



*Dismantling the southwest cornice block of the Parthenon. Photo V. Eleftheriou 2012*

- V. Eleftheriou, 2011-2012, The progress of the restoration works on the Acropolis  
A. Vrouva, The problem of the structural restoration of the capital ΔΚΚ2 of the Parthenon west colonnade  
K. Skaris, The architectural study for the restoration of the Parthenon west tympanum backing wall  
Y. Alexopoulos, M. Katsianis, Digital applications for projecting the Acropolis restoration works on the internet  
I. Kaimara, A. Leonti, S. Paraschou, C. Hadziaslani, Educational programme "A day at the Acropolis restoring its monuments"  
E. Petropoulou, News from the Acropolis  
E. Karakitsou, Nikos Skaris (1923 - 2012)

## 2011-2012, The progress of the restoration works on the Acropolis

When, in 1987, I went to the ESMA offices to meet the committee responsible for the choice of an architect for the anastelosis of the Lindos Acropolis monuments, I could never have imagined that 25 years later I would have the honour of directing the Acropolis Restoration Service (YSMA). Members of that committee were the late I. Zervoudaki, A. Papanikolaou, and G. Knithakis, all recognised scholars, whose contribution to my work with ancient monument was valuable. As Director of the YSMA I would like to thank the members of the ESMA and particularly the President and my Professor, Ch. Bouras, for the trust he has shown me. My thanks go also to the General Secretary of the Ministry of Education and Religious Affairs, Culture and Sports, Dr. L. Mendoni, who approved the appointment and encouraged me in taking up my obligations.

The previous year saw a great change in the staff of the YSMA. Many of the older and more experienced members of the YSMA retired. M. Ioannidou, for many years Director of the YSMA, left on November 27, 2011, after completing 36 years of work on the Acropolis works. From 2000 on, when she assumed the post of Director, M. Ioannidou bore the weight of the organisation and smooth functioning of the Service and this, indeed, during the period of the great works of anastelosis that were accomplished within the 3rd Community Support Framework. M. Ioannidou is continuing to offer her valuable experience in the field of structural restoration of the monuments from the position of restoration expert of the YSMA. On December 31, three of the most important participants of the Acropolis Works retired. First of all we should mention N. Toganidis, architect with long experience in the anastelosis of monuments and for many years head of the restoration work on the Parthenon. For 28 years N. Toganidis worked with devotion and enthusiasm on the completion of the

restoration programmes of the Parthenon. Likewise, the head of the electro-mechanical team, S. Oikonomopoulos, who for 18 years was responsible for the smooth functioning of the electro-mechanical equipment of the YSMA. It should be noted that many of the technical applications and specially designed machinery that facilitated and accelerated the Acropolis works are owed to the inventiveness of S. Oikonomopoulos. Finally, the head of the Information and Education Department, C. Hadziaslani, retired after 23 years of service and ceaseless devotion to the

skolos took part in the Acropolis works from 1987 on and he responded responsibly and with special success to the demands of a difficult work of restoration. Likewise retired are Th. Foutsas, responsible for the Office of Management of Materials, the marble technicians G. Voudouris, K. Mengoulas, K. Dais, V. Takouli, G. Philippousis, the conservator K. Babanika, the draftsman K. Matala, the electricians S. Yiannarakis and S. Gousis, the administrators P. Liakatsia and K. Liakopoulou, and the work technicians A. Athanasopoulos, N. Papadopoulos, D. Sideropoulos and S. Tseperis.



*The west side of the Parthenon after completing works of dismantling.  
Photo T. Souvlakis, 2012*

educational policy of the YSMA and the 1st Ephorate of Prehistoric and Classical Antiquities. C. Hadziaslani conceived, organised and successfully carried out a great number of educational programmes, the purpose of which was to approach the educational community and to make use of the knowledge that comes from study of the monuments for the promotion of the educational process. C. Hadziaslani is continuing to offer her services to the YSMA on a voluntary basis.

We must mention also the head of the Parthenon working team, D. Foskolos, who retired on December 29, 2011. Fo-

Although 2012 was a difficult year from every standpoint, the funding of the Acropolis works was continued as usual and thus the Service was able to fill satisfactorily with new recruitments the vacancies left by the retirement of so many employees. Of the 185 employed today by the YSMA, 50 are new recruits, chosen on the basis of strict criteria in terms of scholarly training or their specialisation in the work of restoration. Now that they have already completed a year in the worksites of the Acropolis monuments, we can say that their limited experience on a specific object is counterbalanced by the enthusiasm with which they are working.

In the Parthenon N. Toganides was replaced on his retirement by R. Christodouloupoulou, an architect with experience in restoration, since her accomplishments include the work on the Parthenon Opisthonaos and the doric stoa of the Asklepieion on the south slope of the Acropolis. The scholarly team of the work includes the architects V. Manidaki, A. Papandropoulos and K. Skaris, the civil engineers A. Vrouva, I. Konteas, E. Tavouktsi, and L. Palaiologou, and the archaeologists E. Karakitsou and E. Mimidou. The architect E. Lambrinou has taken educational leave of absence this year. Heads of the team of marble technicians are G. Angelopoulos and S. Kardamis, who has replaced D. Foskolos, after his retirement.

The works on the Parthenon proceeded on three fronts. On the west side the dismantling of architectural members, which began in May 2011, was completed. A total of 62 architectural members were dismantled from the northwest corner (original evaluation called for 47) and 49 from the southwest (original evaluation 37). The increase in numbers of dismantled members does not signify a planned extension in the area of intervention. It is due, instead, to the fact that only after dismantling can the precise number of blocks that have been used in the hidden sections of the monument be ascertained.

For example, it was found that the marble blocks used for the middle stone of the west architrave, on both the northwest and southwest corners were less in height than the blocks beside them and that the difference in level was compensated for by the addition of four or five marble slabs, 10 to 15 cm thick. Dismantling reached the level of the column capitals, in accordance with the relevant study of V. Manidaki, A. Vrouva and the undersigned. The greatest difficulty lay in the extremely heavy architrave blocks, up to 8.5 tons. Of the twelve that were dismantled, five were already broken, while three more had structural problems to a lesser degree. This necessitated special arrangements for their support before moving them. After dismantling the architrave blocks, it was evident that the column capitals were in worse condition than had been expected. The condition of the second from north column capital of the west side was judged to be especially problematical. The action of the dowels of the overlying architrave blocks caused cracks, which had been dealt with in the past by the addition of exterior metal clamps. After removal of the architrave blocks, more cracks were discovered, invisible on the outer surface, that made the restoration of the members difficult (details in the next article of the present Newsletter). A final decision as to how to deal with the problem will be



***Dismantling the first from north architrave block of the Parthenon NW corner.***

***Photo V. Eleftheriou, 2012***

made when the southeast broken section of the column capital has been removed and the exact state of preservation has been determined. It will be necessary, however, to install a special construction (carrier) to support the entablature at the area of the 2nd intercolumnar space of the west side. This has been studied by the civil engineer A. Vrouva and is to be installed in the autumn.



***The upper surface of the NW corner architrave block of the Parthenon after removal of the overlying members. Visible are the supporting posts of the middle architrave blocks.***

***Photo V. Eleftheriou, 2012***

Seven metopes, four from the northwest corner and three from the southwest corner were dismantled and transferred to the Acropolis Museum. These metopes are the last of the sculptural decoration that is being removed from the Acropolis monuments. Ten ancient metopes will remain on the Parthenon where they will receive conservation in situ. Likewise removed were the copies of the two pedimental sculptures of the west side, Kekrops and Kallirrhoe, which had replaced the originals in 1976. Set in place of the metopes and the pedimental statues will be copies made of a cast material, the

preparation of which is being carried out directly by the YSMA cast team, under the supervision of the civil engineer D. Michalopoulos.

Organic materials, such as bones and fruit stones as well as a few metal objects were discovered in the filling material in the spaces between the architectural members, during the dismantling procedure. The most important find is a bronze dish (phiale) with an engraved decoration; it had been placed in the space between the southernmost metope of the west side and its backing block.

Of the 111 architectural members dismantled, 60 had structural problems. These were due to the action of the metal clamps together with the quality of the marble and, in addition, movements caused by seismic activity. As soon as the ancient blocks had been lowered, in sequence according to priority of resetting, the work of structural restoration began. Twelve blocks have been structurally restored to date.

The installation of scaffolding on the west side of the Parthenon made the entire area



**Lowering the SW metope of the Parthenon with a scene from the Centauromachy. Photo V. Eleftheriou, 2012**

accessible, especially the backing wall of the pedimental tympanon, which was found to be in an exceedingly poor state of preservation. A relevant study for its restoration was made by K. Skaris (details in ensuing article of this issue).

Together with the west side, works on the

north wall of the Parthenon proceeded in accordance with the study by N. Toganidis and K. Matala. The programmed works include conservation of the blocks of the toichobate course and the structural restoration of fifteen ancient blocks of the exterior course of the orthostate. Forty of the fifty marble supplements required in order to assure support of the wall's superstructure, have been made and eight blocks are now ready to be reset.

The anastelosis of the north side of the Parthenon was completed in 2009, and the final surface of the flutes remains to be worked in the areas filled in on the drums of six restored columns. The carving of the flutes, a work requiring high accuracy, has been undertaken by the most experienced marble technicians of the Parthenon team and over 50% of the work has been completed.

In support of all the above works, a moveable trolley on a fixed track was added to the existing worksite arrangements in order to move marble blocks from the west side to the Parthenon cella, and two bridge cranes were introduced for joining architectural members.



**Adjusting a filling to a north orthostate block. Photo R. Christodopoulou, 2012**



**Attaching a filling to a north orthostate block of the Parthenon. Photo R. Christodopoulou, 2012**



**View of the west façade of the Propylaea showing the scaffolding supporting the NW column of the central building. Photo V. Eleftheriou, 2012**



**Dismantling a frieze block from the SE corner of the south wing. Photo K. Karanasos, 2012**

For the Propylaea, 2012 was a period of organisation and preparation for the next restoration programmes. The existing scholarly personnel of the work, comprising the architect K. Karanasos, the civil engineer V. Papabasilieou and the archaeologists E. Petropoulou and K. Kousadelis, was increased by the addition of the civil engineer D. Michalopoulou (head of the now-completed works on the temple of Athena Nike) and the architect K. Mamaloungas. G. Desypris is head of the marble technician team.

Preparation for intervention on the south

wing was started with the completion of the works on the south wall and removal of the scaffolding. According to the study by T. Tanoulas, 60 fragments have been recognised that come from 45 blocks of the south wing of the Propylaea. These had been among the architectural blocks that lay scattered on the Acropolis rock from the time when the Frankish tower was torn down in 1875. In addition, 15 blocks will be dismantled that had been restored during the periods 1946-1954 and 1957-1960 since they either have structural problems or have been wrongly set. The anastelosis of all 60 blocks in their

original positions will not only protect the architectural members themselves, but it is expected to make the south side of the Propylaea easier to know and to understand. During the past year twelve casts for new fillings and five fillings were made and two blocks were structurally restored. A bridge crane with two winches was installed in the spring of 2012 in the south wing of the monument. The second winch, which moves on a projection, was considered necessary so that the towers holding the bridge crane could be founded south of the north colonnade in order not to interfere with the movement of visitors. The worksite infrastructure of the area was completed with the installation of a trolley on fixed tracks for transporting architectural members from the south wing to the worksite area and to make the Propylaea worksite more functional. Because the northwest column capital of the central building of the Propylaea had a serious structural problem, scaffolding was installed and part of the northeast corner of the capital, which had become detached, was removed. A study for the restoration of this area was made by K. Karanasos and has been sent to the Central Archaeological Council for approval.

The secure acquisition of marble for the required fillings in the architectural members is an important factor in the smooth course of anastelosis of both the Parthenon and the Propylaea. For the Acropolis monuments Pentelic marble from Dionysos is used. The YSMA will obtain a supply of 150 cubic metres of marble to meet the needs of the works of the next two years.

In the temple of Athena Nike the restoration of the crown along the north side of the bastion and the arrangement of the subterranean space, where the poros temple is preserved, were both completed. The replacement of the reinforced concrete slab originally planned, was finally avoided and, instead, the existing slab was reinforced with sprayed concrete and



**View of the temple of Athena Nike after completing the restoration of the north crown of the bastion. Photo S. Gesaphidis, 2012**

additional metal reinforcement. With the completion of these works, the worksite installations were removed and the area of the Brauroneion was cleaned, exposing again the base of the Chairedemos dedication in the centre. A study for the arrangement of the site and access to a view of the Temple of Athena Nike is to follow. Head of the marble technicians team, which has already moved to the teams of the Propylaia and the Parthenon, was L. Zacharopoulos.

The works on surface conservation of the monuments continued during the past year headed by the chemical engineer E.

Angelakopoulou. In the Parthenon, with the conservator A. Panou in charge, 17 members of the superstructure of the southwest corner underwent conservation. The conservation team supported the dismantling of the corners of the west side and conservation was carried out on 20 of the architectural members that had been taken down. Conservation of the upper bedding surfaces of the 15 blocks of the north toichobate was likewise completed and bed joints of the blocks of the orthostates and drums of the north colonnade were sealed after carving the final surfaces of the new fillings.

In the Propylaia, with the conservator

K. Frantzikinaki in charge, systematic conservation of the blocks of the superstructure of the south wall of the central building was completed and spikes were set to ward off pigeons. Eighteen blocks of the south wing received systematic conservation and conservation interventions continue on the 3rd and 4th drums of the northwest column in the central building.

In the temple of Athena Nike, with the conservator A. Tsiremeki in charge, conservation interventions were completed on the north crown blocks of the bastion, the orthostates and the blocks of the cymatium-decorated toichobate. At the same time, systematic conservation works were initiated on the blocks of the walls.

In the Erechtheion, with the conservator G. Frantzi in charge, systematic conservation was carried out on orthostates and blocks of the west wall of the cella. In the coffered ceiling of the south porch cleaning by means of the laser system was completed, the removal of deposits of soot from the marble fillings using a chemical paste continued, and work was done on improving the appearance of the old mortar. Specific photography of the ceiling coffers was continued, and infrared photography was used to determine the presence of ancient colour (Egyptian blue).

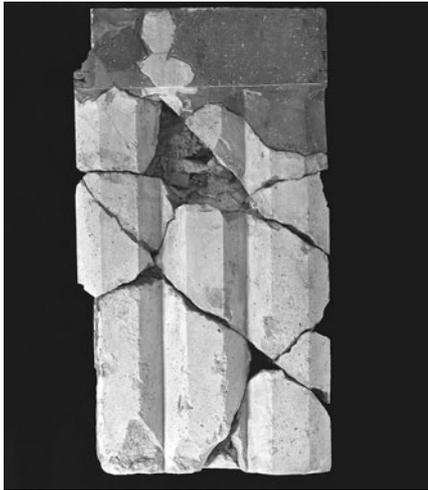
Finally, in collaboration with the Office of



**Adjusting a filling to a north crown block of the temple of Athena Nike. Photo D. Michalopoulou, 2012**



**Carving a filling for a north crown block of the temple of Athena Nike. Photo D. Michalopoulou. 2012**



*Triglyph Inv. No. A.E. 21432 from the Hekatombedon. Photo T. Souvlakis, 2012*

inventorying, documentation and classification of the scattered architectural members, samples were taken and analyses made of the coatings on a triglyph of the Hekatombedon, which had been filled in and conserved in the period around 1900.

The Office of inventorying, documentation and classification of the scattered architectural members, headed by the archaeologist E. Sioumpara, with the collaboration of the archaeologist E. Salavoura, continued the registration and classification of the scattered material. During the past year 297 marble architectural members from the pile in the area of the Arrhephorion were numbered, registered, photographed, and electronically entered and archived. Fragment-piles from the areas of the worksites of the Parthenon, Propylaia and temple of Athena Nike were taken down and the material was separated into architectural members and formless fragments. Some 500 of these fragments were taken to new locations, west of the Ancient Temple of Athena Polias and around the old Acropolis Museum. In the context of preparation for an intervention on the south fortification wall a fragment-pile SW of the old Acropolis Museum was dismantled and 108 architectural members were transported to the area of the Chalkotheke.



