



The restored ceiling of the West Hall of the Propylaea. Photo T. Tanoulas, December 2008

- Ch. Bouras, Strict and less strict adherence to the principles of anastelosis of the ancient monuments in Greece
M. Ioannidou, 2008-2009, Progress in the Restoration Works on the Acropolis
M. Ioannidou, Strategies for the anti-seismic protection of the Acropolis Monuments
R. Christodouloupoulou, Study for the anastelosis of the upper part of the entablature of the Parthenon north colonnade
E. Karakitsou, Games in the Parthenon
C. Hadziaslani, I. Kaimara, A. Leonti, www.parthenonfrieze.gr
F. Mallouchou-Tufano, News from the Acropolis

Strict and less strict adherence to the principles of anastelosis of the ancient monuments in Greece

For the interventions on valuable cultural resources to be accepted academically, but chiefly socially, as is the case with architectural heritage, it is necessary that certain principles be established and that they be in force. As we know, in connection with the conservation and restoration of ancient and historical monuments, a range of opinion and objections are raised that are not unrelated to the complexity of the subjects and the feelings and values that connect people with memories or with their sense of history.

The principles, in general, depend on the values ascribed to things by people in each period and place, specifically to the architectural monuments. Societies, however, develop, and the values they attribute to the various monuments change. This means that principles are in no way dogmas, and they may therefore be applied with greater or lesser strictness, under a system of syllogisms directly related to the monument itself or to its environment.

As a battle against fatal damage, the conservation of architectural monuments, moreover, is endless. Taken as a dynamic process it is subject to powerful criticism. Yet the value of age, not to say archaeological value, likewise changes, increases, while other buildings come along to be added every so often to the so-called monumental richness of a city, an area or a place.

Indeed in the actual present we cannot work without principles, without some codes based on the values, I repeat, of the very monuments. Each case differs from the next because of the dissimilarity in evaluation, in the grading of these values. We all know the opposing tendencies that are

evident in nearly all cases between artistic, historical, utilitarian and environmental values. And cases are not rare in which to save a monument from certain destruction it was necessary to apply the principles loosely or even to negate principles that

cede in time the well-known Charter of Venice.

It was drawn up and published in May 1964 as a result of the 2nd International Congress of Architects and Technicians of Historical Monuments that had assembled

in Venice. It is not only in force today, after forty-four years, but nothing in it has been changed, although discussions on bringing it up to date have been held two times. It should not be forgotten, however, that this valuable document was composed by architects, such as Roberto Pane and Piotr Bieganski, who were familiar with monuments quite different from ours, following the mass reconstructions of post-war Europe. The soul of the Congress was Pierro Gazzola, famous then for his reconstruction of the bridges of Verona. Neither archaeologists nor art historians took part in the Venice Congress. The Charter of Venice defined principles based on values historical, artistic and of use, principles that are indeed applicable also to the ancient monuments of Greece, those which we consider to be the most valuable. Yet in this case there are peculiarities that were not foreseen at that time in Venice. The years that have passed since then have introduced new experiences in the handling of the architectural remains of Greco-roman antiquity in Greece, Italy and in the lands of the Eastern Mediterranean. Critical review of the interventions has already produced a valuable theoretical reserve for the new studies and works of anastelosis.

The architectural monuments of Greco-roman antiquity, those which have survived, are practically all in ruined condition. Some have come to light in excava-



*The tower of the Acciaiuoli in the Propylaea shortly before its demolition in 1875.
Photo P. Sebah, 1872-1875, ESMA Archives*



*The Roman Agora of Athens with its diachronal stratigraphy. View from N.
Photo E. Bardani, 2003. Archive of the 1st Ephorate of Prehistoric and Classical Antiquities*

had been established from the beginning. Let us remember the official, internationally accepted principles for conservation and restoration of architectural monuments. The so-called Charter of Athens of 1931 and the Italian Charter for the protection and restoration of historical buildings pre-

tions and were totally invisible for centuries. It is evident that all belong in the category of historical evidence and that scientific and archaeological values take supremacy over others. The process of excavation, study, interpretation and anastelosis brings them back into our life. It does not, however, give them life again, excepting perhaps the theatres; it does not restore their use, but changes them rather into simple exhibits.

Returning to the principles that were institutionalised in Venice in 1964 and bearing in mind what has been observed above about the monuments of Greco-roman architecture and the experience gained, suffice it to note that six additional principles have been accepted *de facto* in Greece after the political turnover of 1974, which will be discussed below.

Emphasised in one of the Charter's first articles is the value of the later phases of the monuments. Indirectly, their removal in order to project the morphological unity of their original phase was condemned. In modern Greece, especially during the 19th and early 20th centuries, the classicising perception and intention of displaying ancient culture became the motive for demolishing not only more recent buildings but valuable mediaeval buildings such as the tower of the Acciaiuoli in the Propylaia, the Church of the Asomatos on the Steps and the Church of the Megale Panaghia, both in the Library of Hadrian. In 1960, maturer thinking saved, at the last moment, the Mediaeval Tower of the Parthenon, demolition of which had already begun. And, to remain in Athens, a place where one can easily grasp the diachronical course of history, the so-called historical

stratification demanded by the Charter, there is the Roman Agora where Roman, Early Christian, Byzantine and Ottoman remains still co-exist, despite the drastic demolitions of the previous century.

For the stipulation of the Charter of Venice

Culture and direct and supervise works of anastelosis on monuments. The Archaeological Ephorates, however, carrying out similar works but with un-specialised personnel, have had to apply some of the requirements loosely.

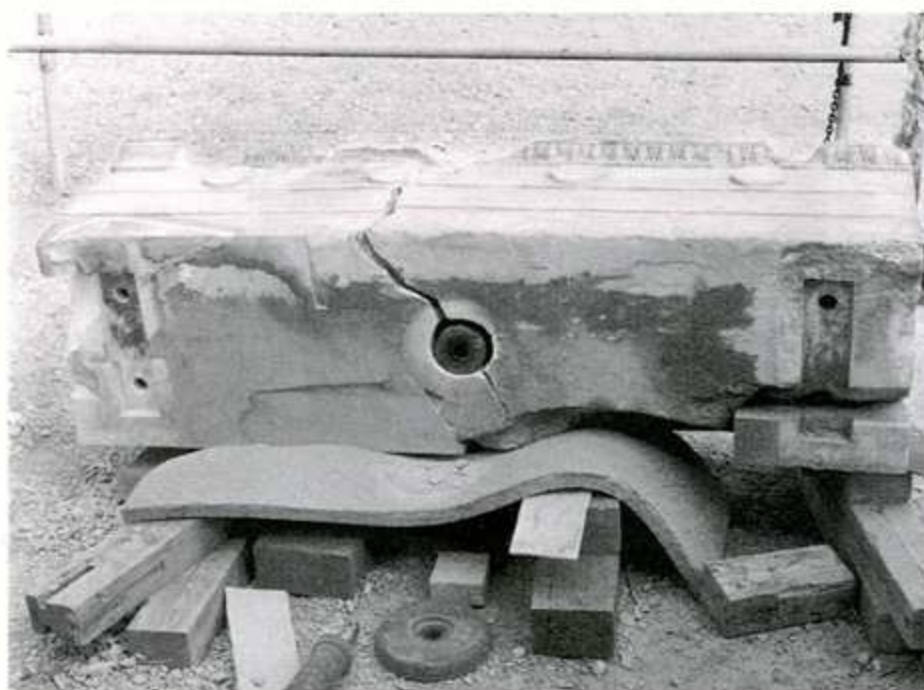
The big problems on the Acropolis come from denial of what was later the Charter's Article 10, all of which happened during the first years of the last century, well before the existence of the Charter. The article permits the application of modern material and technology in the restoration of the monuments, under the explicit supposition that their resistance has been demonstrated with the passage of time. The use of iron and reinforced concrete, which began at that time, was catastrophic for the monuments of the Acropolis. Nikolaos Balanos (the earlier restorer of the Acropolis monuments) had not understood that reinforced concrete is not impermeable and that the simple steel rods rust out easily, expanding in the process. The reinforced concrete likewise proved to have a limited life-span and, depending on conditions, is destroyed by the rusting of its reinforcement. The *béton armé* floors of three houses in Delos, the House of the Masks, the House of the Trident and the House of the Herms, are already threatened with collapse. So too, the slabs of *béton* around the temple of Athena Nike and in the

Pinacothèque of the Propylaia will have to be replaced within a few years, if not immediately. The iron reinforcements incorporated into the west doorway of the theatre of Epidauros have already been replaced, as they too were in danger of collapsing.

This same article was strictly observed in



Performance of Medea (directed by Peter Stein) in the theatre of Epidauros. Photo F. Mallouchou-Tufano, July 2004



Break in an architrave block of the south porch of the Erechtheion, caused by the iron and cement used in the intervention of N. Balanos. Photo A. Tzakou, October 1979

(article 2) on a multi-disciplinary approach to the problems that concern us, expectations have been met, in addition to the Committee for Conservation of the Acropolis Monuments, by all the Interdisciplinary Committees that function in the framework of the Hellenic Ministry of



The Stoa of Attalos just after its reconstruction in 1956. Photo Archive of the American School of Classical Studies

the Acropolis programmes after 1975. The modern polymers and various resins that offer easy solutions in contemporary building have not yet been tested through time. Thus from the beginning, from 1975, their use on the monuments was excluded, thanks to the insistence of the late Theodore Skoulikidis, who was a member of the ESMA and whose approach has since been completely justified. The wide use of these

materials abroad has proved with the passage of time to have been catastrophic and today their use is excluded for every kind of historical monument.

