeed a great accomplishment for the Ephorate of Antiquities of Athens. It is worth noting that the Acropolis projects of conservation and restoration, carried out for many years by the YSMA, together with the activities of the Service in education and information about the work, strengthened the candidacy submission and were considered of decisive importance for its positive evaluation.

Exhibitions

The Acropolis monuments and every day contact with them provide a source of inspiration for the people who work there, who frequently create works that express not only their sensitivity to the monuments but also a lively dialectic

F. Mallouchou-Tufano discusses an exhibit during the opening of the art exhibition at the Bath House of the Winds, attended by Ch. Bouras, M. Boura, V. Eleftheriou and C. Hadziaslani. At the left is the sculptor of the work, V. Tsitsibakos. Photo P. Georgopoulos, 2014

relationship with them. Two art exhibitions of works were organized during the past two years with great success. The first was held in the Plaka at the Bath House of the Winds from 16 May to 1 June 2014. The exhibition was supervised by E. Tagaridi, G. Alexandridis, P. Pravitas, M. Zervos and L. Michalakos. The exhibiting artists came from all specialties of the Acropolis work force. The second exhibition, entitled "25+ Acropolites", took place from 9 to 25 September 2014 at the Association of Greek Archaeologists' building. Twenty-seven workers from the Ministry of Culture participated as artists, most of them from teams of the Acropolis rock. The exhibition was supervised by the art-historian N. Papaspyrou and the architect S. Nasainas.

Visit by the General Secretary of the Ministry of Culture and Sports and the Deputy Minister of Culture, Education and Religious Affairs

During this same period, important political persons visited the Acropolis works and were informed about their progress. They expressed the undivided interest of the State in the anastelosis of the monuments. On 24 July 2014, the General Secretary of the Ministry of Culture, Dr L. Mendoni, presided at a meeting of the ESMA on the Acropolis, during which she herself and the ESMA members visited the YSMA worksites. On 17 March 2015 the Deputy Minister of Culture, Mr N. Xydakis, visited the Acropolis and was guided through the works by the ESMA President, Prof. Ch. Bouras, the Director of the YSMA, V. Eleftheriou and the Head of the Ephorate of Antiquities of Athens, E. Banou. Prof. M. Korres was also present at the meeting. During the meeting, the progress of the works was demonstrated and the need for unceasing continuation of the anastelosis programme was stressed.

Lectures - Publications

Once again the YSMA personnel were active in communicating with and informing the scholarly community through a series of lectures and publications.

V. Eleftheriou attended a two-day seminar of the programme "E-Cult Value" on 8-9 December 2014 at the Acropolis Museum, where she presented the YSMA applications for documenting the restoration works, the applications for informing the general public and the digital applications of the educational programmes.

K. Karanasos participated in a seminar arranged by the Italian Archaeological School in the context of the 7th edition of the itinerant Master's Degree Programme of the Accademia Adrianea di Architettura e Archeologia di Roma, giving a lecture on 3 February 2014 about the anastelosis of the Acropolis monuments. On 5 May 2014, he also presented the restoration work on the Propylaia at a seminar arranged in the context of a post-graduate programme on the Conservation of Architectural Heritage at the Polytechnic University of Valencia. The following year on 16 January 2015, by invitation again from the Accademia Adrianea di Architettura e Archeologia, K. Karanasos lectured on the Acropolis restoration, in the framework of the 8th edition of the above-mentioned post-graduate programme. On 29 May 2015, he also participated in a Symposium on the theme "Replica and Museum: approaches and interpretation of historical subjects", with a report entitled "Replica e restauro archeologico: la ricostruzione di nuove membrature architettoniche nel restauro dei Propilei dell Acropoli di Atene".

The architect V. Manidaki participated in the seminar of the Finnish Archaeological Institute "Greek building projects" (22-24 May 2014). Her report was on "The Arrhephorion and the planning of the Acropolis from the mid-sixth to the end of the fifth century BC".