*Application of injections into a block of the south wing of the Propylaia. Photo E. Frangiadaki, 2012*

The inscribed stones, MA 13225 (IG II<sup>2</sup> 4117), MA 13226 (IG I<sup>2</sup> 572) and MA 13217 (IG II<sup>2</sup> 3827), which lay SW of the Parthenon were taken to the old Acropolis Museum. After laboratory tests, in collaboration with Dr N. Maravelaki, Professor at the Technical University of Crete, a mortar was chosen that was suitable for joining fragments of poros architectural members. The joining of fragments of 33 poros architectural members is to begin immediately. Finally, the Japanese group surveying the members of the temple of Augustus and Roma under the direction of Yoshinobu Hayashida, Professor at the National College of

Technology of Miyakonojo and the German group studying the inscribed blocks and headed by Ralph Krummeich, received support from the Scattered Architectural Members team with the transportation of stones.

In the framework of research, documentation and display of the work, which is performed by the YSMA Documentation Office, headed by the archaeologist E. Lembidaki, documentation of the restoration interventions on the Parthenon, Propylaia, temple of Athena Nike and Scattered Architectural Members continued to be entered into the archive and



*Mapping fragments of an architrave block of the Parthenon NW corner. Photo V. Eleftheriou, 2012*



**Photographing the superstructure of the Parthenon with ballon. Photo S. Gesaphidis, 2012**

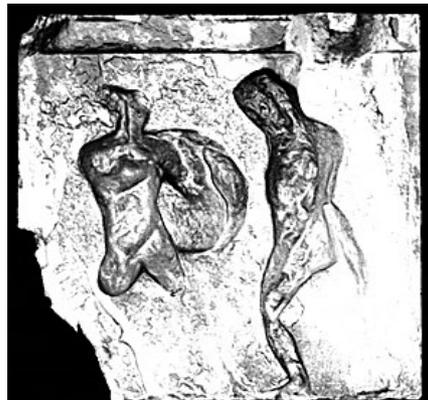
into the digital database of the Service. Cinematographic documentation of the works of anastelosis was also entered in digital form. The work in the central office of the YSMA Archive has recently been supported by the archaeologists M. Katsianis and A. Sophou. The minutes of the ESMA meetings were kept by the archaeologist E. Petropoulou, who also edits the publication “The Acropolis Restoration News” of the YSMA.

In the context of management of documentation by the central Archive, the regulation concerning matters of producing and archiving the YSMA digital documentation was supplemented in accordance with the study by M. Katsianis of correct practices for long-term conservation of the digital collections of the Service (photographs, conventional drawings, archives of automated drawings, texts, audiovisual material). To this end, a database was created (MS Access) for the registration and management of the written works of the YSMA (books, studies, offprints, periodicals), day books, automated design archives (CAD) and photographic collections other than those of the YSMA; entrance of the data has been started. Created also were digital copies of the Service’s studies in PDF format. From

here on reports, studies and proposals will be in digital form as well. Finally, the actual documents of the library (books, offprints) were organised, the audiovisual material of the archive and digitisation of the conventional material of documentation continued (B/W photographs and drawings) and the systematic archiving of documentation in the field of conservation was initiated.

Photographic documentation of the works by the photographer T. Souvlakis, proceeded.

Likewise in the framework of documentation, during the past year the production of orthophotomosaics of the west side of the Parthenon was continued



by the rural and surveying engineer D. Mavromati. So too, select architectural members such as the corner blocks of the raking sima, the acroteria bases and the metopes of the Parthenon, and five archaic column capitals were surveyed with three-dimensional scanning by the rural and surveying engineer A. Valani. The two above mentioned engineers also prepared the contract for the work “Photogrammetric surveying of the Acropolis monuments” after international tenders were made. The procedure began in October 2011 and consignment of the work went to the partnership “Geoanalysis S.A. - Elpho - Fotopo S.A”. The work comprises the production of orthophotomosaics, at a scale of 1:10 to 1:25, of the ground plan of the north side and corners of the west side and the view of the entablature of the north side of the Parthenon. Included also are the ground plan and views of the walls of the south wing of the Propylaia. A photogrammetric survey will also be made of the wider area of the Propylaia and the temple of Athena Nike, at a scale of 1:100. The survey will be incorporated in a previous survey, which was carried out in the context of the work “The Development of Geographical Information Systems on the Acropolis of Athens”.

Also during the past year, the YSMA Electromechanical support section, led by the electrical engineer D. Zois, supported the worksites with the monitoring and super-



**3D models of the surface of Parthenon metopes. Scanning and elaboration: A. Valani**

vision of the electromechanical installations.

The Education and Information Department of the YSMA continued its activities, which are analytically reported in an ensuing article in the present issue of the *Acropolis Restoration News*. The scholarly team of the Department comprises the archaeologist E. Kaimara—who has assumed the headship on the retirement of C. Hadziaslani—A. Leonti and the EKT employee S. Paraschou.

Special mention should be made of the educational programme entitled “A Day at the Acropolis restoring its monuments”, organised in collaboration with the 1st Ephorate of Prehistoric and Classical Antiquities, and held on the 29th and 30th of March 2012. The purpose of the programme was to familiarise the pupils with the works of restoration being carried out on the Acropolis by following a series of laboratories on the archaeological site. Attendance was large with the participation of a total of 600 pupils from the middle grades of 40 schools. The pro-

gramme was drawn up and coordinated by the archaeologists of the Education and Information Department, whereas the works were presented by the scientific and technical personnel of the worksites.

The contribution of the YSMA Accounting Office was again substantial this past year, with P. Katsimichas as head, in the particularly demanding procedure for the economic management and monitoring of the community funds with which the work is supported. Important too was the contribution of the Secretariat, led by Ch. Papanikolaou and the Office for the Management of Materials, where G. Vasilaras was in charge.

The work of the YSMA, internationally recognised for its principles and methodology and for its continuous relation to research and application of modern technologies, was from the very beginning of superior quality. Responsibility for continuing the work in the same framework is great and we are assuming it at a difficult time for the nation and its people. The de-

dedication and obligation that we feel toward the monuments, I should like to believe, will guide us to solving any problems. In this effort we have the undivided support of our retired colleagues, who, despite their formal departure from the Service, continue to attend the works ready to offer valuable assistance to the younger colleagues.

**Vasiliki Eleftheriou**

*Architect*

*Director of the YSMA*



*General view of the Acropolis from the west. Balloon photograph. Photo S. Gesaphidis, 2012*

# The problem of the structural restoration of the capital ΔKK2 of the Parthenon west colonnade

## Introduction

The dismantlement carried out on the northwest corner of the temple revealed the structural problems of the capital ΔKK2 to their full extent. The state of preservation in which it was found necessitated systematic survey of its pathology. A thorough investigation made for the intervention posed serious questions about selecting the most appropriate solution for its rehabilitation. It was clear that the conventional methods that have until now served the purposes of restoring the Acropolis monuments and have been established as formal restoration practice, are not able to provide the required safety factor for maintaining this particular architectural member in its original bearing position. Presented here are the problems encountered in the study and the proposals introduced and studied. This is a very distinctive example in which the various contradictory values in the restoration project had to be carefully weighed.

## Brief presentation of the pathology

The problems of the capitals were described as thoroughly as external observation allowed since the initial study of the state of preservation of the west colonnade was made. Even then it was obvious that the second capital was one of the most severely damaged members, as

during the Balanos restoration a systematic effort had been made to secure the obviously loose fragments.

After dismantling part of the northwest corner new evidence came to light for the structural stability of the capital. It was thus possible to make an overall estimation of the severity of the damage as well as to determine the factors that provoked it.

It was evident that the fractures had been well estimated in terms of form and that they can be attributed to a weak inner stratum of the marble within its volume that was incited by the presence of the dowels. Another fracture was also ascertained, for which there was no external indication prior to the dismantling.

The risk due to specific damages is increased in view of the observations which concern the seating of the SE fragment on the drum beneath and the seating of the inner east block of the second architrave.

The fragments show a clear recession in comparison to the upper surface of the capital. This means that the load of the architrave blocks is carried through their seat on the capital no matter how small a part remains intact, excluding the area of the fragments. This indicates stress concentration in a small area of the architrave. The restoration of the SE fragment of



*Plan view of the capital ΔKK2 after dismantling the first span of the west colonnade. Photo A. Vrouva, 2012*

the capital is therefore considered to be of vital importance for the load stream on the column and ultimately on the ground. The intervention should provide a solution that can deliver a fully functional load stream.

The location of the seat of the SE fragment on the drum below makes the intervention extremely difficult. Cancelling the seat on the drum means that all loads carried by the fragment (almost 2 fully loaded architrave blocks) would have to be assumed by the reinforcement bars.

The above together with a number of dir-



*The column capital ΔKK2 before dismantlement. View from the S. (left), from the W. (center) and from the E. (right). Photos A. Vrouva, 2012*

actions for the restoration of the column capital were presented at the 6th meeting of the ESMA on 24.5.2012.

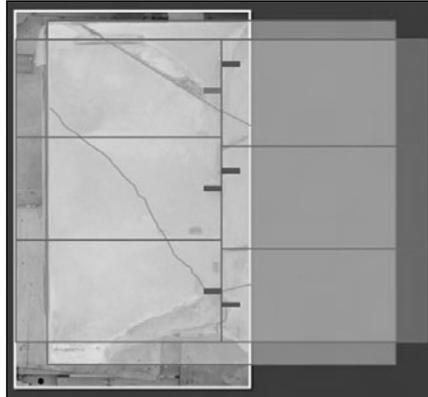
### Methodological approach

For the fundamental decision as to whether a restoration could achieve a sufficient safety factor for transporting the load, an analytical calculation was made of the reinforcement required to restore the fragments of the capital. Thus the load that each fragment bears because of the overlying architectural members, was calculated. The loads have been calculated for every member on the basis of the existing study for the restoration of the west façade and the assumption of a probable restoration of the ceilings.

The column capital was simulated in a three dimensional digital drawing. The seats of the overlying architrave blocks and the assumed positions of their loads were defined on this.

### Restoration proposals

The proposals delivered and studied for the restoration of the column capital escalated in terms of their intrusiveness and their originality, as the study matured and the decisions of the ESMA each time im-



**Capital ΔKK2 – pathology layout, after dismantling the first span of the west colonnade**

posed new directions. Studied initially were various scenarios of conventional reinforcement of the fragments with the use of titanium bars and cement mortar, following the usual practice, or as an alternative, external tendons.

#### 1. Use of external reinforcement bars with visible perforation on the east side of the abacus

The use of external reinforcement is not a usual practice in the Acropolis works. It was considered preferable in this case, however, because it allowed in situ rehabilitation using a light scaffolding for

the support of the superstructure and the necessities of the works while also assuring minimum disturbance to the monument. From the standpoint, moreover, of cost and time, it was superior to any other type of intervention. The deformations cannot be revoked in this case.

#### 2. Detachment of the SE fragment and use of internal titanium reinforcement bars

This particular solution was considered since it allowed the use of a greater number of reinforcement bars in the area beyond the abacus, making it possible to revoke the deformations. It was found that serious effort would be needed to detach the fragment because of impactions provoked by a) corrosion of the clamps, b) the earlier restoration techniques used to secure the fragment in place and c) further creep of the material in the fragmented areas. To reposition the fragment would require the construction of a heavy type of scaffolding for setting in place the 1.5 ton fragment with its internal reinforcement. This would be extremely difficult given the narrowness of the space. In addition, the 2nd intercolumnar architrave, in situ, would require support. The ergonomics of



**The SE fragment rests on an area with extensive mass loss in the underlying drum (left, center) and fracture attributed to stress concentration in the lower NW corner of the inner east block of the architrave of the second span (right). Photo A. Vrouva, 2012**

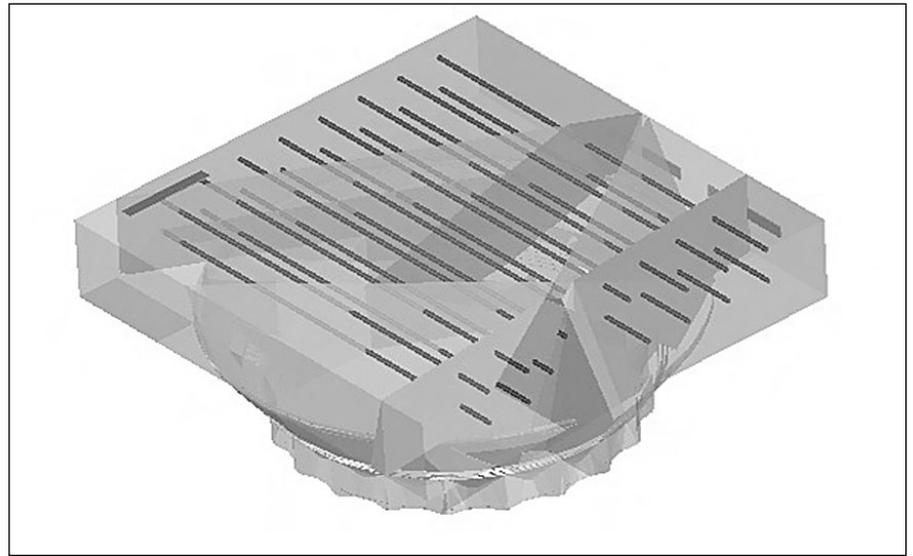
this intervention constituted a significant shortcoming.

### 3. Use of internal titanium reinforcement bars

The use of internal titanium reinforcement bars in all the fractured surfaces was an alternative the purpose of which was to ascertain that the bars would have the best inclination, thus maximizing their effectiveness for adjusting the fragments. This kind of intervention required that the fragmented capital would have to be moved to the worksite in order to manipulate it properly. The deformations could then be completely restored. The method, however, was to be preferred only if the safety factor thus provided was much greater than in all the other reinforcement methods. This was because removal of the capital from its original position was a significant decision with various implications.

### 4. Use of external pre-stressed tendons

The use of exterior pre-stressed tendons was an alternative to the first solution, proposed in order to avoid visible per-



**Suggested positioning of the titanium bars inside the abacus of the capital for joining the fragments together**

foration of the exterior surface. It would have facilitated the correction of some of the deformations. The reversibility allowed by this method was one of its strongest points, but the final aesthetic result was a serious drawback. The constant need for monitoring the system had also to be taken into consideration.

The reinforcement design for the static

load cases in the above mentioned solutions was concentrated in the SE fragment since it proved to be the most critical. The calculations considered the most critical, but not less likely, load situation.

It has become eminently clear that any attempt to restore the SE fragment by the usual practice of reinforcement cannot yield a viable solution. Further analysis of loads related to chance phenomena, such as seismic load, were considered redundant since it would require an increase of the static loads by 20% or consideration of edge seating and lateral loads (ESMA meeting 8/12.7.2012).

Further analyses were carried out considering a lighter superstructure, and a partial restoration of the ceilings was considered. The ceiling loads were not to be superimposed on this particular span of the architrave (August 2012). The results of the analyses showed that the fragment could bear the static loads, but that the seismic loads gave unacceptably low safety factors.

The study excludes in addition the solution with external pre-stressed tendons, since the shear of the fractured surface could not be assumed by the reinforce-



**Schematic representation of the solution with pre-stressed tendons**

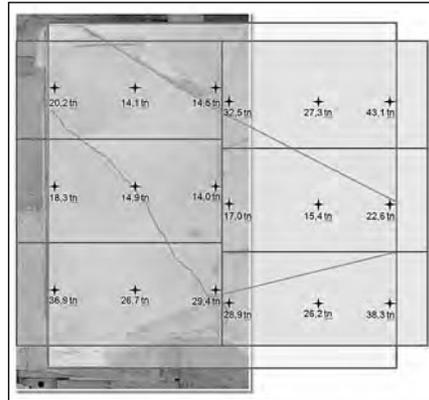
ment and the friction mechanism had also to be taken into consideration.