Both, the period when the Charter was published and the work of its compilers justify the view that monuments should be put to use, as stated in article 5. This stipulation, to be sure, concerns chiefly the more recent monuments and not those of



The Stoa at Brauron, after its anastelosis. Photo I. Ioannides, 1962

antiquity. Insistence on monuments being used had increased ten years later, around 1975, when the historical centre of Bologna was renovated with extraordinary success, with drastic restorations and changes in use. This, however, does not concern us. In Greece the subject becomes serious, mainly in respect to the use of the ancient theatres. This is a matter that could well occupy a sizeable international congress, with speakers of many different disciplines. The ancient theatres that have come to light through excavations are valuable monuments from the artistic and historical standpoint, but they are very fragile because of their antiquity. People connected with the theatre or with tourism understand the historical charge of these ancient remains and they are in a hurry to organise performances, overlooking the tremendous damage caused by the audiences or even by the periodic deformation of the monuments with their stage scenery, usually massive. Very few of the ancient theatres, even after systematic conservation and under strict rules, can be used again for performances. A case where the values of use outweighed other values is certainly the Odeion of Herodes Atticus, the cavea of which was «re-marbled» by Anastasios Orlandos. It lost its archaeological significance but I believe that it has been justified as a public resource, for half a century. A similar case is seen in the Panathenaic Stadium, where the construction in marble obliterated even the smallest trace of archaeological interest.

On the subject of restoration of the classical monuments, the provision is that no restoration shall be made unless the original form of the monument is certain, and unless a full archaeological study has been made prior to any intervention. We would add that in the case of important historical and artistic monuments, the archaeological study together with theoretical graphic restoration of the monument must be published, so that criticism and discussion, always fruitful, can precede the work. Yet this rarely happens. The Committee for Conservation of the Acropolis Monuments (ESMA), with the organisation of regular international meetings specifically for the works, has always published all its studies and given them wide publicity. Yet the ana-

stelosis of the temple at Sounion was carried out without a study and while the Stoa of Attalos was rebuilt on the basis of the excellent plans of Yiannis Travlos, they have not so far been published in an independent monograph. It is self-evident that the theoretical study for the restoration, which is based on research, must precede every intervention. Further examples, apart from the temple at Sounion, are the Odeion of Patras, the cavea of the theatre at Dodone, and others.

As well-known errors of anastelosis we may note the columns of the Tholos at Delphi (restored with one drum too many) and the temple of Athena at Priene (with one drum less than the original). Exclusion of every action (according to the Charter of Venice), when there is not absolute certainty as to the form to be restored, would condemn all efforts to display the monuments, unless applied with a certain freedom. A typical example is the Stoa at Brauron. The height of the columns has been estimated to within approximately two or three centimeters. The first drums, of all the columns, were preserved unmoved in place, except that more or less all of the upper resting surfaces had been destroyed by the ploughs of the local farmers. Estimation of the height was made in three different ways, but absolute certainty was impossible. When Orlandos planned the «re-marble-ling» of the Odeion of Herodes Atticus, for access to the upper part of the cavea from the diazoma, he solved the problem with side steps for which there was not the slightest archaeological evidence.

Matters themselves sometimes lead to the acceptance of a deviation from the archaeological evidence. The far right cuneus of the upper section of the cavea of the Epidauros theatre, which was restored during the 1990s, does not follow precisely the cutting indicated by the size of the ancient members because a correction here would have required dismantling and resetting two adjoining cunei that had already undergone natural small shifts and had created a stable situation, accepted by A. Orlandos in the 1960s.

According to the principles defined, the addition of new material in the course of the anasteloses must be limited to the mini-



The pronaos columns of the so-called Theseion, restored by A. Orlandos in 1937. Photo F. Mallouchou-Tufano, May 2008

mum required and the additions must be differentiated from the authentic parts, in order to avoid falsifying the monument. This differentiation is a serious problem for monuments of classical antiquity, where every change of form threatens to upset their utter harmony. In his restoration of the pronaos of the Theseion, Anastasios Orlandos succeeded with the problem of



Restoration of the Monument of the Crotonians at Delphi, showing a justified use of much new material. Photo Ch. Bouras, 2006

differentiation by making the column drums without fluting. The result is good, given that the ancient parts are few and the form of an unfluted column is what predominates. Better known is Balanos' making of cement drums for the side colonnades of the Parthenon, which was considered a success. Yet in this case the material betrayed the intention: the cement cracked, salts resulted and the iron rods introduced as reinforcements rusted, causing damage to the adjacent ancient members. These have already been removed, but differentiation between the new additions and the ancient sections of the monuments, demanded by the Charter, remains a problem. In the work of the Acropolis there is no differentiation either in material or in the method used to carve the new fillings. The form is thoroughly respected and the meticulous documentation and publication removes any fear of falsification. Another relatively recent case, with differentiation overdone, is seen in the columns of the stoa of the Prytaneion at Ephesos.

The so-called artificial stone, the basis of which is cement, has led to other failures, such as seen in the monuments of Lindos and Cameiros in Rhodes, restored by the Italians before World War II, and the Altar of the Chians at Delphi, restored a second time in the 1960s. Artificial stone is indeed used in the Acropolis works, but solely for making copies of the architectural sculpture (such as the Caryatids, the metopes and the frieze of the Parthenon), where the accuracy of the copy can be assured only by a material that is cast. It goes without saying that the copies are made of a special material and according to specifications that insure their resistance and good condition over time. To make architectural members of artificial stone and especially on monuments of great importance, such as the temple of Zeus at Olympia, is totally unjustified.

Practically all the sculptural decoration of the Acropolis monuments has been removed to the Museum since it was understood that it was absolutely necessary for their preservation, precisely as stipulated in article 8 of the Charter. This was preceded by hesitation, experiments in protection *in situ* and endless discussions. It is possible,



The copy of the Parthenon west frieze after being set on the monument. Photo Ch. Bouras, 2005

however, to return the sculptures to their original places when environmental conditions permit.

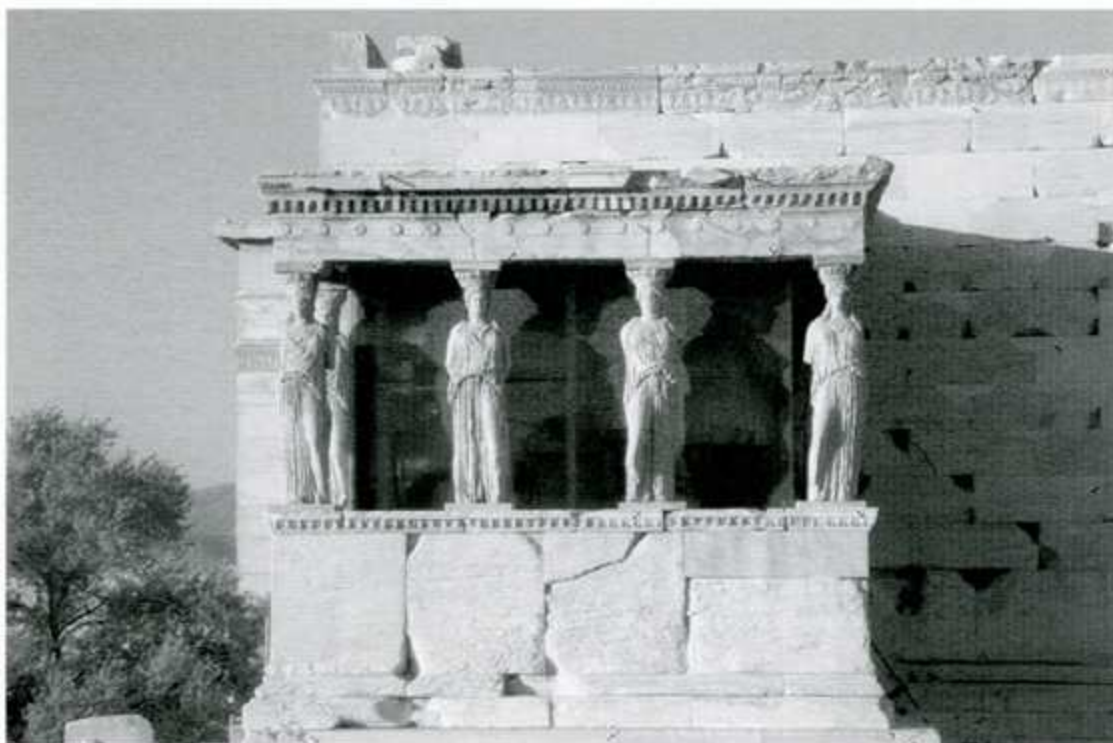
The reversibility of our actions was not specified in the Charter and it applies only to those monuments of antiquity that have been constructed of independent architectural members, without mortar. It is a principle that has become respected during the last thirty years in Greece. It permits the correction of errors and it is based on both

meticulous documentation, as specified in article 16 of the Charter, and on absolute respect for the ancient architectural members, which are never re-cut. Well known information about the method of application will not be repeated here, but it is worth noting that some «invulnerable» systems of anastelosis have been ruled out, in which the ancient material was destroyed, even though invisibly, as in the proposal for the temple at Nemea. Another principle, di-

rectly connected to the preceding, is the retention of structural independence of the architectural members, which, in cases where they are filled in, must attain the resistance and structural function they had in antiquity.