The Conservation Department represented by its Head, the chemical engineer, E. Aggelakopoulou, presented a report on "Technical investigation of the polychromy in the Acropolis monuments" at the International Symposium

Visit by the ESMA to the Acropolis works in July 2014, presided by the General Secretary of the Ministry of Culture and Sports. From left to right: D. Svolopoulos, K. Kissas, V. Kaselouri, P. Themelis, L. Mendoni, M. Korres, N. Valakou, Ch. Bouras and V. Eleftheriou

Tour of the Acropolis works by the Deputy Minister of Culture, N. Xydakis, led by Prof. Ch. Bouras and V. Eleftheriou. Photo T. Souvlakis, March 2015

"Rethinking the Parthenon: colour, materiality and aesthetics", organized by the University of Georgia, USA, between 17 and 18 October 2014. The Department also participated in the Symposium "The conservation of cultural heritage" held from 25 to 29 May 2015, with two reports: the first by G. Fratzi, A. Maridaki and E. Papakonstantinou had as its theme "The conservation of the coffered ceiling of the porch of the Maidens in the Erechtheion"; the second, by E. Aggelakopoulou, A. Panou, I.P. Kotsifakos, G. Fratzi, A. Sotiropoulou, T. Souvlakis and A. Moutsatsou concerned the "Technical investigation of the painted decoration of the architectural members of the Parthenon".

The Head of the Scattered Members Project, E. Sioumpara, gave a lecture entitled "Die Acropolis von Athen in archaischer Zeit. Neue Forschungen und Ergebnisse" at the University Ludwig-Maximilians in Munich (27 January 2014), the University of Salzburg (28 January 2014) and the University of Vienna (29 January 2014). She also lectured on the subject of "Die Akropolis von Athen. Neue Forschungen zum archaischen Parthenon und zur Topographie" at the Architectural Section of the Institute for Anastelosis of Historical Monuments and the History of Architecture, of the Zurich Polytechneion (7 March 2014). She participated with a report on the same subject in the symposium "Greek building projects" organized by the Finnish Institute of Archaeology. On 3 June 2014 she gave a lecture on "The archaic Parthenon. The new restoration and the place of the temple in the history of ancient Greek architecture" in the context of a postgraduate lesson in the Department of History and Archaeology of the University of Athens. On 12 February 2015, she lectured at the American School of Classical Studies in Athens, on the theme "A new reconstruction of the archaic Parthenon: the archaic Acropolis and the development of Greek architecture revisited". E. Sioumpara took also part (14 May 2015) in a Symposium in Berlin arranged by the German Archaeological Institute, with a report entitled "Zahneisen – Werkspuren und ihre Bedeutung für die Topographie der archaischen Akropolis von Athen".

The archaeologist of the Documentation Office, K. Katsianis, participated in a Symposium held in Rethymnon, Crete (7-8 March 2014) on the theme "Communication applications and quantitative methods in archaeology (GAA-GR)". His report was entitled "3-D modeling and navigation tools for the data management system of the Acropolis Restoration Service".

Finally, the rural and surveying engineer D. Mavromati, gave a lecture entitled "Topographical and Photogrammetric Surveying on the Acropolis of Athens" (March 2014) in the framework of the lesson "Photogrammetry Applications" of the Department of Surveying of the TEI Athens. A lecture on the same subject was also given, after an invitation by the same Department, in November 2015.

Epilogue

We conclude with a brief word about those of our colleagues who retired during the previous period after many years of contribution to the Acropolis works: they are L. Zacharopoulos, marble technician who, in the position of head of the working team for many years coordinated and led the team of the temple of Athena Nike; the marble technician, G. Vidalis, who has made an important contribution to the restoration of the Propylaia; the experienced draughtswoman, T. Skari, one of the longest-serving members of the Parthenon restoration office; the draughtsman P. Psaltis, known not only for his artistic sensitivity but also for his irrepressible sense of humour; and the draughtswoman G. Moutopoulou, who with determination and depth documented the different stages of the work of restoration of the Propylaia. To all we wish the best of good luck.

Evi Petropoulou
Archaeologist
Documentation Office

View of the NW corner of the Parthenon from the E, after completing the intervention. Photo T. Souvlakis, 2015

View of the N entablature of the Propylaia south wing, after completing the intervention. Photo T. Souvlakis, 2015

ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
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Ευρωπαϊκή Ένωση
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