To conclude, the specific fracture cannot be handled by means of conventional practice because of its individual characteristics (position, loads and bedding on the drum beneath it).

The study began to move in various different directions in order to ensure the optimal restoration scheme for the capital (ESMA meeting 12/11.10.2012).

#### 5. Detachment of the SE fragment, moulding of a new complement with a shear protrusion-carving of the capital and use of internal reinforcement bars

The replacement of the SE fragment with a new complement of different shape would require the construction of heavy scaffolding in the area. The functionality and safety of the intervention were doubtful since the core of solid marble has been diminished by the fractures. This is an intervention with significant loss of ancient material. Among the advantages of the method are a well assured seating of the fragment on the drum and the restoration of the deformations.



**Possible location for the architrave supports on the upper surface of the capital and the respective loads**

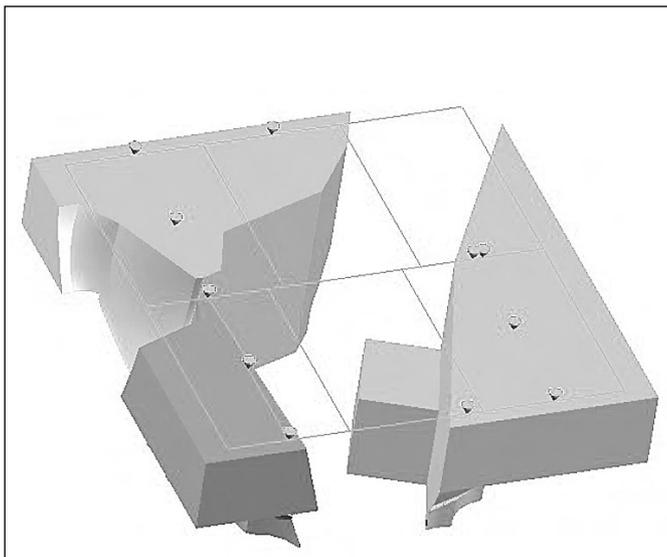
#### 6. Use of a nested titanium beam inside the architrave to secure the inner architrave block in place

To transfer the load of the inner architrave block to the intact surface of the upper bedding of the column capital with the least disturbance of the ancient material, and to satisfy the demand for an *in situ* intervention, it was proposed to insert a metal beam at the side of the epistyle blocks in the area where they rest on the column capital. By these means the capital fragment does not bear the load of the architrave blocks; the presence of the beam assumes this function. The loads of the other two architrave blocks assure that

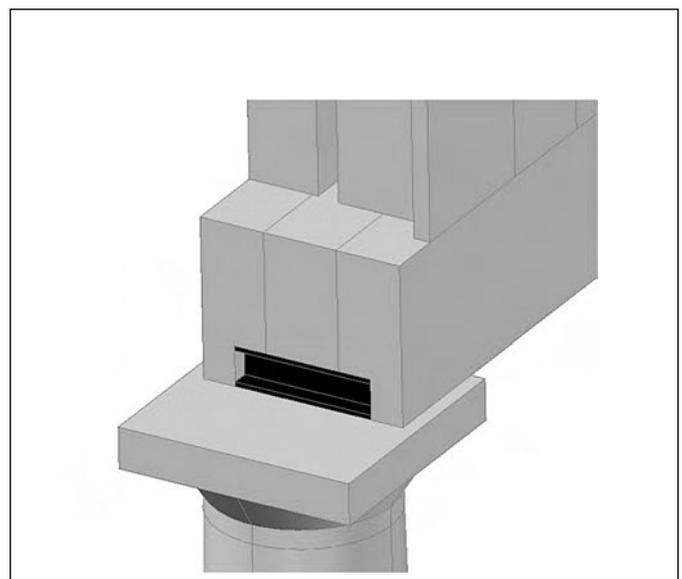
the beam remains in place. The condition of the capital would thus be consolidated in its present state. This solution meets the requirements for the static loads, yet further and in-depth study is required on seismic response.

#### 7. Replacement with a new member

Considered as a scheme of last resort was the replacement of the capital, because of its severe problems and its critical position in the whole construction. How to remove the capital and to replace it raised serious discussion. Again, two solutions were considered: raising the entablature and dismantling the intercolumnar blocks. To raise the entablature was considered risky because of the difficulty of assuring a precisely level elevation; even slight inclinations could imperil the entablature. This procedure called for a strong and heavy splint, which, given the geometrical characteristics of the entablature would be difficult to construct. The scaffolding required for the works, a heavy steel structure, was studied. It necessitated the construction of an enormous base of reinforced concrete. The overall project was neither time nor cost effective compared to the dismantling of 25 ancient architectural members. Yet the decisions to be made



**Schematic representation of the solution with incorporation of a new complement with a shear protrusion**



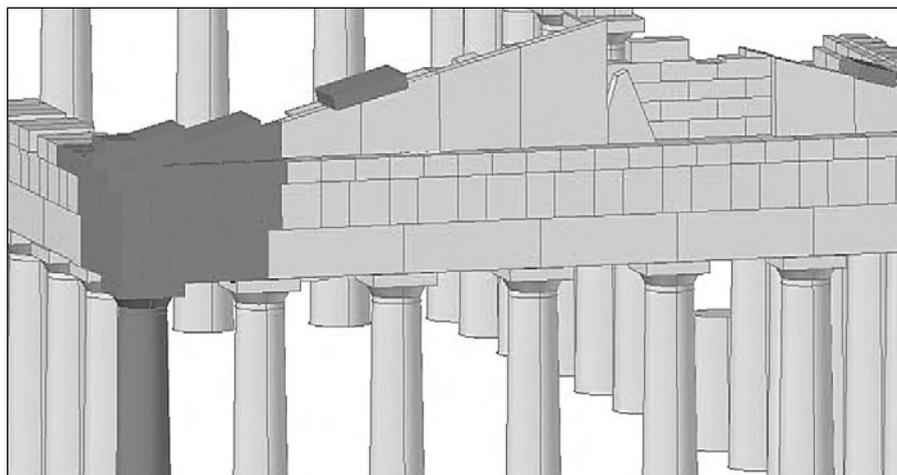
**Schematic representation of the solution with nested beam**

were neither simple nor self-evident, since dismantlement concerned an area that had remained undisturbed since antiquity, and authenticity of a structure is a non-negotiable value for the restoration projects.

#### *8. Detachment of the SE fragment and insertion of a reinforcement system with shear spheres and tendons*

This original solution was proposed by Professor M. Korres, fellow member of the ESMA, at the meeting 13/16.11.2012. The proposal was the detachment of the SE fragment, the insertion of small spheres in the fracture-surface and the adjustment of the fragment in place with three pre-stressed tendons to secure it. Study of the proposal showed that the solution was weakened by the existence of the other fractures in the area where the tendons would have to be anchored. The ESMA requested experimental research on the method and verification of its effectiveness before its adoption.

The final decision in favour of a nested titanium beam in the architraves (solution 6) was made at the ESMA meeting 14/6.12.2012. This solution avoids the function of the fragment which cannot be adequately secured on the rest of the column capital so as to bear the load it was



**Replacement of the fractured capital with a new one – west view**

supposed to carry; the load is transferred, through an alternative path, to the concrete part of the structure. Minimum disturbance of the structural entity of the monument was set as the most crucial value that determined the method of restoration.

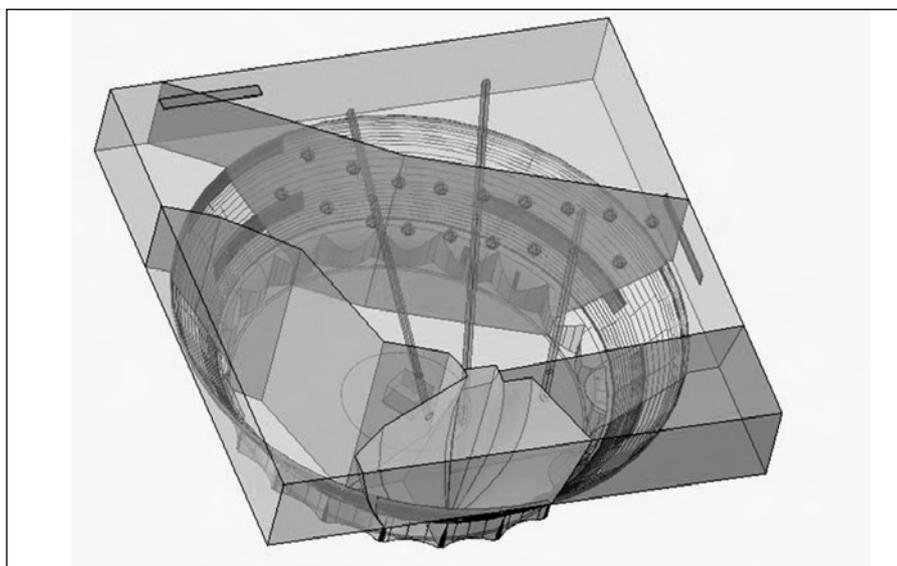
#### **Conclusions**

The problems posed by this study show that in restoration there can be no unambiguous solutions. Decisions rest on the evaluation of a variety of parameters, usually contradictory. The process of forming a decision is complex, going through many stages that affect and direct the

study. The usual tools for strategic planning are not easy to adopt, since evaluation of the parameters is perplexing indeed and cannot be standardised to accommodate each case.

#### **Acknowledgements**

This study was greatly assisted by observations and suggestions of vital importance from the fellow-members of the ESMA. Special reference is due to Professor M. Korres and Professor M. Chronopoulos, for the time and impetus given to the overall study, to our former colleagues, Ms. M. Mentzini and Ms. E.E. Toubakari, civil engineers, for sharing their valuable experience in similar works, and to other colleagues, architects and civil engineers of the works, whose opinions and support have been important in conceptualising the various solutions.



**Schematic representation of the solution with the insertion of spheres and tendons**

**Antigoni Vrouva**  
Civil Engineer  
Parthenon Restoration Project

# The architectural study for the restoration of the Parthenon west tympanum backing wall

## Structural composition

The west tympanum backing wall (from now on backing wall) rests on the course of the west cornice, just behind the orthostates of the tympanum, the east side of which it conceals with precision. It comprises six courses of blocks with an average measurement of 1.80 x 0.85 x 0.54 m. The configuration of the two raking surfaces of the pediment is accomplished by means of special wedge-shaped blocks at the ends of the courses. Despite the fact that it was visible only from within the inner space of the roof, the east side of the backing wall is quite carefully worked. Examination of the material preserved shows that second quality marble with many natural defects was used, clearly because it was invisible. Dowels assure the joining of the courses to each other and to the courses of the horizontal and raking cornices. The blocks are joined with a simple series of clamps. Transverse clamps in the sloping upper surfaces of the backing wall assure its join with the tympanum orthostates. Recorded in addition are eight pairs of special joining elements –twisted clamps– to connect the backing wall with the central orthostates of the tympanum. This gave the builders increased assurance against the possibility of the orthostates overturning outwards. Remaining on the third course of the wall are evidence of five pairs of such joining elements, on the fourth course two, and on the fifth one. The twisted clamps of each pair are set at a small distance apart, and are anchored on one end in mortises of the courses of the backing wall with heads of the element horizontal, and at the other in mortises in the thrust surfaces of the orthostates with the head of the element vertical. The adjustment at the two different levels of anchoring was accomplished by turning the level of the stem 90°, which was done in the space left by cutting the rear surface of the orthostates. The question remains, however, as to how the twisted clamps were incorporated in the construction since nothing has survived from the parts in which the stem turned.

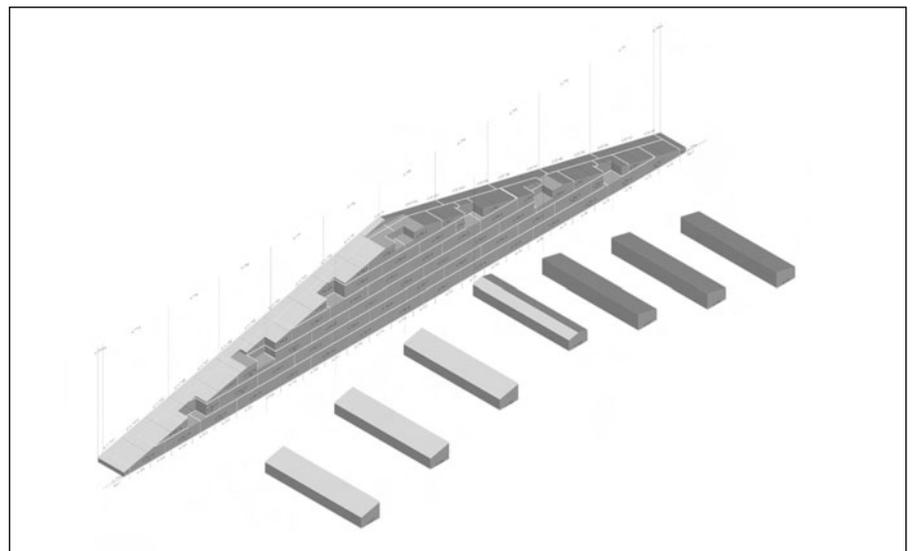
The dowel marks preserved on the ancient material make it clear that the blocks were

set from the centre towards the edges. Along the length of the slanting surfaces of the east side of the backing wall seven beam casings were cut to hold the west ends of the roof beams. The great destruction of the blocks around the beam holes by fire suggests that the beams here were wooden. Yet the precision with which the horizontal surfaces of the beam cases are carved and the measurements of the beams leave open the probability that the beams were in fact of marble.

Programmed in the framework of the work are laboratory tests on the ancient surfaces that may provide a definitive answer to this question. On the basis of existing evidence, the probable phases of construction of the west pediment are as follows: a) construction of the three first courses of the backing wall, b) setting the orthostates of the tympanum working from the centre toward the ends, placing at the same time all the tips of the twisted clamps in the orthostates and placing in

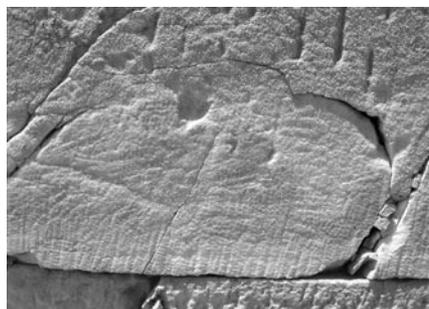


*General view of the east side of the backing wall of the west tympanum from the northeast. Photo YSMA Archive*



*General perspective reconstruction view of the backing wall, the orthostates of the tympanum and the roof beams*

the backing wall the west ends of the twisted clamps that correspond to the third course, c) etching the ceiling beams of the west flank, d) etching the beam cases corresponding to the beams of the



**Detail of the surface of the east side of the wall. Visible are traces of the original tooling with a point that were not totally obliterated in the final working of the surface with a toothed chisel (thrapina).**

**Photo YSMA Archive**

roof and cutting them, together with setting the fourth course, e) setting the west tips of the twisted clamps of the fourth course, f) etching the thrust joint of the fifth course with displacement relative to the underlying courses, the intention being for three of the four side surfaces of the beam cases to coincide with joints, g) constructing the fifth course, carefully carving the side surfaces of the beam cases to coincide with the anathyroses of the thrust joints, h) installation of the west tips of the twisted clamps of the fifth course, i) laying the sixth course and forming the peak beam case, j) working the east side of the backing wall with a toothed chisel, k) setting the raking cornices in place with consecutive positioning from the peak to the ends. The curvature evident in all the courses of the west side is found also in the courses of the backing wall, and curvature is verified along the sloping surfaces of the pediment.