In article 15 of the Charter, it is specified that additions must be kept to the minimum required. With classical monuments an effort is made to add new material in cases where it is needed so as to base or support authentic ancient members on top of them. Thus in the Propylaia, the ancient coffered slabs, which have enriched the anastelosis, justify both the new beams and the new copies of the Ionic column capitals. A less than strict application of this principle is seen in the altar of Apollo Maleata at Epidauros, in the stage building of the theatre at Philippi and in the back part of the propylon of the Library of Hadrian.

Systematic study of the cuttings and traces on the architectural members makes it possible to determine their original position. This is strictly observed on the Acropolis, the only exception being the anastelosis of members that originally had no cuttings for joining, as, for example, the coffered ceiling slabs of the Propylaia. The principle is followed less strictly in cases where few members have survived; by setting similar members without distinction, the general result



The south porch of the Erechtheion with the copies of the Caryatids in place. View from the S. Photo F. Mallouchou-Tufano, March 2006



The projecting block of the «epicranitis» (wall crown) of the east wall of the Erechtheion restored. Photo F. Mallouchou-Tufano. May 2009

is improved, as for example in the Abaton at Epidauros.

While it has not been defined as a principle, it is obvious that in the anastelosis of the classical monuments of antiquity forms should not emerge that offend the viewer's sensitivity to structure.

For the canon of natural ruination and the aesthetic of the ruins, the observations of the great Victorian, John Ruskin, are still timely. Fortunate circumstances allowed us to have just such a tranquil and, in a sense, natural result in the Stoa at Bauron. The same cannot be said for the *epikranitis* (wall crown) of the east wall of the Erechtheion or for the half-finished buttress of the theatre at Philippi.

Article 15 of the Charter of Venice, which refers to excavations and antiquities, literally encourages «every decision that will facilitate the understanding of the monument without altering its significance...», that is, its so-called comprehensibility. The goal is clearly for the archaeological finds to be cultural goods open to all, and if the architectural work is considered as connected with the meanings of place and environment, the anastelosis as an act has proved to be justified and it is proposed as a social request.

Yet it is known to all involved that the demand for comprehensibility and aesthetic



*Restoration of the stage-building "skene" of the Philippi theatre showing unjustified use of new marble.
Photo Ch. Bouras, 2007*

enhancement runs counter to archaeological and scholarly values, which require that the ruin remain intact so as not to lessen to the slightest degree the historical evidence that is preserved. It is this contention that is the focus of most of all the theoretical discussions about the management of the monuments, be they classical or not.

It is true that during recent years there has been a tendency toward greater additions

of new material, which has caused some to speak of «the creation of antiquities», while the Charter demands the minimum of new additions, in order to retain formal continuity. Quite rightly no mention is made of the amount of additional material permitted, as it all depends on the nature of each individual monument. Comprehensibility is achieved by displaying the height of the buildings, with the restoration again of



Buttress of the cavea of the Philippi theatre, restored in half-finished stage, projecting into the site of the monument. Photo Ch. Bouras, 2007



*Didactic partial anastelosis of the Philippeion at Olympia.
Photo F. Mallouchou-Tufano, 2004*

columns and walls. This is the case with the propylon of the dining hall at Epidauros, which is now astonishing with its size and harmony, the colonnade at Pella, the temple of Zeus and the Philippeion at Olympia. Comprehensibility is likewise improved by establishing the boundaries of a monument that has been levelled, as the temple of Asklepios at Epidauros, or the cella of the Parthenon, the orthostates of which have been restored and define its outline on the interior. All this is as a rule reversible and as a result does not lessen the archaeological value of the monuments. Adhering strictly to the principles may save a monument for future generations, but the present generation is deprived. This is the situation with the members of the temple at Rhamnous that have been stored in a closed shed, and the foundations of the Arrephorion on the Acropolis, which were backfilled.

Articles 1, 6 and 7 of the Charter refer to the environment. For the Classical Greek monuments, the problem has been resolved as a rule by defining buffer-zones around them. That does not mean that there have been no mistakes (for example, the building of the Mycenae Museum within the archaeological site), or the relaxed application of principles in the use of temporary shelters of all sorts. Today all have understood the immediate relation between nature – environment – monuments. The recent international symposium of ICOM at Xi-an in China had this relationship as its sole theme. For the immediate environment of the classical monuments of the Acropolis, with the

restoration of the ancient terrain, Professor Manolis Korres has made a study that was presented six years ago at the 5th International Meeting for the Restoration of the

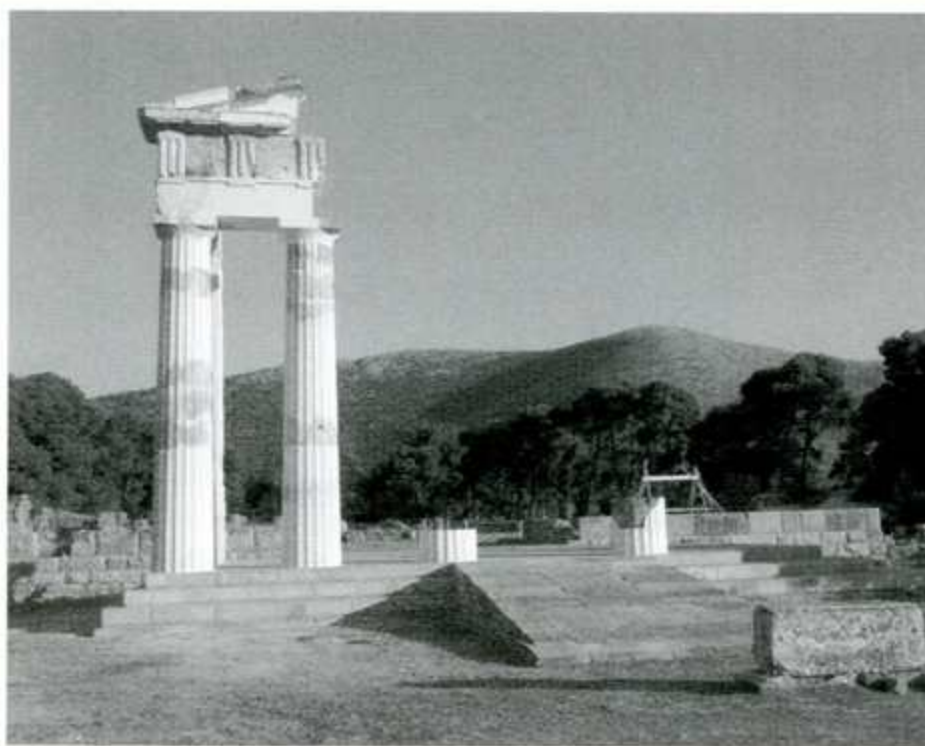
interventions and especially in the anasteloses there are always positive and negative results. Between total negation, with piles of stones in abandoned fields, and rebuilding, for the purpose of use or of manipulated comprehensibility, there is surely a balance. A balance between the values, corresponding principles and rules on one hand, and, on the other, an assessment of the needs, rationalisation of facts and what is known.

With our initial comments about the dynamic change of ideas, proposals and possibilities in mind, we turn to the Stoa of Attalos. Today a decision to rebuild it would not be made, so as not to harm its archaeological values, and because of lack of purpose, imagination, suitable people and economic means. Yet the Stoa stands there, it has become accepted, it meets the actual needs of society, and it is a landmark in the city. And, if you like, that reconstructed building again carries the burden of history with the meeting in that very place of the European Union a few years ago.

Nothing remains as it was. All is transformed.

Professor Emeritus **Charalambos Bouras**
President of the ESMA

Text of a lecture given at the Centre for Acropolis Studies in December 2008



Didactic partial anastelosis of the propylon of the dining hall of the Asklepieion at Epidauros. View from N. Photo S. Kyriakis, July 2009



The Meeting of the European Union in the Stoa of Attalos, April 2003. Photo G. Mauzy. Archive of the American School of Classical Studies

Acropolis Monuments. My personal view on the demolition of the old Acropolis Museum and the restriction of the entire surface of the Rock to the antiquities and their wonder, has had no effect. Clearly in the in-

The restoration works on the Acropolis continued at undiminished pace during the second half of 2008 and the first half of 2009. As we know, the works are carried out by the Acropolis Restoration Service (YSMA) of the Hellenic Ministry of Culture, with the scholarly supervision of the Committee for Conservation of the Acropolis Monuments (ESMA) and with co-funding by the 3rd Community Support Framework.

Briefly, the following works were carried out on the Acropolis monuments during the past year.

In the **Parthenon** anastelosis of the north side, including its west end, continued. In the middle section, the resetting of the architrave blocks was completed, and work continues on reassembling the layer of the Doric frieze. Specifically, 22 architrave blocks, 14 frieze blocks, 6 filling stones and 5 triglyphs have been set. Continued with this was work on the structural restoration of dismantled members. The structural restoration of 9 cornice blocks and 2 filling stones was completed, while 2 cornice blocks and 5 filling stones were made of new marble from Dionysos-Penteli. At the west end of the north entablature, structural restoration was completed on the members that had been dismantled (1 triglyph, 2 filling stones and two frieze blocks). Copies of 7 metopes were made of artificial material cast in existing moulds of the early 20th century. The members that had been restored were replaced on the monument together with 6 copies of metopes in place of the dismantled originals. Completed too was the fluting of the fillings on the 10th and 11th columns in the north colonnade.

Structural restoration of the orthostate

blocks and of the three first courses of the north cella wall of the monument was begun. Fourteen fillings were made for the orthostates and blocks of the 1st course of the wall.

To facilitate the anastelosis works, the Derrick crane was turned around to the interior of the temple, with the addition of a special grapple made for lifting the stones and designed by the mechanical and electrical engineer Spyros Oikonomopoulos. Scaffolding was installed at the west wall of the cella.

All the above works are supervised by the architects Nikos Toganidis (who is the head of the entire work of restoration of the Parthenon), Vassiliki Eleftheriou and Lena Lambrinou. The architect, Rosalia Christo-

the orthophotomosaics are carried out by the specialised topographer engineer, Dionysia Mavromati.

In the context of the new exhibition of the Parthenon sculptures in the New Acropolis Museum, 29 blocks of the frieze and 26 metopes were drawn by the architect, Angelos Papandropoulos and the draftsman, Kleopatra Matala.

As far as the studies are concerned, in collaboration with the National Technical University of Athens, a research programme has been initiated on the static behaviour of the cella walls and on ways of restoring their structural resistance. Approved also by the Central Archaeological Council (KAS) of the Hellenic Ministry of Culture is the

study for restoration of the entablature of the west façade of the Parthenon by the architects Vassiliki Eleftheriou and Vasso Manidaki and the civil engineer Antigoni Vrouva. Submitted and approved by the Committee for Conservation of the Acropolis Monuments (ESMA) is the proposal for carving the flutes of the new fillings of the restored columns of the Parthenon Pronaos, on the basis of a study by the architects Vassiliki Eleftheriou and Lena Lambrinou (approval of the proposal by KAS is pending). Document-

tation of the restoration work of the Parthenon is the responsibility of the archaeologist Elena Karakitsou.

In the **Propylaea** the restoration of the ceiling of the west hall was completed with the resetting of the ceiling coffers and inter-beam blocks. After completion of the restoration, water-proofing of the restored coffered ceiling was carried out on its outer surface with reinforced mortar of a special composition. With the completion of the works of restoration on the ceiling of the west



*The north colonnade of the Parthenon under anastelosis View from the NW.
Photo A. Kaphourou, April 2009*

doulopoulou, was responsible for the study for restoration of the entablature of the west end of the north colonnade. The studies for structural restoration of the architectural members are carried out by the civil engineers, Antigoni Vrouva and Yiannis Stephanou. Photographical and topographical plotting for the production of orthophotomosaics has been carried out on the east side of the west entablature, the restored layers of the entablature of the north colonnade, of the west wall of the cella and of the lintel. Elaboration and final production of



Resetting of a member of the entablature of the Parthenon north colonnade, using a specially designed grapple. Photo V. Eleftheriou, April 2009

hall of the monument, the bridge crane, scaffolding and the bases that had been constructed to support them, together with the slab of reinforced concrete that had been made to protect the original marble floor of the hall, were all removed. This has improved the aesthetic aspect of the restoration and display of this area of the monument.

Work on the anastelosis of the entablature of the East Portico of the monument was completed. Reset in place are the cornice blocks, the tympanon blocks, the pedimental cornice and the sima blocks. In order to support the rear parts of the cornice blocks, 17 small marble pillars were set behind the frieze where N. Balanos had placed concrete supports. In order to complete the form of the southeast corner of the monument, two architrave blocks of new marble (the corner and adjacent block) were reset in the south façade of the monument. The anastelosis in the ceiling of the East Portico is in its final phase. Of the 4 beams that were needed to complete the anastelosis, one of ancient marble with new filling was reset in place, and another will soon be ready for setting.

Fourteen coffered slabs of the ceiling were also reset in the first and second from north inter-beam spaces. The anastelosis will be

completed with the resetting of two remaining beams composed of ancient fragments and fillings of new marble, now being structurally restored, and the remaining 12 coffered slabs.

The underground space of the Justinian cistern was cleaned and arranged with shelves of stainless steel. Here have been stored fragments of the coffers from the ceiling of the central building of the monument that were not used in the present intervention and had been kept until then in the area of the Arrephorion.

Carried out in addition was conservation work on the floor of the north wing of the Propylaia (the so-called Pinakothek), using reinforced concrete. A network of optical fiber sensors for monitoring and recording possible small shifts has been set in the west wall of the north wing, where there are openings between the joints of the blocks. Finally, the work of transporting architectural members of the north wing to the work-site has begun. The purpose is to identify and prepare the members for future restoration to the building. In charge of the work of restoration of the Propylaia is the architect, Tasos Tanoulas. Collaborating also in the work are the architect Konstantinos Karanasos and the civil engineer, Vasilis Papavasileiou. Documentation of the



Carving the guttae on a new architrave block of the entablature of the Parthenon north colonnade. Photo A. Papandropoulos, September 2008

work is being carried out by the archaeologist Evi Petropoulou. The work of the Propylaia benefits also from the collaboration of the exceedingly experienced drafts-woman, Yiota Moutopoulou.

In the **Temple of Athena Nike**, the 8 columns that had been dismantled (bases, columns and capitals), were reset in place and the two antae (pilasters and capitals) of the monument, and their joining elements, while work continued on resetting the dismantled architrave blocks. The structural restoration of all the members of the horizontal cornice was completed, and work continues on structural restoration of the members of the overlying courses (coffered ceilings, beams). Likewise completed, with the assistance of outside collaborating technicians, is the construction in new marble of 11 members of the horizontal cornice, 3 members of the raking cornice, 4 sima tiles and 4 of the other members of the sima (corner and raking). Work on the lion heads of the 4 side sima tiles was also finished and work on the surface of 3 members of the raking cornice. The YSMA cast makers have finished the copies in artificial stone of 14 blocks of the frieze, which will replace the originals on the monument. Inserted fragments were joined in 2 mem-

bers of the frieze. Finally, the water-proofing of two slabs of reinforced concrete south of the temple was completed.

The work of the restoration of the temple of Athena Nike is directed by the civil engineer Dionysia Michalopoulou, with the collaboration of the architect, Kostas Mameloungas, and the archaeologist, Evi Lebidaki, who is in charge of documenting the intervention.

Carried out during this time as well were the continuous **works of surface conservation** on all the monuments, headed by the chemical engineer, Evi Papakonstantinou in collaboration with the following conservators responsible for the individual monuments: Anastasiou Panou (Parthenon), Katerina Frantzikinaki (Propylaia), Anthe Tsimereki (Athena Nike), and Yiasemi Frantzi (Erechtheion). **Recording and arrangement of the scattered architectural members** of the Acropolis continued with the archaeologist Elisavet Sioubara in charge. In addition to conservation of the surfaces of members being restored on all the monuments of the Rock, this year the conservation section of the YSMA undertook the cleaning, by laser, of the interior surface of the coffered ceiling of the south porch of the Erechtheion. In the work of systematic recording and documentation of the scattered members of the Acropolis, the poros architectural members have been entered in the systematic inventory and documentation. Eight hundred members from the large stone pile south of the Old Acropolis Museum have now been sorted, moved, recorded and documented. From among these members, and from the poros architectural members kept in the storerooms of the Old Acropolis Museum, a total of 84 related fragments of Doric entablatures, column drums, members with incised guilloche on the front surfaces and other categories of architectural members, have to date emerged.

The storeroom of the Belvedere tower provides a place to store the poros members so as to avoid their further deterioration. It is planned to transfer them immediately. Likewise, in collaboration with the Surface Conservation Section, a programme of study for the conservation of the surfaces

and joining materials of the poros members has been initiated.

Work proceeds on the **Circuit Wall** of the Acropolis. Systematic coordinated monitoring was carried out with optical fiber sensors. Acquired for this purpose was a dynamic signal acquisition device (upper limit: 100 Hz) for measuring dynamic seismic loading, and an inclinometer (with the possibility of simultaneous use as an extensionmeter). Likewise completed was the installation of arrays of optical fiber sensors in the SE section of the Wall, set vertically in characteristic vertical sections, a computer programme was devised for the automatic recording of information from the

optical fiber sensors (with assurance of support for one year), and a section of the N. Wall and the SE area of the Circuit Wall was monitored with accurate topographical measurements. In charge of the work on the Wall is the civil engineer-ground engineer Dimitris Englezos and historical documentation of the monument has been undertaken by the archaeologist, Dorina Moullou.