The reconstruction drawing of the east side of the wall shows that the first course had 15 blocks, the second 14, the third 11, the fourth 8, the fifth 6 (and a small filling stone behind the west end of the fifth from north beam), and the sixth course 4. At the ends of the fourth course

the length available for the wedge-shaped block is around 2.20 m., thus 40 cm more than for the other blocks. We consider it likely that these blocks will have had the canonical length of 1.80 m, leaving the remaining space empty.

### **Evidence of historical phases**

The extensive problems inflicted on the backing wall by fire show that its condition today is mainly the result of the great fire of the 3rd century A.C. and the tremendous explosion of the 26th of September, 1687. The fire of the 3rd century A.C. changed forever the appearance and the protective environment of the backing wall. Whatever blocks survived were burnt to a great extent and fractured and they had lost the protection afforded them by the roof. From the 12th to the 17th century the backing wall is likely to have been incorporated in constructions evidenced on top of the west pediment and the ceiling of the west flank. It is certain that the catastrophic explosion of 1687 gave a shock to the west pediment, despite the fact that its epicentre was in the east side

of the cella. We can well imagine that a considerable number of the blocks already fragmented by the 3rd century A.C. fire fell or lost fragments.

### **Earlier interventions**

The first interventions on the backing wall after the foundation of the new Hellenic State probably included the demolition of remains of mediaeval constructions. There is evidence, moreover, for the use of metal reinforcements to support the central orthostate and the raking cornice blocks of the north section. The interventions of N. Balanos in the years 1898 to 1902 included a) dismantling of blocks in the north and south end, b) dismantling or shifting blocks or fragments in the upper courses, c) extempore joining of fragments and filling of cracks and joints with cement plaster, d) extensive introduction of iron clamps in locations different from the ancient ones, e) filling of spaces between architectural members with extempore mortar, incorporating building material from different phases and f) additions of supplementary new marble in locations and forms ignoring the original



**View of the beam case for the second beam from the north. A broken line shows the edges of the blocks before cutting the beam case and the dowel that was rejected. The arrow marks the location of the black crust, probably left from the fire.**

**Photo YSMA Archive**

design. To A. Orlandos are attributed the addition of a new block for supporting the raking cornice of the south cuneus and the insertion of two metal strips to support an orthostate fragment of the tympanum. Many other minor interventions such as inserting bronze nails in fragments that were about to fall off and the filling of joints with cement mortar and paste, probably go back to the period of 1969-1974.

### The state of preservation

Examination of the material in place shows clearly that the main problem concerning the condition of the wall is the catastrophe inflicted by the fire. Contributing to the damage was probably the fact that second-rate material had been used for its construction. In other words, a considerable number of natural faults and weak courses in its construction as a whole will have made it all the more vulnerable to the fire. In the beam cases and generally in the areas closest to the roof, extensive destruction is recorded and absence of material that presupposes the burning of the wood of the roof very close to, or even in contact with, the marble. In the other areas indeed, while the loss of material is limited and a great part of the original outer surface preserved, numerous



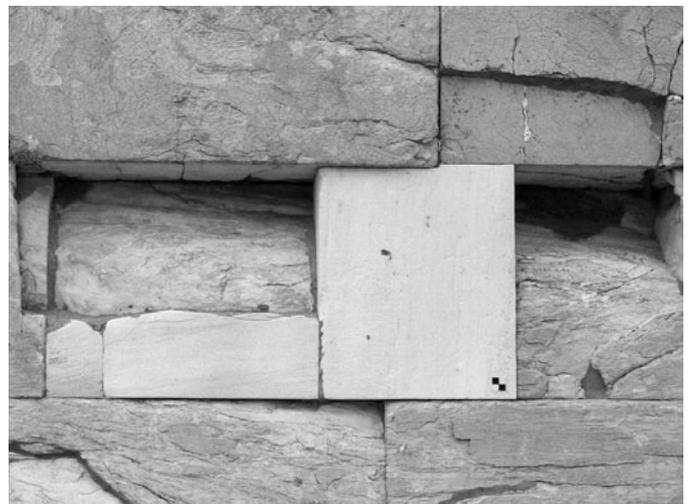
*View of cornice block A.F.5 and the overlying members of the antithematic wall and the tympanum from the north, after dismantling the NW corner. The depth to which the cracks caused by thermal fracturing of the blocks of the antithematic wall appear to extend is characteristic*

thermal breaks, changes in colour, small surface cracks and crumbling of the surface layers of the material are apparent. These areas have retained their mass, even though fragmented, since their exposure to the fire was probably at some distance and the fragments formed were held in place by the remnants of the upper courses. Consequences of the fragment-

ation of the blocks by the fire and by the powerful stresses they were subjected to later on, are the significant relative shifts and turns between the blocks or fragments of blocks. Apart from the breaks and cracks caused by the fire, recorded in addition is a crack almost vertical in direction, north of the symmetrical axis, that runs through the courses of the blocks and continues as significant openings of the joints in the members of the underlying entablature. The interventions of N. Balanos in the backing wall, as in all the other parts of the west side of the Parthenon, have given rise to problems associated with the placing of joining elements between the members in locations other than those used in antiquity and also with the rusting of the metallic elements that he used. Problems of interpretation are created by the use of fragments of ancient material for filling spaces or for supporting blocks of the upper courses, together with an extensive use of cement plaster for filling in joints and cracks. Another observation is that the corner blocks of the fourth course project slightly beyond the sloping levels of the cunei. This is probably because the fragments that make up the blocks of the course have not been correctly adjusted to each other, thus altering the measure-



*View of the joining element (N. Balanos), length around 3.5 m. that joins the fifth orthostate of the tympanum with the backing wall.  
Photo YSMA Archive*



*Supplements of new marble from the intervention of N. Balanos.  
Photo YSMA Archive*

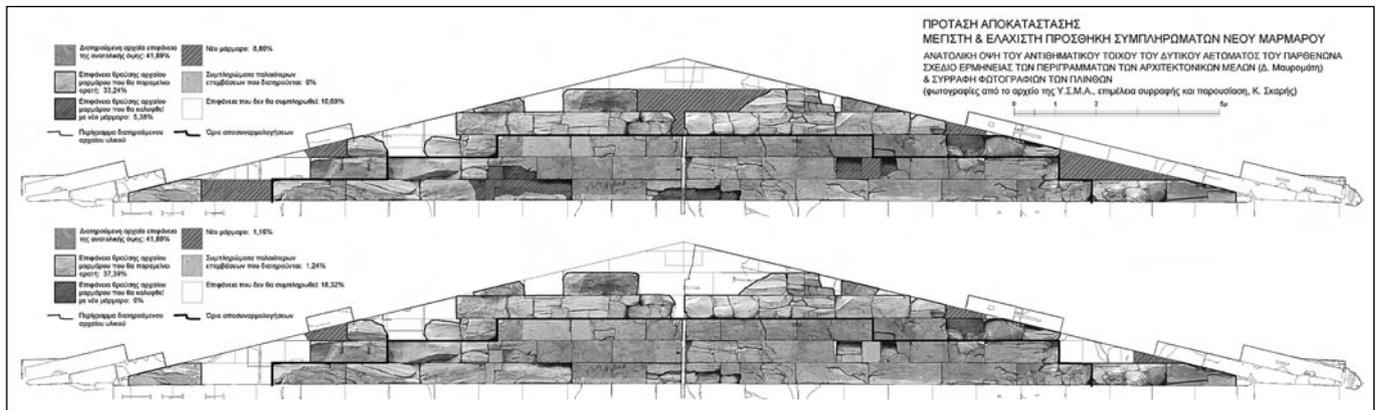
ments of the members. A major constructional problem for the backing wall of the tympanum is the absorption of rain water. The fragmentation and loss of blocks in the upper courses creates conditions in which rain water can enter, accelerating erosion. Evident, furthermore, are problems of the shifting of a number of blocks from their original positions, while there is also a wedge-shaped

In detail, we must a) stop the continuation of the cracking of the marble that results from oxidation and swelling of the iron joining elements, b) remove all the crumbling and eroded mortar that is harmful to the ancient material, c) seal the construction, to the extent possible, to prevent rain water from getting into the joints and cracks, d) conserve the surfaces systematically in order to stop continuous

scattered material has been identified as belonging to that part of the monument.

### The proposed intervention and its reasoning

Analysis of the east side shows that 81% of the original surface of the ancient material has survived. Of this percentage, 42% is preserved ancient surface and the remaining 39% is surface breakage. The



**Restoration proposal. Maximum and minimum addition of new marble. Study - Presentation: K. Skaris**

block from the scattered material which has been found to belong in a specific location (M. Korres).

### Purposes of the intervention

The purposes of the planned intervention are to remove the causes of the continued destruction, to better conserve that part of the monument once the intervention is completed and to preserve and improve its value.

loss from flaking and the falling of small unstable fragments, e) improve the resistance of the backing wall to powerful stresses by setting new joining elements and titanium reinforcements, f) limit the interventions on ancient material to the absolutely necessary, so as to retain undisturbed as much of the ancient structure as possible, g) correct the misplacement of specific blocks during previous interventions and h) incorporate whatever

character of the planned intervention has been determined by the basic decision to limit dismantling to what is absolutely necessary and to retain to the extent possible most of the ancient construction undisturbed. On the other hand, it is very important for the backing wall to continue to play the part for which it was designed and which continues in force today in the ruined monument, namely to hold the orthostates of the tympanum so that they do



**Relative displacement between pieces of fragmented blocks.**  
 Photo YSMA Archive



**Characteristic case of damage from the use of metal clamps during the intervention of N. Balanos.** Photo YSMA Archive

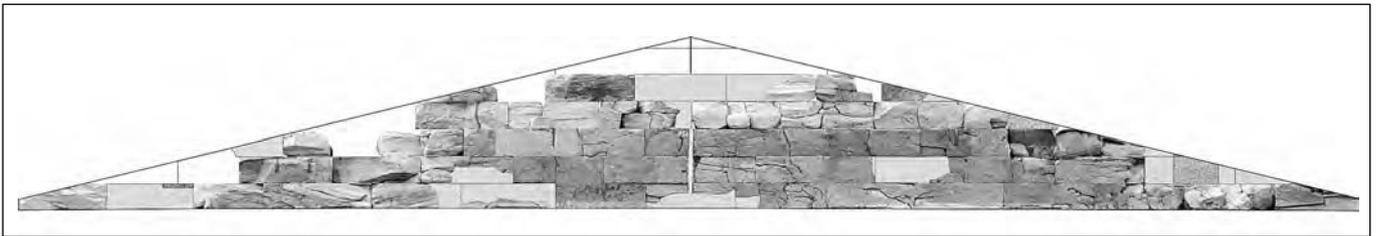


**View of the crack that runs through the courses of the backing wall blocks. The opening of the joint between the blocks of the diazoma is characteristic.** Photo YSMA Archive

not fall out, and to support the raking cornices. Dismantling is restricted to the need for access to the upper resting surfaces of the blocks in the third course so that it is possible to replace the twisted clamps at that level. Dismantling in the fourth and fifth courses and selected blocks at the ends of the third and second courses is necessary in order to correct erroneous settings and improvised joins of the N. Balanos intervention. The decision

at 14% of the total original surface of the east side of the backing wall, 8.8% of which represents additions beyond the outline of the preserved ancient material. The supplements of new marble and the proposed new blocks have been chosen so as to be set in positions that will meet structural and constructional demands, while improving the comprehensibility of the backing wall. From the course of the works and the timetable it emerges that

and the proposals for its restoration, making valuable comments. In addition his earlier notes, now in the YSMA archive, his published studies and plans, are always a treasure of information. The architects V. Eleftheriou, R. Christodoulou and V. Manidaki, and the civil engineer A. Vrouva contributed substantially to the study, with observations and by sharing their personal notes, bibliographical references and archival material.



**Presentation of the proposed maximum incorporation of supplements of new marble in the east side of the backing wall (composite photograph). Study - Presentation: K. Skaris**

to reconstruct completely the orthostates of the tympanum and the expected decision for the addition of two new raking cornice blocks in the north cuneus, together with the structural requirements, as will be shown in the statical analysis for its application, unavoidably affect the choices open for intervention on the backing wall. The study therefore calls for a maximum incorporation of new material

the work of the conservators is the most time-consuming of all and that the expected time needed for completion is approximately 16 months.

#### **Acknowledgements**

Inestimable indeed was the assistance of Professor M. Korres in the study, for he listened patiently to all the observations about the architecture of the backing wall

Likewise significant was the contribution of the chemical engineer E. Angelakopoulou and the conservators A. Panou, Ch. Lascharidis and I. Kotsiphakos from the laboratory of surface conservation, who contributed observations and evidence from the surface of the wall and comments on the time needed to carry out the operation. I owe warm thanks for their contributions to all those mentioned above. In particular, however, I would like to thank the President of the ESMA, Professor Emeritus Ch. Bouras who entrusted me with the subject and who is always a source of knowledge and of inspiration. The spirit of creative co-operation and mutual assistance that has been established between the personnel of the technical office and the Parthenon conservation laboratory is a catalyst for completing the study and implementing the work.



**View of proposed additions of new marble behind the axial joint of the tympanum orthostates. With this solution the pair of twisted clamps in the fifth course regains its original position.**

**Kosmas Skaris**

Architect

Parthenon Restoration Project

# Digital applications for projecting the Acropolis restoration works on the Internet

Information technologies constantly offer new ways of representing and understanding our environment. It is understandable that the Acropolis monuments and the ongoing restoration works provide a challenging field for the application of these technologies. Information technology has been employed from an early stage by the Committee for the Conservation of the Acropolis Monuments (ESMA) in various instances, in order to support the restoration works. A considerable number of digital applications developed by the Acropolis Restoration Service (YSMA) have been published in relevant publications and presented at scholarly conferences in the past.

In this article we focus on two relatively recent digital applications of the Documentation Office. They have been deployed in order to raise public awareness about the activities of the Service in relation to the progress of the restoration works: the new website of the Service and the web-based virtual tour of the Acropolis monuments.

The first application has to do with replacing the Service's previous website with a new more dynamic viewing platform. The main factor that led to its re-engineering was the need for frequent content updates in order to keep pace with the progress of the restoration works and their administrative details.

In this context, a more flexible website was developed, allowing improved content management. It offers an upgraded graphic interface design and incorporates a conti-

nuously expanding content that includes text, image, audio and video archives in digital form. These improvements enable the more efficient communication of current and previous restoration works and facilitate a more extensive account of the theoretical and methodological framework of the interventions. The website can be accessed at [www.ysma.gr](http://www.ysma.gr).

the YSMA Documentation Office. The website's texts have been authored by the scientific personnel of the Acropolis Restoration Service, while the update of the website (new content authoring, structuring and deployment) has been carried out by the personnel of the Documentation Office under the curation of Markos Katsianis (Archaeologist - CI specialist) who, since the beginning of 2012, has undertaken content administration.

The home page introduces the visitor to the website of the Service through a slideshow showing scenes from the restoration works. On the lower section of the page the visitor can find a news list about the current activities of the Service. The contents have been arranged around six themes, accessible from the website's navigation bar.

The first includes information about the Acropolis Restoration Service and the Committee for the Conservation of the Acropolis Monuments, the scientific and technical personnel, as well as their allocation to their respective worksites. Another section is devoted to the individual monuments of the Acropolis, giving basic historical information and summarizing the completed and current restoration interventions on each monument.