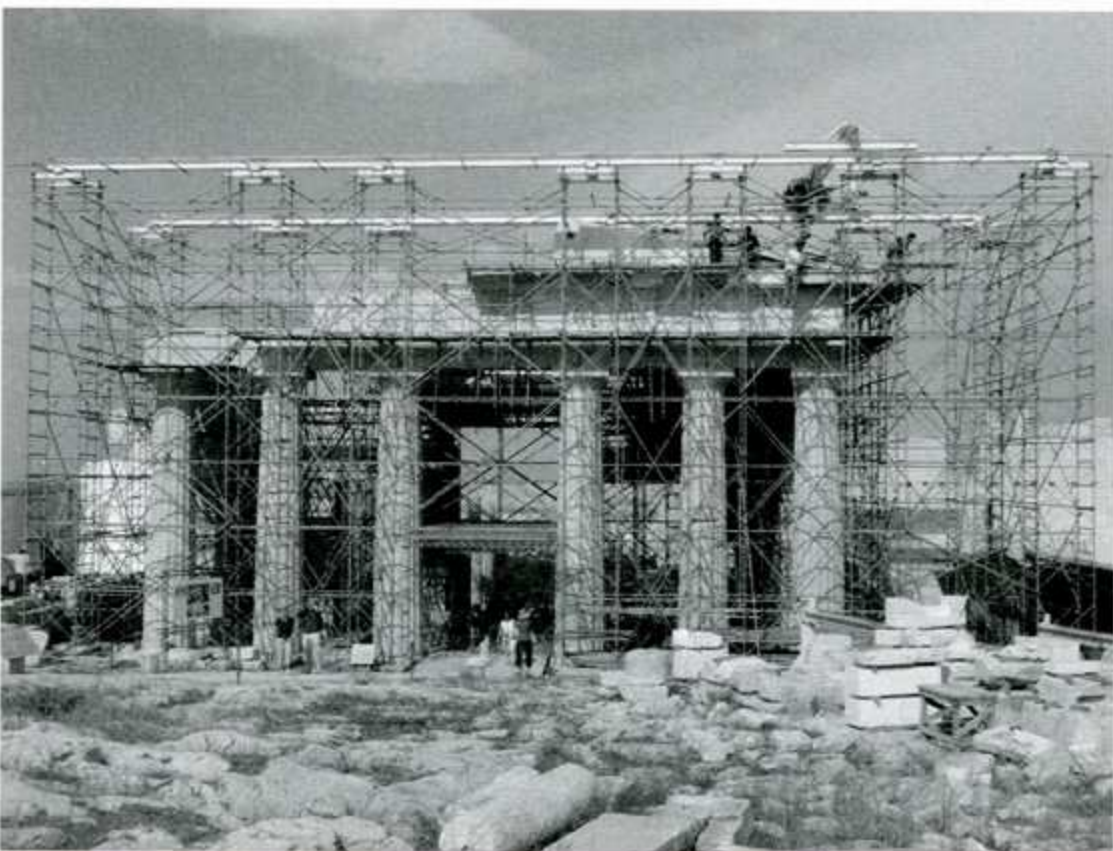
In addition, again under the direction of D. Englezos, small rockblocks in the SE area of the Acropolis rock were fixed, together with the consolidation of the fractured surface limestone rockmass with passive rockbolts (anchors-dowels) and the use of solidifying injections and drainholes.



Setting the coffered ceiling slabs in the east portico of the Propylaia. View from the NE. Photo V. Papavassileiou, June 2009



Setting a sima block in the north side of the east portico of the Propylaia. Photo T. Tanoulas, March 2009



The east portico of the Propylaia under anastelosis. View from east. Photo E. Petropoulou, May 2009



*The restored ceiling of the west hall of the Propylaea central building. View from below and the W.
Photo T. Tanoulas, December 2008*

The digital recording and management of the documentation of the works of anastelosis and conservation of all the Acropolis monuments was continued by the Documentation Office, with the archaeologist

Fani Mallouchou-Tufano as head. So too, the educational programmes continued to be conducted by the YSMA Office of Information and Education, headed by the architect-archaeologist Cornelia Hatziz-



Preparations for making protective roofing over the restored ceiling of the west portico of the Propylaea central building. Photo T. Tanoulas, February 2009

aslani. The construction of copies in artificial stone of the original architectural sculptures that have been removed from the monuments, continued in the YSMA **Cast Laboratory**. Heading the **electrical-mechanical support** of the works was, as always, the mechanical and electrical engineer Spyros Oikonomopoulos, and the heads of the **Accounting Office** and **Secretariat** of the YSMA are Panayiotis Katsimichas and Hara Papanikolaou, respectively.

To monitor the seismic behaviour of the Acropolis area, in collaboration with the Geodynamic Institute of the National Observatory of Athens, a network of 7 accelerographs were installed in the fill at topographically characteristic points of the surface where there is limestone outcrop on the Athenian schist bedrock, and at other suitable places on the Circuit Wall and in the Parthenon. The purpose of installing the network is to record seismic events and to evaluate the response of the hill and the monuments. The civil engineer Dimitris Englezos is in charge of the work. In the context of the work, the scholarly personnel of the YSMA were trained in the use of the seismic information, and a «Seismic Hazard Analysis» was proposed for determining suitable seismic actions for planning the measures to be taken in the restoration of the Acropolis monuments. Finally, in collaboration with the National Technical University of Athens and the Japanese University MIE, measurements of microtremors were carried out (in the Parthenon and at characteristic locations of free field) in order to explore the effect of the geology and topography of the Acropolis hill on the intensification (or/and reduction) of seismic action, in relation to its affect on the rock and the Circuit Wall. Preliminary results are already being evaluated.

Special reference must be made to a work that has, particularly during the past year, furthered the activities of the YSMA, and is funded by the **European Operational Programme «Information Society»**.

The activities funded by the «Information Society» were carried out during the past year. They comprise, to begin with, digital

activities that are included in the work of the 3rd Community Support Framework «Digitisation and Digital Documentation of the Collections of Monuments of the Ministry of Culture». These activities of the YSMA include a) the development of Internet applications for display of the work of the YSMA and the delivery of advanced services to all those interested, including access to e-Learning, b) the production of educational multimedia programmes of virtual reality about the Acropolis and its monuments (to date two films have been produced entitled «The Acropolis in Antiquity» and «Building an Ancient Temple»), c) the development of applications of virtual reality in order to make educational CD and DVD Roms and to provide the general public with these applications through the Web, d) the creation of a hall of virtual reality in the New Acropolis Museum for projecting the above and other material for the general public, e) work on digitising the ESMA archives, which includes studies and publications of the Service, specially chosen subjects and scholarly articles on the subject of the Acropolis and the restoration works, so as to create a digital library.

The second programme that was completed during the past year is «The Development of Geographical Information Systems on the Acropolis of Athens», which includes: a) the creation of a topographical-photogrammetric infrastructure and a full topographical-photogrammetric survey of the Circuit Wall of the Acropolis, the Erechtheion and the Rock itself, b) the development of a Geographical Information System for the anastelosis interventions on the Acropolis monuments and for the Wall of the Acropolis, as well as corresponding data bases, in order to manage and distribute information about the Wall of the Acropolis and the Erechtheion, c) the redesigning and upgrading of the existing ESMA archives data base that documents the Acropolis restoration works, d) a 3D scanning and creation of 3D models with the actual texture of the Acropolis Wall, the Erechtheion (interior and exterior) and the Rock to its roots and, e) the acquisition and installation of a geodetic station for accurate monitoring of micro-displacements in cho-

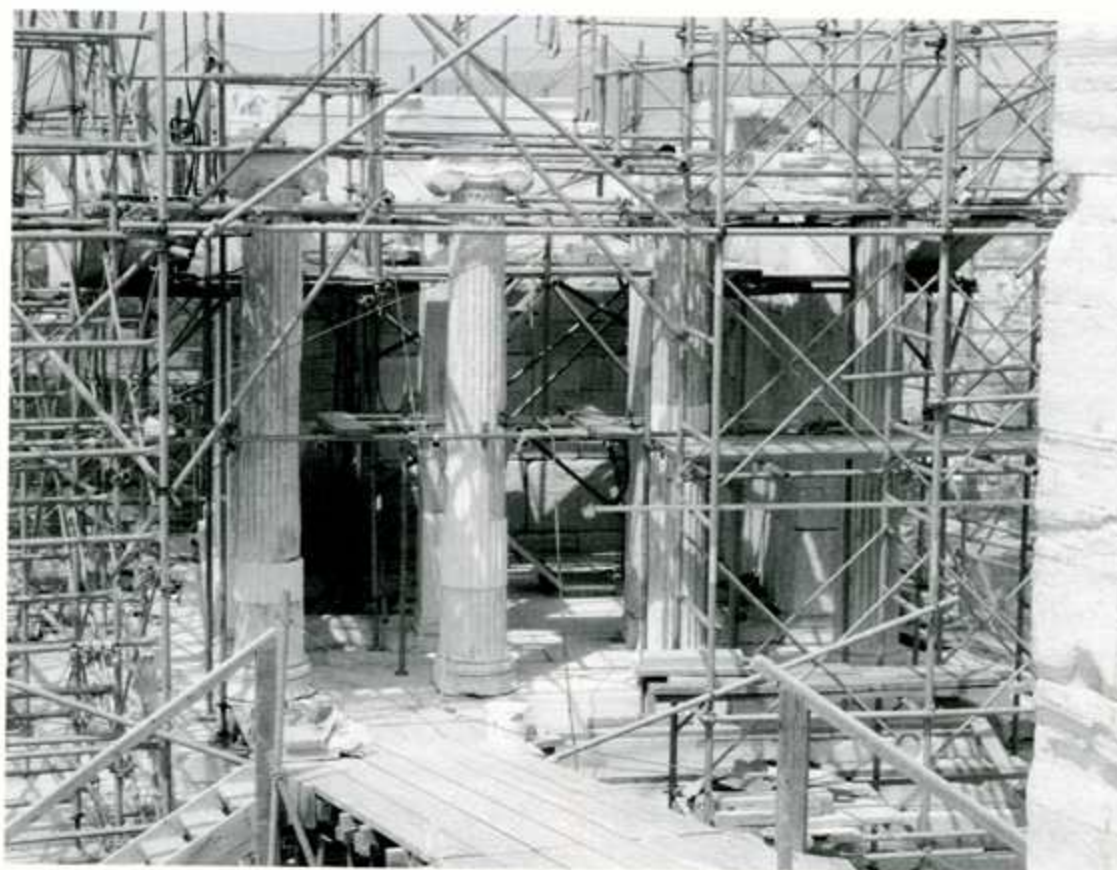
sen areas of the Acropolis Circuit Wall. The YSMA programmes funded by the «Information Society» are under the supervision of the archaeologist Dorina Moulou. The various, partial activities are supervised and directed by the relevant specialists: Yiannis Alexopoulos (information technology specialist of the Documentation Office) is in charge of the digital performance of the ESMA archives and the upgrading of the existing Data Base, Dimitris Englezos (civil engineer-ground engineer) is in charge of the instrumental monitoring

of the Acropolis Circuit Wall, Dionysia Mavromati (topographer engineer) is responsible for the topographical and photogrammetric survey of the Acropolis Rock and its monuments and Spyros Oikonomopoulos (mechanical and electrical engineer) is the head of the group responsible for the development of applications of virtual reality and for equipping space for their projection.