The rest of the themes present the work of the Service organised in four categories: restoration interventions, conservation works, documentation and educational activities. The section on restoration opens with an introduction giving the history of the restoration works on the Acropolis and



*The homepage of the Acropolis Restoration Service website*

The website was developed following the most recent standards on the design of digital applications with the use of free-open source software by ORBITLAB Ltd. The development software platform contributed to the implementation of a Content Management System (CMS) at the heart of the application that is user-friendly and provides increased functionality in terms of display customization and content updating. The site's webpages are dynamically generated allowing for faster reload rates. The webpage is bilingual and includes information covering all the activities of the Service. Graphic design was assumed by A. Mouriadou (Graphic Designer) in collaboration with the development team and the personnel of

continues with a reference to the principles and the methods that guide the interventions and to the technical infrastructure of the worksites as well. The responsibilities of the mechanical team, and also the research applications that were developed in the course of the works are outlined in the same chapter.

The section on conservation introduces the visitor to the types of environmental and anthropogenic decay factors that affect the monuments and to the conservation techniques that are being applied in order to limit or inhibit the decay effects. Finally, the conservation activities in each monument are portrayed, while a summary of the research programmes that have been carried out in the course of the works (for example, laser cleaning) is also included.

The documentation section describes the recording procedures and provides the visitor with a presentation of the Service's Archive and the various record types it contains. Attention is also given to the use of new technologies, such as the database management system of the Documentation Office, the photogrammetric survey and the Geographical Information System (GIS) applications. The section on education provides an outline of all relevant activities, incorporating a wealth of teaching material from present and past educational events in digital form.

From the homepage the visitor can access complementary material, such as "The Acropolis Restoration News" in PDF format and a list of publications by the Service (digital copies of selected publications are to become available in the immediate future). Links are also provided to the rest of the web applications that have been developed by the Service.

The second web-based application is about a virtual tour of the Acropolis rock and its monuments. The purpose of the project is to provide remote access to the archaeological site enabling the visitor to walk through the monuments and at the same time to get an idea of the ongoing restoration works. This is achieved by choosing a series of successive locations on the rock



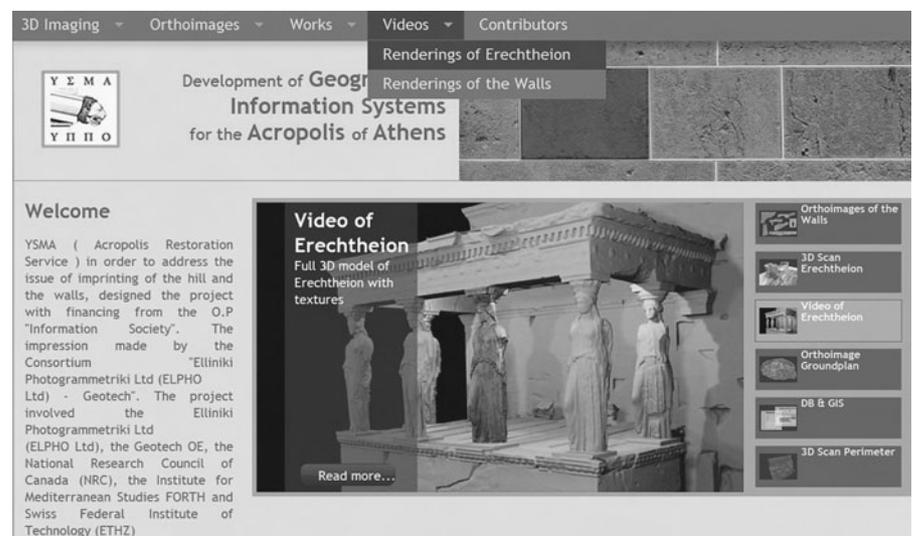
**Website content about the circuit walls of the Acropolis with archive pictures and animation of phototextured 3D model of wall segment**

where the visitor is provided with a perimetrical view of 360°.

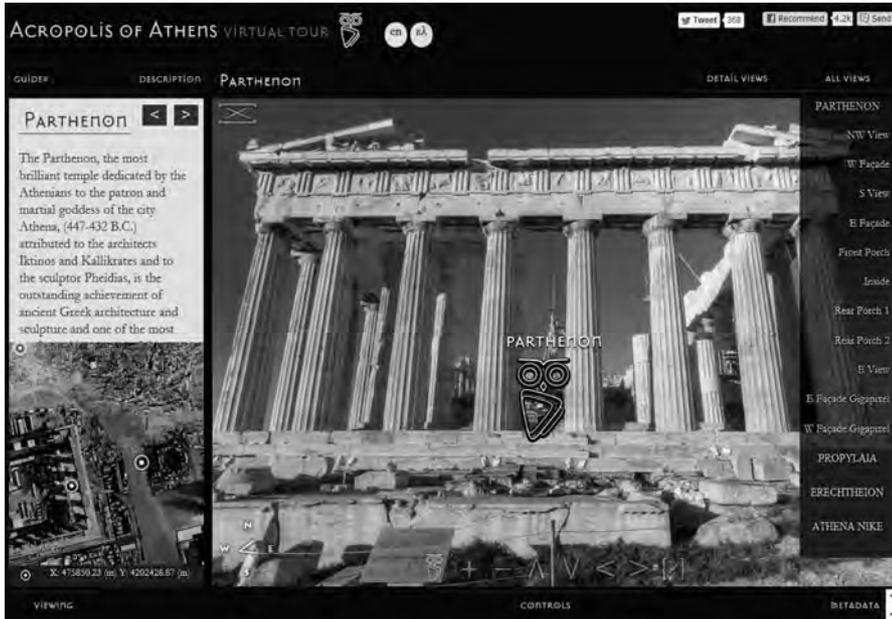
Yiannis Alexopoulos (Technical Engineer) and Dionysia Mavromati (Rural and Surveying Engineer) were in charge of the project on behalf of the Service and collaborated with the development team from ORBITLAB Ltd. Initially, the photomosaic of the ground plan of the Acropolis was used, so as to detect the most suitable locations for photo acquisition. Then these spots were validated on the ground for their suitability; issues related to camera angles, sunlight and possible obstructions

were examined. This was followed by recording the coordinates at each selected location, using a GPS device, so that in the next stage the tripod with the camera could be placed with precision.

During the process of choosing the locations, it was decided to produce ultra-high resolution images of specific views of the monuments that present special interest. It was also considered worthwhile to take shots during the night, when the monuments are lit up, so as to incorporate in the virtual tour pictures of the site out of visiting hours. In a similar manner, it was



**The homepage of the programme "Development of Geographical Information Systems for the Acropolis of Athens"**



**Panoramic view of the west façade of the Parthenon**

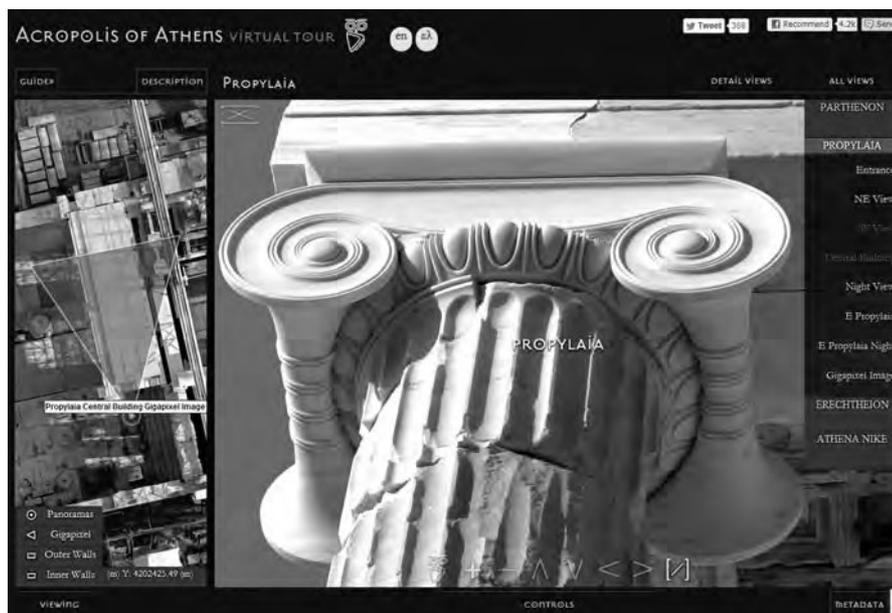
decided to take shots in the interior of the Parthenon, so as to provide a representative view of the worksite area, which at present is closed to the public.

The photo shooting crew took shots at different times during the day outside visiting hours in order to obtain an unobstructed view of the monuments. A basic requirement was proper lighting, which can obviously be affected by the

particular weather conditions. The resulting images were then examined together with the team members from the Service, in order to pick out possible problems and omissions. Many of the pictures had to be retaken either to adjust the shooting location or to take advantage of improved lighting conditions. In the end, 25 spherical panoramas of moderate resolution (6000 x 3000 pixels) were used. These are produced by stitching and blending a

series of photographs that cover an optical field of 360° using appropriate digital software. Five illustrations of very high resolution (in the order of gigapixels) were also included in the virtual tour. In effect, these are photomosaics formed by hundreds of pictures taken using a camera that is mounted on a robotic arm and scans the visual field with successive movements of one millimeter.

The virtual tour can be accessed directly from the address <https://acropolis-virtualtour.gr> or through a link from the Service's webpage. At the lower left part of the computer screen the ground plan of the Acropolis rock and the monuments is displayed including the locations of the panoramas, which are marked by circles. The tour is launched either by selecting viewpoints or through a list of monuments which can be found at the top right part of the screen. Alternatively, during the tour the figure of an owl leads to the next viewpoint location. Each image is manipulated (movement left-right, up-down, zoom in-out) either using the mouse or by selecting the corresponding symbols on the screen. Of particular interest are the parts of the monuments that are depicted in gigapixel resolution. These images can be greatly enlarged, so that the users can observe details that cannot be seen in an actual visit to the monuments.



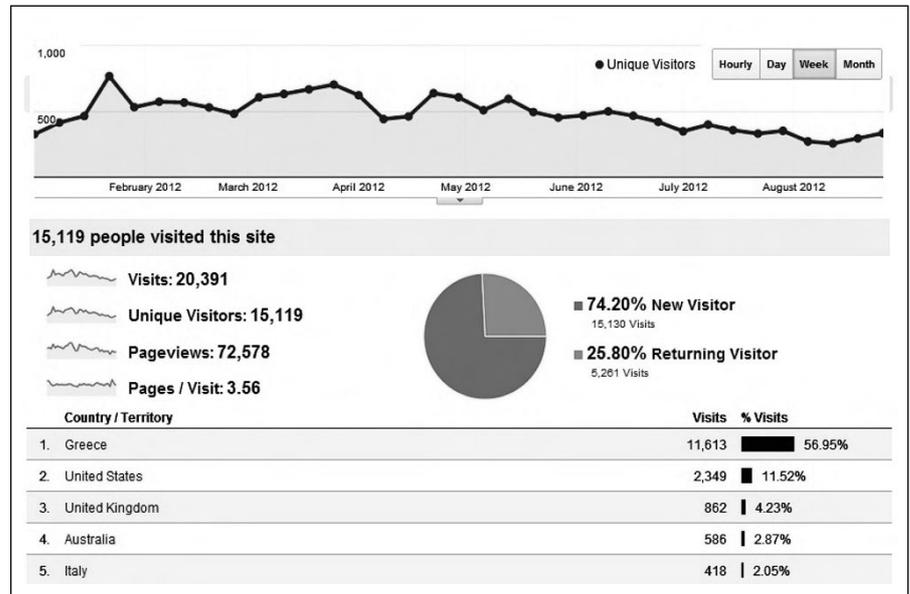
**The Ionic column capital copy from the Propylaea (made exclusively of new marble). High resolution view**

It was considered worthwhile to include in addition the orthophotomosaics of the circuit walls of the Acropolis, which had been produced in the context of the operational programme "Information Society" of the 3rd Community Support Framework. This addition facilitates the viewing of each section of the fortification walls in extraordinary detail, thus allowing a complete virtual experience of the Acropolis and its monuments.

For both applications visitor statistics are held using Google Analytics. Usage data for the Service's website within 2012 show a steady visiting rate with some 500-1000 people per week. Around 26% of the

visitors return to the webpage and the evidence indicates that they spend a considerable amount of time exploring its contents. The overwhelming majority are from Greece (57%), whereas 20% come from English-speaking countries (USA, England, Canada, Australia). It is noteworthy that there is an increasing use of the website by educators; this is likely to be a result of the educational material that is available through the webpage.

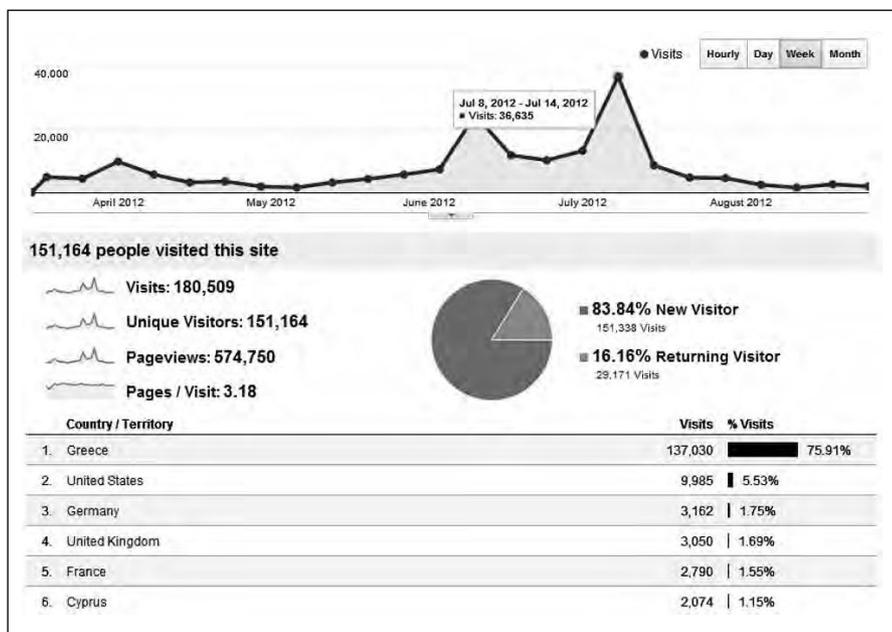
The application of the virtual tour of the Acropolis has received considerable publicity in the past six months during which it has been released in trial version (Beta Version). Since the beginning of March of this year the application has had over 150,000 visits and notable statistics have been recorded. For example, the percentage of visitors who return to the site for a second time is increasing at a steady pace, having reached 16.15%. As far as usage trends are concerned, the largest audience is to be found in Greece (75.92%), followed by 16.25% in the English-speaking countries. However, the linguistic indication of the visitors shows that within Greece the application additionally



Visitor statistics for the Acropolis Restoration Service website in 2012

receives a significant number of visits by tourists from other countries. Moreover, this summer, in the peak of the tourist season, there was a significant visitor increase. To exemplify the situation, a percentage of 32.32% of users use English, whereas 24.05% use Chinese. Another interesting aspect is related to the kind of appliances employed by the visitors to access the application. Apart

from the PCs that use the MS Windows platform, an increase is evident when it comes to portable appliances, especially tablets and mobile phones; this shows targeted access to the website by an audience that is on the move. Finally, a special reference has to be made with respect to the nocturnal panoramas, which seem to attract visitors more frequently than the rest of the scenes.



Visitor statistics for the Acropolis virtual tour in 2012

**Yiannis Alexopoulos**  
 Technical Engineer  
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 Archaeologist, PhD  
 Documentation Office

# Educational programme

## “A day at the Acropolis restoring its monuments”

The Information and Education Department of the Acropolis Restoration Service (YSMA) in collaboration with the 1st Ephorate of Prehistoric and Classical Antiquities held a special two-day educational programme at the Acropolis on the theme “A Day at the Acropolis restoring its monuments”. Participating were 600 pupils and 38 educators from 21 schools in Attica.

The programme was designed for schools of the Secondary Education, in particular the 3rd grade of the Gymnasium. The purpose was to familiarize and inform the pupils about the monuments and the major technical work being carried out on the Acropolis by following and participating in a series of workshops in the Acropolis area.