Maria Ioannidou
Civil Engineer
Director of the YSMA



Consolidated rock-mass in the southeast area of the Acropolis hill. Photo D. Englezos, December 2008



The Temple of Athena Nike after restoration of the columns of the east porch. Photo D. Michalopoulou, May 2009

Strategies for the anti-seismic protection of the Acropolis Monuments

The Acropolis, the most important and most impressive sanctuary of ancient Athens, dominates the centre of the modern city. On the rock, which is fortified with strong circuit walls, stand some of the most important monuments of classical antiquity: the Parthenon, the Erechtheion, the Propylaia and the temple of Athena Nike. These unique buildings, witnesses of a culture that has deeply affected today's world, survived standing until our time, preserving most of the features of their incomparable beauty. The monuments have been damaged mainly by the incursions and additions of the various occupiers of Athens and by unsuccessful human interventions, the purpose of which was to restore them; far less by natural causes.

According to historical facts, the powerful earthquakes that have struck the monuments of the Acropolis caused damage of a restricted kind, which can be recognised only through continuous archaeological, historical and architectural research.

A characteristic example is to be seen in Manolis Korres' study for the Parthenon. After examining the historical evidence together with the displacements of the architectural members of the monument and the details of its construction, he reached the conclusion that the great earthquake of 426 B.C. caused the NE corner of the temple, only a few years after its completion, to shift notably to the north, and that it also destroyed one of the cornice blocks. This damage obliged the builders of the temple to proceed with a partial repair, without dismantling the area. This meant that the lateral joint of the 2nd architrave block (the numbering of all the blocks is from the N.) remained open and the relative displacement of the drums of 1st and 2nd columns was retained. Research in the photographic archive of Balanos, moreover, showed that the crack observable in the exterior south architrave block of the SW corner of the Parthenon is a result of the earthquake of 1981. The crack does not appear in the photograph in Balanos' archive, therefore it is later. It was caused by the earthquake of 1981, but the increase in its width was a result of the earthquake of 1999.

It is otherwise with the deformation and damage to the entablature of the West side

of the Parthenon, which has resulted in the curvature of the façade on the horizontal level, the cracking of the corner architrave blocks, the opening of joints between the members, the fracture of members, and rotations and fractures of the edges of the column drums. These are all results of the stresses inflicted on the monument during the course of its long history. These include the fire of ancient times, the explosion of 1687, the strong earthquakes that struck

quakes on the Acropolis, all the more at present, since the structural image of the monuments has undergone significant changes in relation to the original. And here we may pose the first question: what is the reason for the proven resistance of the monuments to the seismic events of the past? Is it due to the favourable seismic behavior of the Acropolis hill or is it that the way in which the buildings were constructed enabled them to withstand suc-



The west end of the entablature of the Parthenon south colonnade. Photo Balanos Archive, after 1933

the monument and indeed the rusting out of the iron reinforcements of the previous anastelosis. Finally, the shifting of part of the South wall of the Propylaia, which led to the fracturing of many architectural members and joining elements (clamps, dowels), is due to the explosion in 1640 of the dynamite that the Turks had stored in the monument. This same explosion also caused the collapse of most of the ceilings.

For the future, we hope that catastrophic human interventions on the monuments will no longer occur. Earthquakes, however, are certain to continue. It is therefore necessary to study the phenomenon of earth-

quakes on the Acropolis, all the more at present, since the structural image of the monuments has undergone significant changes in relation to the original. The method of building the monuments of the Acropolis, the proper formation of the structural system, the choice of material, the high quality of construction and the details of construction show that the builders had taken into consideration the likelihood of seismic loading.

The monuments of the Acropolis have, over the centuries, been subjected to many strains and their standing parts have responded satisfactorily. The geometric distortions, shifts and damage they have suffered are evidence of their reaction over a

long time to load, a situation that does not apply to more recent buildings. It is thus most important to plot the damage and to diagnose its causes. This is a complex process with a compound content, technical, historical, archaeological. To distinguish the damage caused by seismic events from that brought on by human interventions, contributes greatly to the recognition of the problems of construction and anti-seismic planning in the interventions.

and the monuments to the phenomenon of earthquake.

5. Continuous seismological and structural monitoring.

The comment of Manolis Korres in his study, where he describes the effects of the 1981 earthquake on the Parthenon is worth noting. «Unfortunately the most important features of the shocks of the Athenian ground in this earthquake remained practically unknown! For the Acropolis rock we

cal, architectural, geometric, structural pathology, etc) and research of seismic events of the past.

2. Instrumental monitoring and observation on the spot (structural, seismological).

3. Laboratory research (defining of mechanical peculiarities, behaviour of constructions).

4. Analytical simulations.

Recent activities of the YSMA include:

1. In the context of documentation, in addition to surveying and measuring with conventional instruments (which are considered *sine qua non*), fully up to date methods of geometric documentation were employed, specifically three-dimensional scanning together with photogrammetric recording. The application of these methods particularly for extensive areas and objects with strong relief, provide the perfect solution since they combine precision, speed and reliability. Accomplished in this way were the mapping of the Acropolis rockhill in relief, with full topographical and photogrammetric plotting of the Circuit Wall (at a scale of 1:50 and 1:25), and the ground plan of the Acropolis (scale 1:100), the 3D scanning of the Erechtheion and the Wall for their full length, both inside and out. At the same time, supporting photogrammetric studies were carried out in areas of the monuments where interventions are planned or have just been finished. This provides the possibility of replotting and remeasuring after each strong seismic event, for comparison with the results.

2. The purpose of instrumental monitoring is to record seismic events and their effects on the monuments. They are useful for distributing information relevant to the response of the monuments and the dynamic properties of structural materials. They can be distinguished as monitoring the structural behavior and monitoring the seismic response.

The purpose of monitoring the structural behaviour is to identify the distortions and small displacements in areas of the monuments, especially those resulting from seismic action. Installed for this purpose are the following:



The west end of the entablature of the Parthenon south colonnade showing the cracked, first (from W), outer architrave block after the earthquakes of 1981 and 1999. Photo M. Ioannidou, February 2009

There is an imperative need, therefore, for an overall plan, based on suitable interdisciplinary collaboration, for a rational systematisation of the actions required, which can be briefly described as follows:

1. Recording and surveying of the changes in the original geometry of the construction and the structural damage to the buildings, so as to document and control the existing condition.

2. Study of the historical and archaeological evidence.

3. Utilisation of all types of seismic data concerning the area of the monumental site.

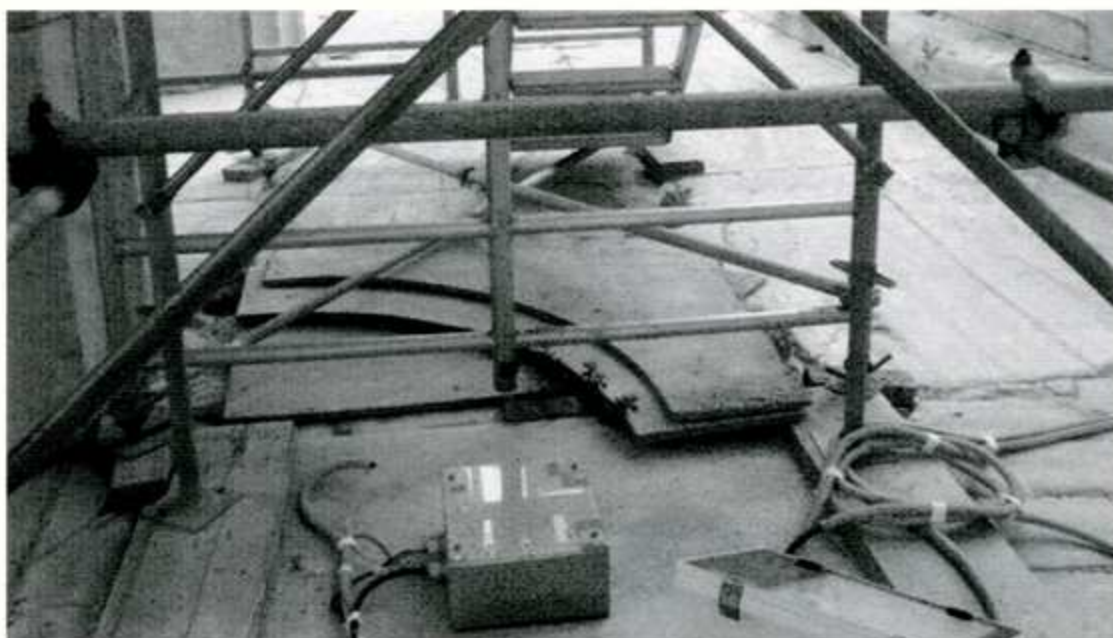
4. Study of the response by the geological formation of the rockhill of the Acropolis

should like to know the average and maximum acceleration, the precise direction, the average and maximum amplitude of ground motion».

Contemporary technology today offers many possibilities for gathering all sorts of information desired, accurate recording of deformations, the plotting of structural damage and monitoring of the behaviour of the monuments during earthquake.

In the context of documentation, diagnosis and evaluation of structural damage to the Acropolis monuments and the study of their reaction to seismic load, the YSMA is carrying out the following:

1. Documentation (archaeological, histori-



Accelerographs on the floor of the Parthenon. Photo A. Vrouva, September 2008

A. Instrumentation with optical fiber sensors of strain, temperature and pressure in proper arrays in areas of the north, south and east Circuit Walls, in the Pinakothike of the Propylaia, in the Arrephorion fill and along a certain rockbolt in the southeast part of the Acropolis rock. It should be noted that it is now possible to record dynamic signals and therefore distortions can be recorded during the phase of actual seismic movement.

B. Sixty-five special topographic prisms (marks) in the southeast corner of the Wall (52) and in an area of the north Wall (13) for measuring with a topographical instrument of high accuracy.

C. Mechanical crack-meters in the southeast corner of the Wall. The purpose of monitoring here is to bridge and measure the widening of existing cracks. A total of 18 crack-meters were set and 12 series of measurements have been made with the use



Setting the accelerographs on the upper surface of the NE corner of the Parthenon. Photo A. Vrouva, September 2008

of the suspension platform or by photographs by a special group of climbers.

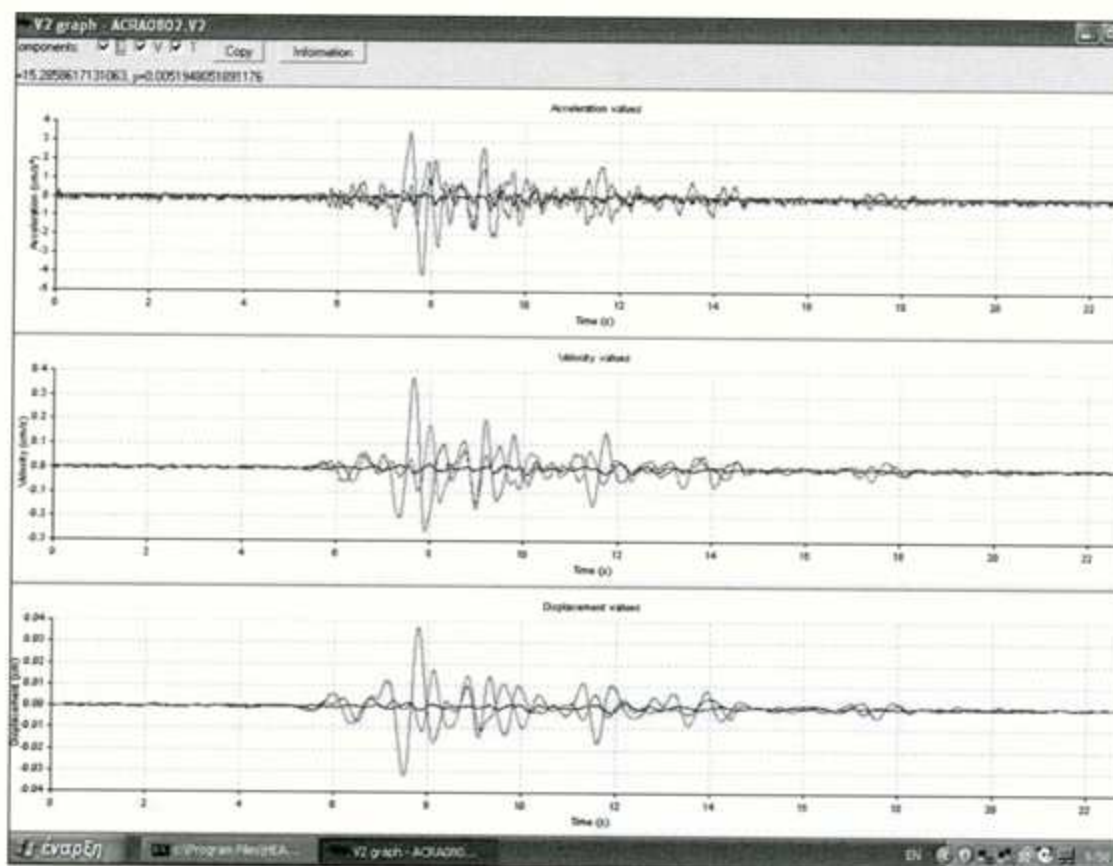
D. INVAR extent meter. The purpose is to monitor chance displacements around the middle of the south Circuit Wall.

Here it should be noted that high-accuracy monitoring of the geometry of vertical sections of the Circuit Wall were programmed to be done with the use of an inclinometer.

Seismic behaviour is monitored in order to determine the seismic actions that overload the monuments of the site. For this purpose, a network of 7 accelerographs have been installed on the Acropolis. They have been set at characteristic locations: in fill, at points where there is limestone outcropping, in the schist bedrock and at specific locations in the Parthenon. The aim of developing this network, which is being carried out by the YSMA in collaboration with the Geodynamic Institute of the National Observatory of Athens, is to record the seismic events and reaction of the hill and its monuments and also to study the results of seismic strikes on the monuments in connection with its formation in view of the complex geological and tectonic conditions prevailing on the Acropolis rockhill. Already recorded is the seismic motion of the rock during the Andravida earthquake (8.6.2008) with maximum acceleration of 6mg; so too the Mantoudi earthquake (14.10.2008) with a maximum acceleration of 4mg. These are the first recordings to have been made of seismic events on the Acropolis Rock.

In collaboration with the University MIE in Japan and the National Technical University of Athens (NTUA), a research programme has been established in order to study the comparable seismic response of articulated structures, such as the monuments of classical antiquity and the pagodas of Japan. For this programme two accelerographs have been installed in the Parthenon and the dynamic properties of the area of the Parthenon were investigated with the use of micro-sound meters.

3. For the proper simulation of mechanical behaviour of the materials of the monuments and the geological bedrock, material was gathered from mechanical trials that were performed. At the same time system-



Recording of the Mantoudi earthquake by the accelerograph north of the Old Acropolis Museum.
14 October 2008

atic tests were documented, such as the determination of the mechanical properties in the southeast side of the rock, where consolidation was carried out. In addition it should be noted that new experimental

investigations are being planned for the structural restoration of marble members. 4. The purpose of analytically simulating and evaluating the information given by the seismic recorders and the seismic hazard

analysis in process, is to investigate the response of the anastelosis proposal to seismic load. Such analytical investigation is indeed already in progress in collaboration with the Laboratory of Earthquake Engineering of the NTUA for the study of the proposals for anastelosis of the cella walls of the Parthenon. Geoseismic back analyses in the area of the north Wall where there is structural damage, have been carried out.

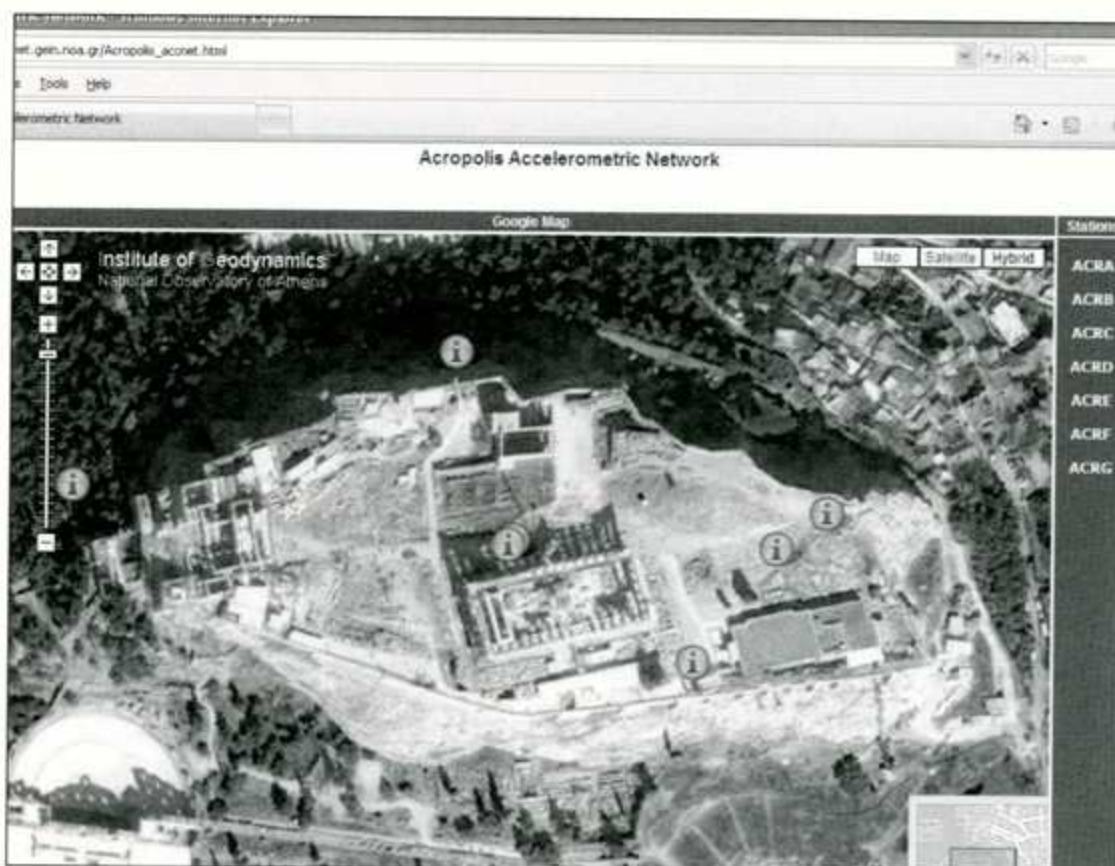
A characteristic example of this total approach to the interpretation of structural damage from earthquake is the following: An area of the north Wall inclines vertically toward the exterior, the greatest displacement at the highest preserved part being 7 cm. This displacement occurred at a moment of time in the past and it was connected with the collapse of the overlying blocks. For the analysis the following information was utilised in the context of an interdisciplinary approach.