A total of 200 e-mails were sent to all the Gymnasia of Attica. Eighty-two schools replied and the first 21 to declare their interest took part. Each school could bring up to 30 pupils, divided into two groups of fifteen, each accompanied by one educator.

In order to participate in the educational programme, both educators from each school were required to attend a seminar, which was held in the Acropolis Museum one month prior to the programme. The educators were informed about the problems of the monuments, the reasons for the interventions and about the restoration projects taking place or already completed in each monument. They saw special films and the YSMA website was analytically presented. Each school was given the teacher’s pack under the title “Restoring the Athenian Acropolis” as well as books and posters for its library. The educators were divided into four groups and, with our guidance, they worked with the teacher’s pack, giving special emphasis to the leaflet, “Proposals for the teacher”, which provides suggestions as to the various possibilities for applying the material to the school curriculum. The seminar ended with a guided tour of the Museum, where the educators saw the architectural members and the

sculptural decoration of each monument as presented inside the Museum.

On the day of the programme, all the pupils and educators were given a small poster of the Acropolis as a remembrance. It contained a specially prepared map of the site showing the locations of the workshops, the itinerary and what they would see in each workshop.

At the Temple of Athena Nike, the pupils were able to learn about a completed pro-

the principles applied for the recording of the numerous scattered architectural members, the purpose of which is to recognise the fragments and attribute them to the monuments from which they came.

Likewise at the Erechtheion they learned about another monument the restoration of which has been completed. The interventions comprised the greater part of the walls and ceilings, the recovery of the



*Marble cutting workshop at the Propylaea.  
Photo T. Souvlakis, 2012*

gramme of anastelosis, since the temple had been totally dismantled, its members conserved and restored and the temple then reassembled.

Inside the Propylaea, the pupils could admire the impressive ceiling with the two new Ionic column capitals, the enormous beams and the coffered slabs that have been retrieved through research and newly joined fragments. They were also able to see the tools used and to learn about the techniques of cutting marble from the experienced marble-technicians. Moreover they were able to observe the traces left by the various tools on ancient marble.

At the next location, they learned about

“closed form” of the hexastyle east facade of the monument with the addition of the copy of the corner column and the overlying entablature, as well as the transfer of the Caryatids to the Museum and their cleaning with laser technology.

In the Parthenon, the largest monument on the Sacred Rock, they learned about many and various works of anastelosis. Within the temple, they saw the restored east side of the temple, the pronaos and also the north colonnade. They learned about the methods used for carving the flutes of the columns. At the next stop, within the temple, they had the opportunity to observe the work involved in the joining of fragments of an ancient

architectural member, weighing 8 tons, on a special joining platform. In the Parthenon worksite they were told about the methods used for surface conservation of an architectural member (injections, cleaning and closing cracks, etc.). In addition they saw how a cast is copied in marble with the aid of various sculptor's copying tools (pointing instruments or pantographs).

At the west side of the temple they had the opportunity to learn about the works of anastelosis now under way on the NW and SW corners. They also were informed about the programme for the Opisthonaos and they saw the copies of the west frieze set on the monument after the removal of the original blocks to the Acropolis Museum.

The various projects of each worksite were presented to the pupils by the experienced personnel of our Service, architects, archaeologists, civil engineers, conservators and marble technicians. Their collaboration was very important for the success of this difficult programme, in which 600 pupils and 38 educators explored the Acropolis and its worksites and learned about the enormous project of restoration being carried out.

The staff involved are the following: the Director of the YSMA, V. Eleftheriou, the YSMA Director Emerita, M. Ioannidou, and also: E. Lembidaki, D. Michalopoulou, K. Karanasos, E. Petropoulou, K. Koutsadelis, P. Georgopoulos, M. Toupheklis, G. Kayiorgis, E. Angelakopoulou, K. Frantzikinaki, E. Frankiadaki, A. Bizimi, A. Sotiropoulos, A. Tsimereki, A. Hatzipapa, E. Takou, E. Koutsouraki, G. Kotsiphakos, M. Petraki, N. Georgiou, V. Tzebelikos, L. Stephanotis, K. Demopoulos, G. Skalkotos, L. Michalakos, Ch. Christopoulou, E. Sioumpara, E. Salavoura, E. Tagaridi, K. Tsiphlas, G. Frantzi, D. Garbis, D. Chamopoulou, S. Gavrielidou, A. Panou, R. Christodoulou, E. Karakitsou, K. Mengoulas, G. Angelopoulos, L. Mimidou, A. Chousakos, I. Chiou, A. Vrouva, G. Anastasiadis, D. Zervas, V. Alexiadis, Ch. Tsibourlas, V. Palieraki, V. Delizisi, E. Tavouktsi, S. Angelopoulos, A. Papandropoulos, S. Kardamis, P. Kokkinakis, P. Pravitas, D. Kostas, Ch. Bazakos, V. Manidaki, I. Konteas, T. Souvlakis.

After the programme, two evaluation questionnaires were prepared, one for the pupils, another for the educators. These were sent to the 21 schools that had participated.



**A class watches the structural restoration of marble blocks on a rolling joining platform. Photo T. Souvlakis, 2012**

The evaluations concerned the following:

- The accomplishment of the programme's goals
- Survey of the whole experience of the pupils
- Record of proposals for future similar programmes.

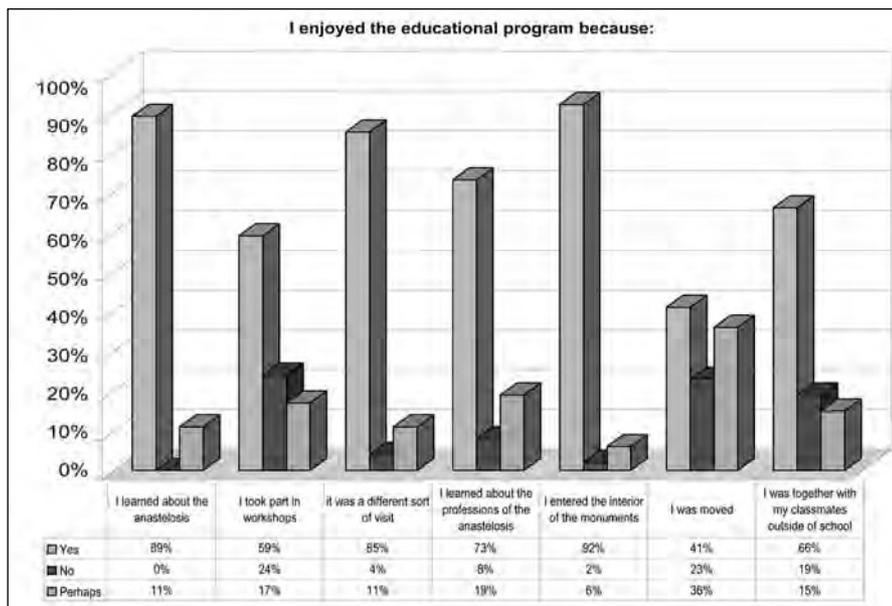
Seventeen schools responded, 446 questionnaires were received from the pupils and 34 from the educators who accompanied them.

A brief presentation of the results follows, first from the pupils, then from the educators. The full text of the presentation of the results as well as the questionnaires can be found at the website: [www.ysma.gr](http://www.ysma.gr)

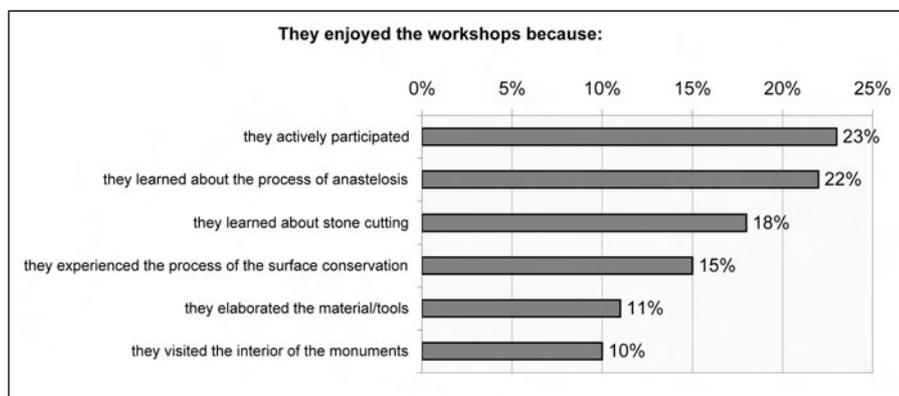
#### Questionnaire for the pupils

The response of the pupils to the evaluation was a pleasant surprise for the Department, since 75% of the pupils replied (446 of the 600).

The questions were mainly multiple choice in type but there were also open questions to which the pupils could



**Graph 1: The pupils' impressions**



**Graph 2: Reasons for students' preference in workshops**

respond freely. They were divided into 4 thematic parts, which form the basis for the following analysis.

### 1st Part

*General characteristics and profile of the pupils (introduction and question 8)*

Most of the pupils that participated in the evaluation were girls (59%). Moreover, the answers provided interesting information about favourite activities of the teenagers.

### 2nd Part

*Experience of previous visits and earlier knowledge of the Acropolis and the restoration works (questions 1 and 2).*

Eighty-five percent of the pupils had visited the Acropolis previously. For only 15% this was their first visit to the Rock. Most of those who had made a previous visit had done so with their school, mainly in the last grades of Primary School (65%); roughly half had visited the Rock with their family (52%). Visits had been made with both school and family by 21%; 3% of the pupils did not specify.

Sixty one percent of the pupils had some knowledge about the Acropolis, or knew quite a lot about it (20%). The opposite holds for the knowledge they had about the restoration works, since two out of three pupils knew little (59%) or nothing (15%).

### 3rd Part

*The pupils' experiences in the course of the programme (questions 3,4,5)*

The pupils answered predetermined questions on what they liked in the pro-

gramme, with "yes", "no" and "perhaps" (graph 1). The cognitive dimension was checked (I learned about the Acropolis and about the professions in anastelosis), the experiential dimension (I participated in worksite activities), and the socio-emotional dimension (I was moved, it was a different sort of visit, I entered the interior of the monuments, I was together with my classmates in a place outside of school). As is clear from the graph, over 60% of the pupils answered in the positive to 5 out of 6 questions.

At the end of the question the pupils had the possibility of adding comments. To a great extent, these were satisfactory and encouraging both for the restoration works themselves and, in general, for the experience of the visit. Although an answer to the question was not obligatory, 200 (45%) of the 446

pupils commented further on what had interested them, that is:

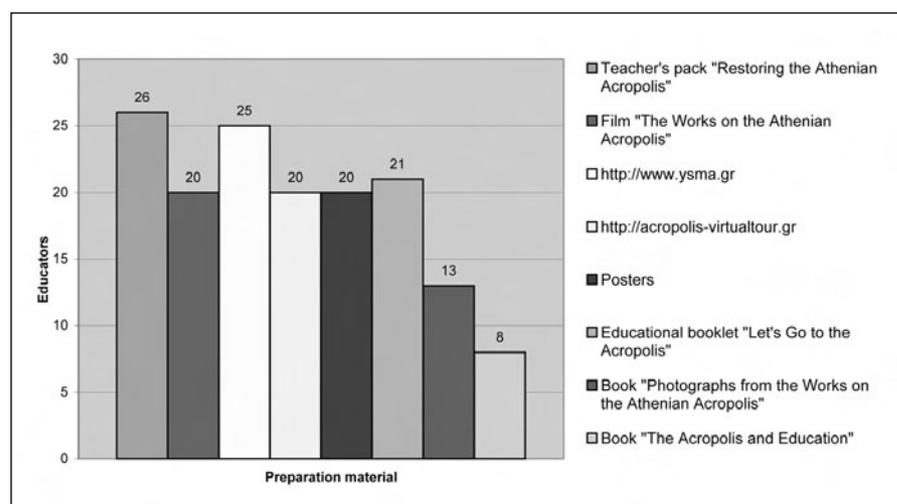
- the personnel of the anastelosis (37%)
- the process of the anastelosis (23%)
- the architecture/size of the monuments (15%)
- the interior of the Parthenon (11%)
- the material/tools of the anastelosis (9%)
- the entire experience (4%)
- the view from the Acropolis (4%)

In the 4th question the pupils responded as to whether they liked the workshops, and specifically which ones they liked the most. To this question 92% of the pupils replied. The grouping of the comments showed that the workshops inside the Parthenon and the workshop for marble cutting made a great impression on the children because, as they themselves said, this was a completely new and different experience for them.

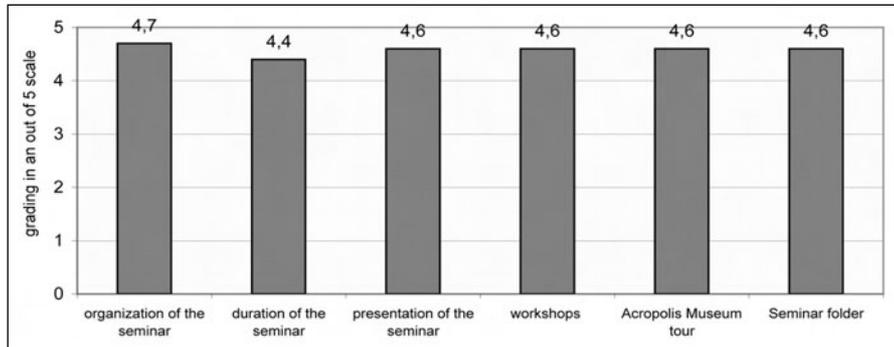
Forty-six percent of the pupils went on to the reason for their preference for a specific workshop. Analysis of their comments can be seen in graph 2.

Some of the comments follow:

- "I was impressed by the careful approach, the clear formulation of the procedures, the contact we had with the professionals who have the great good luck to be restoring the Acropolis monuments", pupil, 16th Gymnasium of Athens.
- "The conservation laboratory (8th) because



**Graph 3: Resources for preparing the pupils**



**Graph 4: Evaluation of the seminar by the educators**

I was amazed when I saw that they treat the ancient members as if they were human bodies”, pupil, 2nd Gymnasium of Kallipoli.

- “I was impressed by the collaboration and cooperation of the specialists. I didn’t expect this!”, pupil, 16th Gymnasium of Athens.

#### 4th Part

*The tendencies of the pupils following the activities of the programme and their suggestions (questions 6 and 7).*

Half of the pupils (46%) replied that the programme encouraged them to look for information about the Acropolis monuments. Twenty-four percent replied that they didn’t, and 30% that they might search. For information about the restoration works, the pupils are divided: 39% gave a positive reply, whereas 34% replied in the negative and 30% were indecisive, replying “perhaps”. It is worth noting that 86 pupils (20%) replied that they also wanted to get information about other monuments.

Concerning the improvement of the programme, 80% of the pupils replied that the programme did not need any change. Only 20% had further suggestions for its improvement. Of the comments made, the most useful are the requests for a break interval (28%) and for more time in each workshop (20%). In addition, 23% of the pupils note that they would prefer some of the workshops to be more interactive.

#### Questionnaire for the educators

Thirty-four questionnaires were collected from the educators of the 17 schools that took part in the evaluation. Half of them were Greek language and history educators, the

others came from various fields. The questions were mainly close ended in combination with open ended questions. They have been divided into three thematic parts.

#### 1st Part

*Preparation of the educators prior to the programme-Training Seminar (questions 1-5)*

The first two close ended questions investigated the way the educators prepared their pupils for the educational programme. Only 2 replied that due to lack of time they had not prepared their pupils at all. The graphs 3 and 4 show how they utilised the educational resources given to them and then how the educators graded the seminar on a scale of 1 to 5 (5 being the highest).

#### 2nd Part

*During the programme (questions 6-11)*

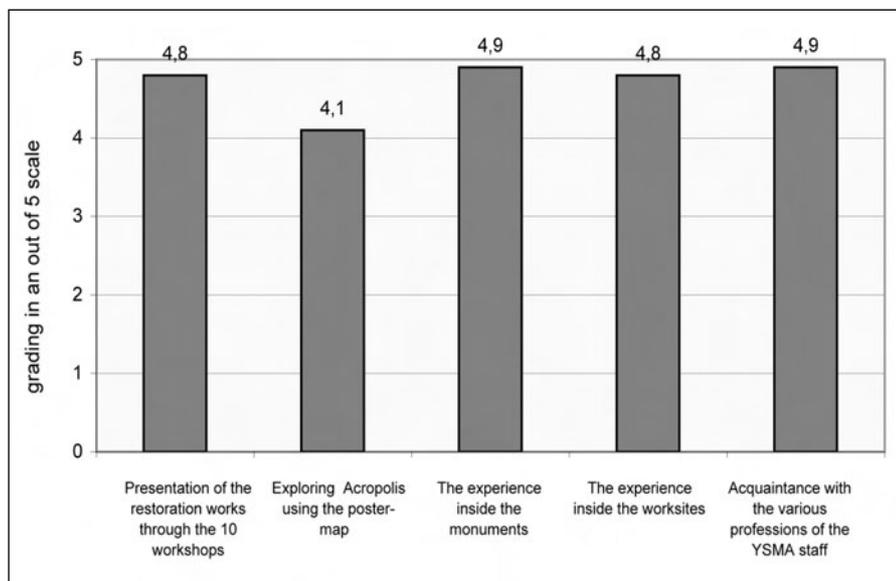
Practically all the educators agreed that the length of the programme was satisfactory (question 6) and that the programme met the pupils’ expectations (question 7). In answer to question 8, 31 educators replied that they confronted no difficulties during the course of the programme. Only 4 educators reported some difficulties and these lay in having to choose 30 children to participate in the programme.

Concerning the quality of the programme, the educators evaluated special features of the programme (question 9) on a scale from 1 to 5 as shown in the graph 5.

One of the basic aims of this evaluation was to survey the experience of the pupils. For the educators (question 11) a list of nine proposals was given and they were asked to grade them, on the scale from 1 to 5. The results (graph 6) were indeed most satisfactory and taken together with the replies of the pupils (question 3) show their experience to have been multidimensional.



**A class watches the pantograph (copying machine) used for the construction of fillings from new marble. Photo T. Souvlakis, 2012**



**Graph 5: Evaluation of the features of the programme**

### 3rd Part

*After the programme (questions 12-13).*

Twenty-four of the 34 educators replied that they had planned to do related work after the programme.

The final question of the questionnaire urged the educators to write any other comments they or their pupils wanted to make. Eighteen of the 34 educators made comments that were on the whole positive. We note here some examples:

- “Your initiative is, in my opinion, extraordinarily positive. Even though the pupils showed signs of fatigue (3.5 hours of touring was admittedly tiring), they recorded an experience which they could perhaps not evaluate to its full measure because of their age. Yet the time will come when they will be able to decipher it correctly”. 8th Gymnasium of Athens.
- “It was the sort of experience that alters one’s perspective, the pupils’ and the educators’, on life and on our country”. 2nd Gymnasium, Hymmetos.
- “An extraordinarily profitable, original and unusual experience. It helped us to see the Acropolis monuments from another perspective and to live the historical continuity of culture, observing

how modern technology “supports”, protects and projects ancient art. Congratulations”. 65th Gymnasium of Athens.

### Conclusions

The groups of pupils were very pleased with their participation in the programme. They understood the importance of the interventions and showed great

interest both in technology and in the method of anastelosis. The factors contributing to success were:

1. The choice of the 3rd grade of Gymnasium which proved to be right since these pupils have the foundation needed to grasp the process and significance of the interventions and to discover aspects of the Acropolis they possibly had never before imagined.
2. The type of educational programme, which focused not only on the past history of the monuments, but was linked also to contemporary time. The innovative technology, the scholars, the various professions that they may not even have heard of, drew the attention of the pupils.
3. The entrance of the pupils into the interior of the Parthenon. The pupils enjoyed this experience and considered this visit as totally different from any other.
4. The contact with the personnel impressed the pupils especially since they learnt about the different professional fields involved in the collaborative work of



**Teachers’ seminar. Photo T. Souvlakis. 2012**

anastelosis. Many were influenced in their orientation towards future jobs.

5. The seminar and the directions given to the educators, since they contributed both in preparing the pupils prior to the Acropolis visit, and in their activities after the programme.

6. The enrichment of the educational programme with the material offered to the schools, since this helped both educators and pupils to understand the theme and gave them alternative approaches as well.

Pupils and educators are likewise asking that the programme be held more often and that a greater number of pupils be allowed to participate. Here, however, there are limits that cannot be ignored since the area of the worksites has to be reformed each time so as to be suitable for



**Marble cutting workshop, at the Propylaea.**  
**Photo T. Souvlakis, 2012**

this sort of activity, and at the same time the accelerated rhythm of the works cannot be interrupted on a frequent basis.

**Irene Kaimara**

Archaeologist

Head of the Department

**Asimina Leonti**

Archaeologist

**Sylia Paraschou**

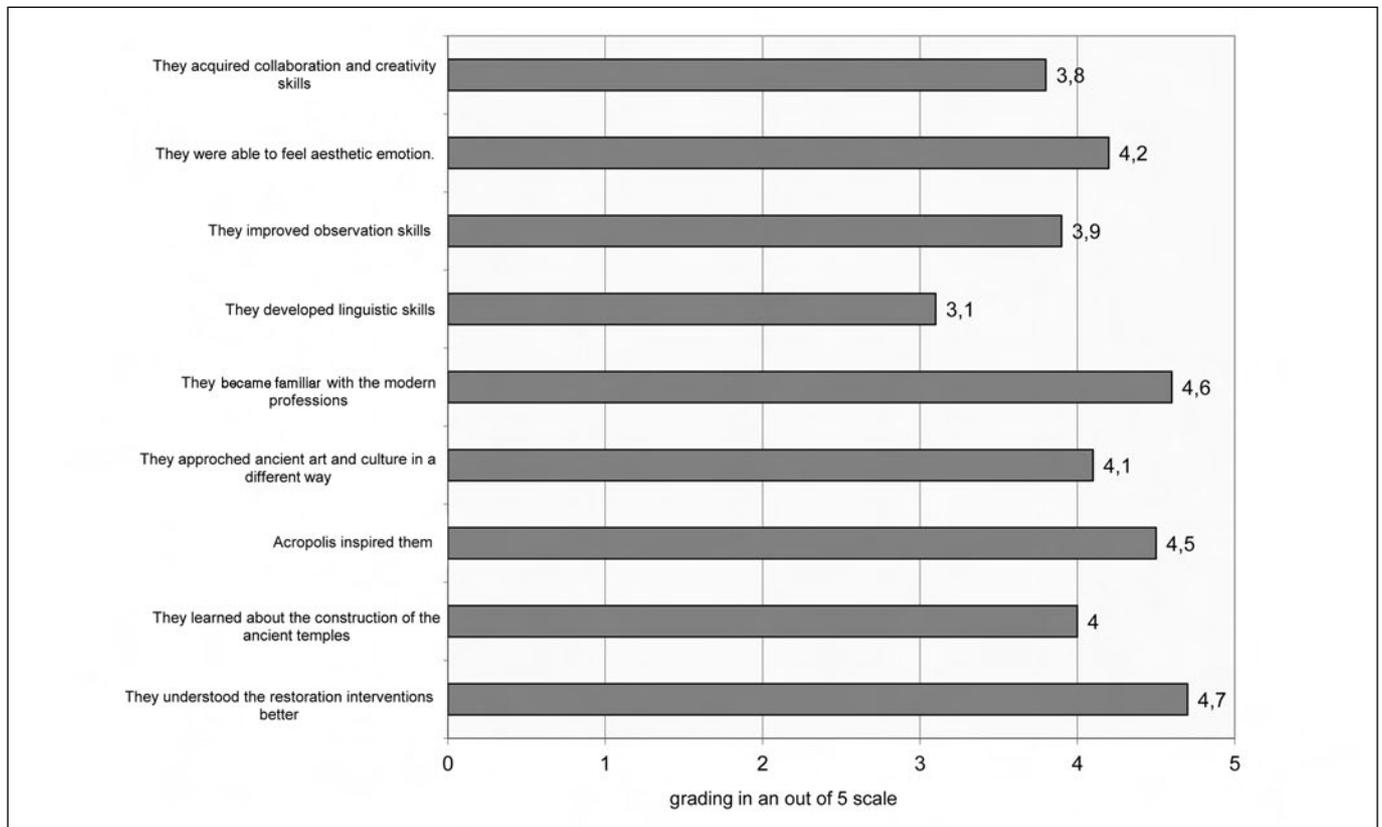
Archaeologist

**Cornelia Hadziaslani**

Archaeologist - Architect

Head of the Department (until 2011)

Information and Education Department



**Graph 6: Evaluation of the experience of the pupils**

The year 2012 saw the retirement of many members of the YSMA. Among those retiring was Ms. M. Ioannidou, for many years Director of the YSMA, who left in November 2011 after devoting 36 continuous years to the Acropolis works. Ms. Ioannidou assumed Directorship of the YSMA in 2000 and worked with zeal and devotion on organising the newly-established Service and on completing the great programmes of anastelosis. Chosen as new Director of the YSMA is Ms. V. Eleftheriou, an architect with many years of experience and with a completed work of anastelosis at the Lindos acropolis, among her accomplishments. Ms. V. Eleftheriou joined the scholarly team of the Parthenon in 2005 and has taken on the Directorship of the YSMA at the moment when new anastelosis programmes begin, funded by the European Union, in the National Strategic Reference Framework (NSRF). Despite the significant changes made during the previous year, the activities of the YSMA in educating the young and informing and promoting its work to the general public, have continued unabated.

## Educational activities

During the school year 2011-2012, the Information and Education Department carried out a variety of educational activities for educators, pupils and for the

general public. Specifically, 105 educational programmes were held for 3,033 pupils from 75 schools. 2,413 pupils from the Primary and (Lower) Secondary classes of 53 schools attended the educational programme “The Sculptures of the Parthenon”, held in the Acropolis Museum. Likewise held in the Museum was a cross-cultural educational programme entitled “28th of Hekatombaion. A Day with the

of the 3rd grade of Secondary Education from 21 schools in Attica took part in the open-day educational programme “A Day at the Acropolis restoring its monuments”, which was held on the Acropolis Rock. (see previous article in the current issue). The Department’s educational museum kits that cover 8 different themes were lent and used by 8,864 pupils from 174 schools (433 classes) in 18 prefectures



*Educational programme in the Acropolis Museum. Photo. E. Kaimara, 2012*

Parthenon Frieze” participating in which were 20 pupils from the 1st Cross-cultural Lykeion (EPAL), with a middle level knowledge of the Greek language, from Albania, Armenia, Bulgaria, Ukraine, Pakistan and Syria. In addition, 600 pupils

throughout Greece. The Acropolis Museum family backpack entitled “A Day in the Acropolis Museum with the Goddess Athena” was lent from September 2011 to August 2012, to 4,598 families (3,525 Greek families and 1,073 from abroad). It is estimated that the packs have been used by some 15,000 parents and children.

A second family backpack entitled “Archaic Colors” was completed in June 2012 to accompany the initiative of the Acropolis Museum under the same title. The backpack contains leaflets and games aiming to help the children to imagine the appearance of the statues in the archaic period with all their colors. On the occasion of this initiative, which had as a focal point the statue known as the Peplophoros Kore, the Department also created the on-line game “Color the Peplophoros Kore” ([www.theacropolismuseum.gr/peploforos](http://www.theacropolismuseum.gr/peploforos)) so that the children can either paint a drawing of the Peplophoros inside the Museum area or



*Educational satchel for the programme “A Day in the Acropolis Museum”. Photo T. Souvlakis*

paint it online at home as many times as they like.

The Department also held seminars for 255 people, educators and students from Greece and abroad, to whom educational resources were given. The theme of most of the seminars was “Educational Programmes about the Acropolis and the Acropolis Museum”. The Department also participated in a symposium on the subject “Museum and Children’s Book: A Two-Way Relationship for Education”, organised by the Ministry of Education, Department of Primary Education in collaboration with the B&M Theocharakis Foundation for Fine Arts and Music.

On September 30, 2011, the book “Acropolis and Education” was presented in the Acropolis Museum. The book was published through a generous grant from the Panayiotis and Effie Michelis Foundation, to whom special thanks are due. The presentation of the book was made by the Director Emerita of YSMA, M. Ioannidou, the Director Emerita of the 1st Ephorate of Prehistoric and Classical Antiquities, S. Samartzidou, the President of the Acropolis Museum, Professor D. Pandermalis, the President of the Michelis Foundation, Professor D. Zevas and by the Head of the YSMA Information and Education Department (until 2011), C. Hadziaslani. The event was a great success. Approximately 250 educators, collaborators of the Department during the past 25 years, as well as many other friends of the educational programmes attended the presentation.

Among the digital applications of the Department, the application about the Parthenon frieze ([www.parthenonfrieze.gr](http://www.parthenonfrieze.gr)), registered 124,200 visits and 100,476 individual visitors. This particular application was presented under the title: “The Parthenon Frieze “has come to life” in the Newsletter published by the General Secretariat of Research and Technology (March 2012 volume).

Likewise the more recent application about the goddess Athena ([www.acropolis-athena.gr](http://www.acropolis-athena.gr)) reached 22,300 visits with 19,061 individual visitors. This application was presented in the

periodical “Innovation-Research & Technology” (vol. 84/June-August 2011).

In addition, the YSMA Department of Information and Education in collaboration with the National Documentation Centre (EKT) proceeded with the digitation of all of the educational material.

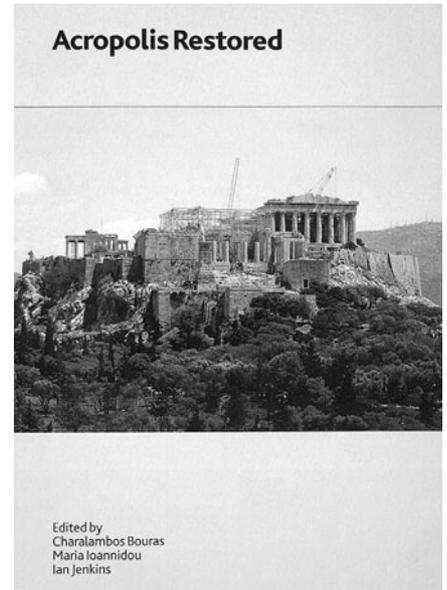
Of special significance was the publication of the activities of our Department under the title: “Case Study “The Acropolis Education Department” in Mike Corbishley's book “Pinning Down the Past: Archaeology, Heritage, and Education Today”, Woodbridge U.K., 2011.

Finally, the museum kit entitled “Ancient Greek Dress” was renewed with the financial support of the Friends of the Acropolis to whom special thanks are due.

### Publications

The second edition of the volume entitled “The Restoration of the Monuments of the Athenian Acropolis” by M. Ioannidou and E. Lembidaki, was issued in October 2011, in Greek and in English. The texts were updated and enriched with recent photographic material. The volume has been structured so as to include not only the programmes already completed, but the YSMA agenda for the period 2011-2013, as well.

Special mention must be made of a British



*The cover of the British Museum publication “Acropolis Restored”*

Museum publication, to which members of the scientific staff of the Acropolis Restoration Service contributed. It comprises the Proceedings of the one-day Conference organised by the British Museum (8 October 2010), which began circulation in March 2012 under the title “Acropolis Restored”, edited by Ch. Bouras, M. Ioannidou and I. Jenkins. The publication was presented to the Greek public on 24 May



*Informative panels about the restoration of the Acropolis monuments. Photo V. Vlachou, 2012*

2012 at a formal presentation held in the garden of the British School at Athens.

### Activities for informing the general public

For the information of visitors to the Acropolis, the YSMA issued an informative leaflet edited by the Documentation Office and now distributed at the entrance to the archaeological site. The leaflet, which contains information about the works being carried out on the monuments and those already completed, was printed in 100,000 copies. In addition, the leaflet was printed in Braille script (140 copies), for visitors with visual problems.

Simultaneously, the YSMA has set up bilingual signs, south of the Parthenon laboratory, providing information about the restoration works on the Acropolis. The signs, which were also edited by the Documentation Office, include information about the restoration interventions and photographs showing the monuments before and after the work. The combination of these two methods of information (leaflet and information signs) is intended to familiarise the visitors to the archaeological site with the works of restoration and, consequently, with the present image of the monuments.

### Distinguished visitors to the Acropolis

On March 27, 2012 the General Secretary of the International Organisation for Tourism, Mr. T. Rifai, and the Minister of Culture and Tourism, Mr. P. Geroulanos, visited the archaeological site of the Acropolis. Mr. Rifai was shown the restoration works by the Minister, the President of the ESMA, Professor Ch. Bouras and the Director of the YSMA Ms. V. Eleftheriou. During their visit they watched the dismantling of the outer block of the architrave of the NW corner of the Parthenon. When this was completed, Mr. Rifai expressed his enthusiasm and commented warmly on the zeal and dedication shown by the Greeks of today for the protection of culture and heritage.

On June 11, 2012, the Minister of Culture and Tourism, Ms. T. Karapanayotis likewise visited the Acropolis works, accompanied by the General Secretary of the Ministry, Dr. L. Mendoni. During their visit they observed the dismantling of architectural members from the SW corner of the Parthenon and were informed about the progress of the anastelosis by the President of the ESMA and the Director of the YSMA.



Information leaflet about the restoration of the monuments

### Guided tours for specialist visitors

As every year, so too in the past year members of the international scientific community showed a lively interest in the Acropolis works. Special tours and presentations were therefore organised on the archaeological site. An example is the guided tour of the participants in the XV European Conference on Soil Mechanics and Geotechnical Engineering, given by M. Ioannidou, Director at that time of the YSMA. The tour was held on September 15, 2011 and was focused on the structural restoration of the monuments, on the monitoring of their seismic behaviour, on the problems of the Acropolis circuit wall and on the research on effective ways of confronting these problems.

The meeting of the YSMA staff likewise with representatives from China should also be mentioned. On May 11, 2012, the Director V. Eleftheriou and M. Ioannidou, met with a six-member Chinese delegation of scholars involved with restoring the Forbidden City of Beijing. The meeting was in the framework of a collaboration that had been initiated in 2008 when the Greek Embassy in Beijing together with the Beijing Municipality/Administrative Division of Haidian, the Old Summer Palace (Yuanmingyuan) and the Architectural School of the Tsinghua University



Remembrance photograph on the occasion of the visit by the General Secretary of the World Organisation for Tourism, Mr. T. Rifai and the Minister of Culture and Tourism, Mr. P. Geroulanos, to the Parthenon worksite. March 2012

had organised a conference on the anastelosis works of the Acropolis monuments and of the Forbidden City. Discussed in the meeting held this year were matters of organisation and structure of the Services of anastelosis and prospects for future collaboration between Greece and China in questions of methodology and principles of conservation and restoration of the monuments. During the meeting each part (Greek and Chinese) presented its own work. The members of the delegation were then given a guided tour of the Acropolis and were informed about the works in progress.

Another six-member delegation from the Municipal Government of the city Suzhou, in Jiangsu Province likewise visited Greece from the 15th to the 18th of May 2012. On May 15 the members of the delegation met on the Acropolis with the Director V. Eleftheriou and M. Ioannidou, where they were informed about the work of the YSMA after watching the dismantling of a metope from the south side of the Parthenon.

#### **Publications - lectures about the Acropolis**

In addition to its responsibilities on-site, the scholarly staff of the YSMA took part in various events, in order to circulate the results of the restoration works to both the general and specialised public.

A symposium entitled “*Restauri dell’antico*” was held at Selinus on 20-23 October, 2012, to which M. Ioannidou, T. Tanoulas and K. Karanasos were invited and participated, giving respectively the following papers: “The anastelosis of the Athenian Acropolis”, “The anastelosis of the Propylaia” and “The anastelosis of the superstructure of the South Wall of the Propylaia”.

In the context of a seminar on the subject “Athens: Historical Analysis and Restoration of Ancient Monuments”, organised by the Italian School of Athens for archaeologists and architects from Italy, N. Toganidis presented the anastelosis programme of the Parthenon (September 21, 2011), K. Karanasos presented the

anastelosis programme of the Propylaia (September 22, 2011) and M. Ioannidou gave a lecture on the subject of the works of anastelosis of the Acropolis (September 23, 2011).

In addition, K. Karanasos gave a lecture on the subject: “The interventions on the monuments of the Acropolis of Athens: principles and methodology” at the Italian School of Archaeology, on October 31, 2011 in the framework of the 5th Master Itinerary of Museography, Architecture and Archaeology of the Academia Adrianna, in collaboration with the Politecnico di Milano. M. Katsiannis, archaeologist from the Documentation Office,

“Techniques in Art Conservation, Diagnostics and Analysis” that was organised by the European organisation CHARISMA and was held at Herakleion, Crete (June 18-22, 2012). Their contribution was entitled “Restoration interventions on the Acropolis monuments”.

To conclude, on June 26, 2012, the heads of the technical offices presented the restoration works of the Acropolis to students of the NTUA, in the framework of the interdepartmental post-graduate programme “Protection of Monuments”. The presentations were given by V. Eleftheriou (The work of the Acropolis Restoration Service), R. Christodoulo-



*During the visit of the Minister of Culture and Tourism, Ms Karapanagioti at the Acropolis worksites. Photo T. Souvlakis, 2012*

participated in a Seminar of the Archaeology Data Service of the University of York on the subject of the digital management and diffusion of information from data collections of cultural heritage (5 to 23 March 2012), in which he presented the procedures of digital documentation and the digital applications of the YSMA. M. Ioannidou gave the traditional presentation for the Friends of the Acropolis, on April 26, 2012, on the subject: “2011-2012: The progress of the restoration works on the Acropolis”. The lecture, which is given yearly, is by now firmly established as a channel of communication with the general public. V. Eleftheriou and E. Angelakopoulou took part in a seminar entitled “Advanced Laser Based Tech-

poulou (Restoration works on the Parthenon) K. Karanasos (Restoration works on the Propylaia), D. Michalopoulou (Restoration works on the Temple of Athena Nike) and E. Angelakopoulou (Surface conservation on the Acropolis Monuments). A few days later, on July 5, 2012 presentation of the works concluded with a visit by students to the Acropolis.

**Evi Petropoulou**  
Archaeologist  
Documentation Office

## Nikos Skaris (1923-2012)

The Acropolis fortification walls embrace not only the history of the monuments they protect through the course of centuries, but the history of the people who work on the monuments as well.

On a certain day the YSMA family was saddened by the loss of a member who was very much their own, mastro-Nikos, as he was known even by the younger generation of those working on the monuments.

Nikos Skaris was born in 1923 in Pyrgos, Tenos. Two and a half years later, he came to Athens. In 1933 he trained in the marble carving unit of Dionysios Pissas and then worked as an assistant in marble workshops, participating in notable works of marble-carving, such as seen in the church of St. Dionysios in Zakynthos, where he learned, as he himself records in his personal notes, “the Byzantine decorations”. His technique and his ability developed rapidly and in 1949-1950 “he carved the flutes of the Doric columns” in the Chamber of Commerce of Piraeus.

Beginning in October 1950, he worked in archaeological sites, in the Delphi Museum with the Feench excavators, where his work centered on the mending of sculpture, followed by the Odeion of Herodes Atticus on the joining and carving of new fillings for the seats. In 1952-1953 he worked successively on the Propylaia of Athens and on the Temple of Aphaia in Aigina. From the middle of 1953 to August 1954 a series of remarkable works gave Nikos Skaris the opportunity to develop his talent and his devotion to marble. He then worked on the templum, the pulpit and the patriarchal throne of Ayios Demetrios in Thessalonike, the

beam and coffered ceiling slabs of the west wing of the Parthenon (A. Orlandos intervention) and the two Ionic column capitals of the Archaeological Society in Athens. In 1954, with the initiation of the restoration interventions, he worked on the Ancient Theatre of Epidauros, in 1955 he carved the column capitals of Ayios Andreas in Patras, and between 1955 and 1958 he worked at various times on the restoration interventions carried out on the Temple of Poseidon at Sounion and on the Odeion of Herodes Atticus. This was



*N. Skaris (1923-2012). Photo YSMA Archive*

followed by a long interval during which he was absent from the work of restoring ancient monuments because he was running his own marble-carving enterprise. Finally, from 1979 until his retirement in 1987, he devoted his work exclusively to the interventions for restoration of the Theatre of Dionysos, the Propylaia, the Erechtheion –as head of the team– and the Parthenon. After his retirement, in 1987 he worked with Professor Ch. Bouras on the creation of a little Museum of Sculpture in the restored refectory of the monastery of Hosios Loukas. His final work, in

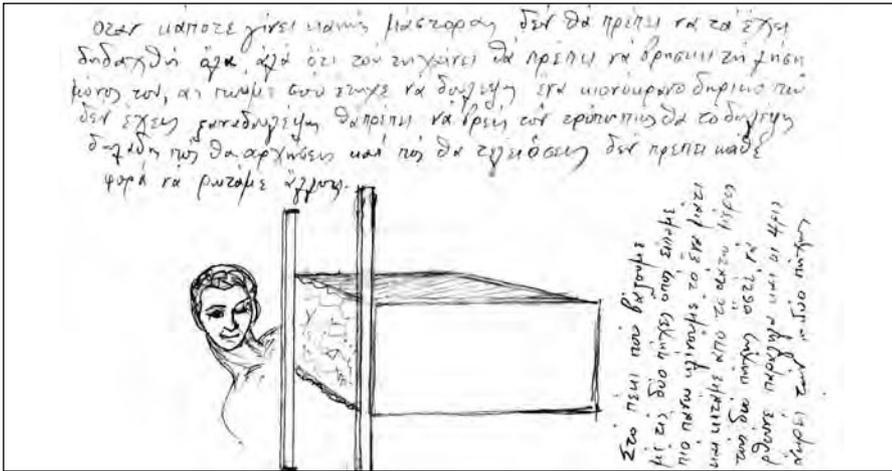
1993, was a model Ionic capital and palmette pillar for the façade of the Arsa-keion.

Skaris believed that the good master technician was not born, but that his ability was the result of experience, practice and “how quickly” the individual mind “moves”. He considered an important factor in the development of artistic skill to be “the works in which a person happens to take part”, so that the technician is able to develop his skills and to have the necessary stimuli.

Nikos Skaris was eminent not only as a good marble technician, but as a teacher who imparted much to the young marble cutters of the Acropolis, never withholding the secrets of his art. As he characteristically writes himself, “at that time, the old masters did not show you how you too could learn to be good, so as to prevent new and good [technicians] from emerging and taking away their livelihood, so you had to watch the technique and steal it”. Apart from being a master technician, Nikos Skaris was an

especially beloved person. His gentleness, his kindness and his smile singled him out. He did not teach the young under pressure, but with calmness and patience because he loved the young and the art of the marble cutter. He was the first to rise for work, giving the example. Affable and endearing, he won the respect and recognition of his colleagues, sentiments demonstrated every day by supervisors and technicians alike.

The love and eagerness to learn the art of the marble cutter was for Nikos Skaris not an undertaking stemming from need, but



**Handwritten notes of N. Skaris with instructions for young marble technicians. Archive of the Skaris Family.**

a deep desire, as is evident from his written notes. From the age of 11 he worked as an apprentice in the marble workshops of Piraeus, “they had me carrying various things to the masters and in the evenings when they stopped work, I would ask one of the nicer masters for a couple of marble scraps and I hammered until it was dark and I could not see anymore, and I said to myself why couldn’t there be three more hours of daylight so I could work when I was alone and it was quiet and I could work by myself.” Elsewhere, he says “I went along to the cemetery and spent hours looking at the good monuments, I

always had a pad of paper with me and I drew whatever appealed to me, and that is why I always say that you have to be in love with art”.

His great contribution to the works of the Athenian Acropolis, and in general to the restoration of ancient and modern monuments was recognised and Nikos Skaris was honoured together with other marble technicians at a special event held by the Friends of the Acropolis in March 2006. Two years after this, in May 2008, he was honoured with the medal of the Golden Cross of the Order of the Phoenix and

decorated by the President of the Hellenic Republic, Mr. Karolos Papoulias at the Presidential Mansion.

Skill, devotion and artistic sensitivity for the monuments are recognised in the person of Nikos Skaris in the best possible way. When people like Nikos Skaris, depart this life, they leave as their bequest for the generations to come, not only their rich work, but a brilliant example of humanity and wisdom.

**Elena Karakitsou**

Archaeologist

Parthenon Restoration Project

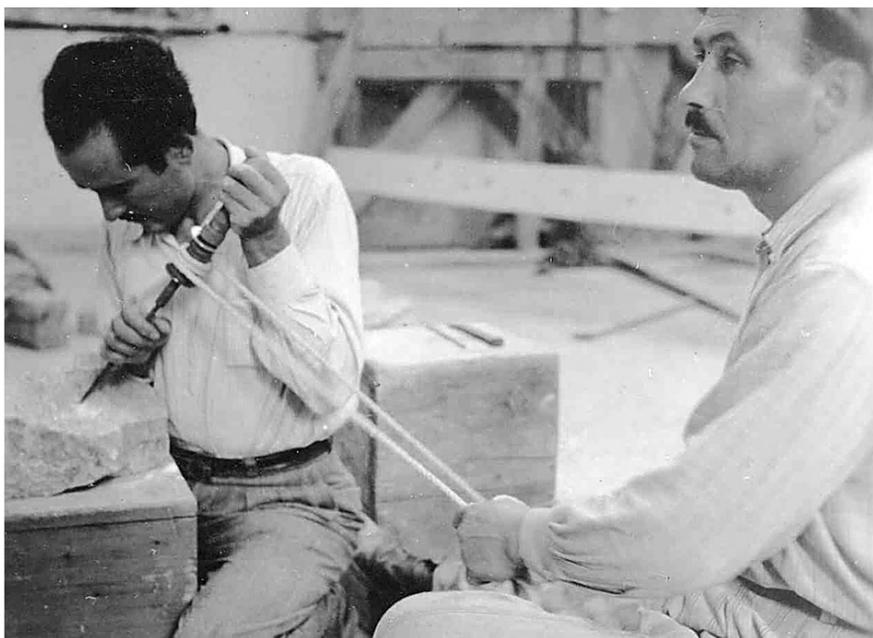
*The biographical facts were drawn from a biographical note that Nikos Skaris had composed and placed in the care of the late architect A. Papanikolaou. The rest of the information comes from the personal archive of the technician, which his daughter, Tina Skari, kindly put at my disposal. I thank her warmly for entrusting me with this.*



**Restoring the Erechtheion: moments of everyday life at the worksite. Photo YSMA Archive**



**Intervention in the Herodeion: N. Skaris working with the "aris" (hand-powered drill).  
Photo Archive of the Skaris family**



**The use of the "aris": N. Skaris (left) and his assistant run the hand-powered drill.  
Photo Archive of the Skaris family**

News Letter of the Acropolis  
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of the General Secretary of Culture  
of the Ministry of Education  
& Religious Affairs, Culture & Sports

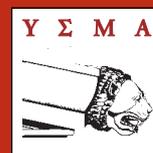
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