1. Architectural and archaeological documentation for determining the original form, the development of the structural phases in the area and the time frame of the damage, 2. Identification of the cause of the damage on the basis of historical events, 3. Historical seismological events for the pertinent time frame, 4. Precise geometric documentation, 5. Analytical simulation of the problem.

The result that emerged from the combined analytical and historical archaeological investigation is, that the damage in that area was caused by seismic action and, precisely, the earthquake of 1785.

This example shows that the methodology applied can be a guide for planning and utilising measures of consolidation with reference to the design of seismic action to be assumed in choosing the intervention.

In sum, we would say that the observation and study of the seismic response of monuments to future earthquakes will yield an antiseismic or earthquake design for the interventions. Thus we will be able to protect the Acropolis monuments against earthquake so that they can be handed down to future generations with all their historical and artistic wealth.



Arrangement of the network of accelerographs on the Acropolis hill.
Satellite recording, September-December 2008

Study for the anastelosis of the upper part of the entablature of the Parthenon north colonnade

Purpose and object of the study

The study for the resetting and anastelosis of the architectural members of the upper part of the entablature of the Parthenon north colonnade has been part of the general study for the new anastelosis of the section of the north side between, the 3rd and 12th columns, that had been restored in the period 1923-1930 by N. Balanos.

The members that were used at that time had been collected from the ground, mainly

along the north side, in order to set them «in the places where they belong», based on a number of their geometrical and structural features, but without attributing them to their original positions. While this is not clearly stated, Balanos also included members that belong to the south side.

Given the incorrect settings and the use of members of the south side by Balanos, after the entablature was dismantled in 2000-2002 for structural restoration, it was considered necessary, for the first time, to make

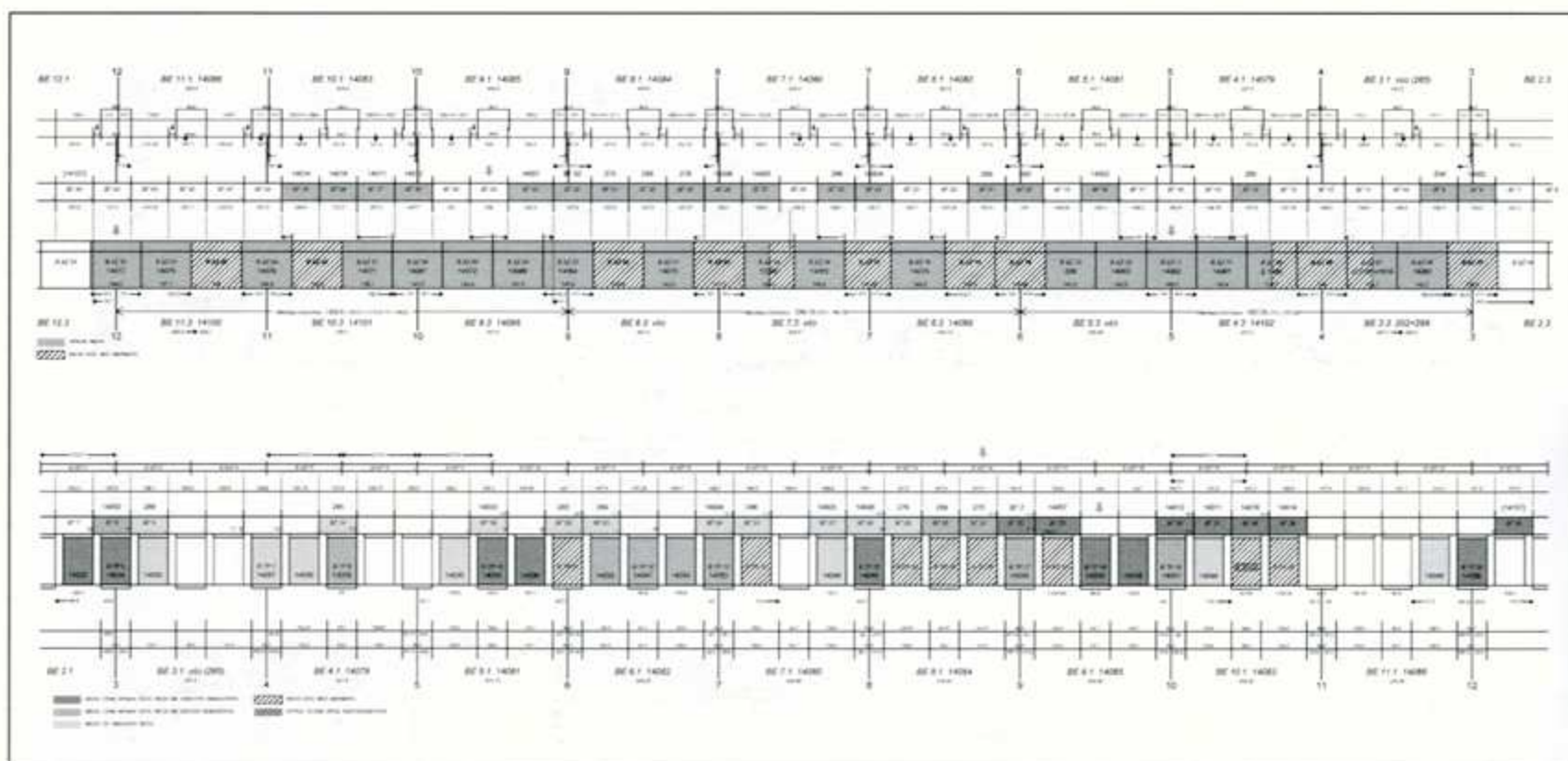
a study of all the members of the upper entablature so as to restore them as originally constructed in their future resetting, attributing as far as possible more members to their original positions.

During the course of the study, in addition to the members dismantled, included were members made up of fragments found among the scattered blocks around the monument, many of which –primarily cornice blocks– had been attributed to the north side in previous studies (by K. Zambas, M. Korres). Studied in addition were the members that Balanos had placed in his restoration of the entablature of the south side, and the scattered members that have been attributed to that side as well.

The upper entablature under investigation includes the layer of the Doric frieze above the architrave and the cornice layer that lies above the frieze and crowns the building. The Doric frieze is comprised of triglyphs set on the axes of the column and architrave blocks and, in between them, metopes, which were preserved in place only where the ends of the entablature were still *in situ*. Behind the metopes and between the triglyphs are the fillers or metope-back-



North colonnade of the Parthenon after the restoration by N. Balanos (1923-1930).
Photorealistic rendition R. Christodouloupoulou, Pl. Konstantopoulos, June-November 2007



Application study for the proposed rearrangement of the members of the upper entablature of the Parthenon north colonnade: final arrangement of the members.
R. Christodouloupoulou, June-November 2007

ers. The layer was closed on the inner side of the colonnade with a continuous row of frieze backing blocks. Characteristic are the large internal voids left between the stones, evidently to reduce cost and load. All the members are joined to each other with long and transverse double-T type clamps, but only the frieze blocks are dowelled to the architrave. The overlying cornice blocks are joined together with a double row of clamps and are dowelled to the frieze and triglyphs or backing blocks. In this way it serves as the joining layer between all the members of the Doric frieze.

Organisation of the study

The study was based on locating, describing and grouping, primarily, the structural and geometrical elements, the positioning and joining, and the damage of each architectural member and, secondly, the features of shaping and working of the marble. Traces of the original shaping were difficult to decipher and measure, even to discern, since all the members had undergone interventions during the previous works of restoration, which ranged from boring holes for new clamps and dowels and reworking of the ancient surface to the cutting off of their damaged sections.

From these features, after relating them to the existing bibliography, a series of criteria were composed on the basis of which all the members, by layers and type, were classified in groups or characterised as specific members. With its assignment to a specific group, each member could be placed in a defined area along the length of the entablature, while its characterisation as a specific member provided the exact position. An important role in determining the breadth of the areas was played by understanding

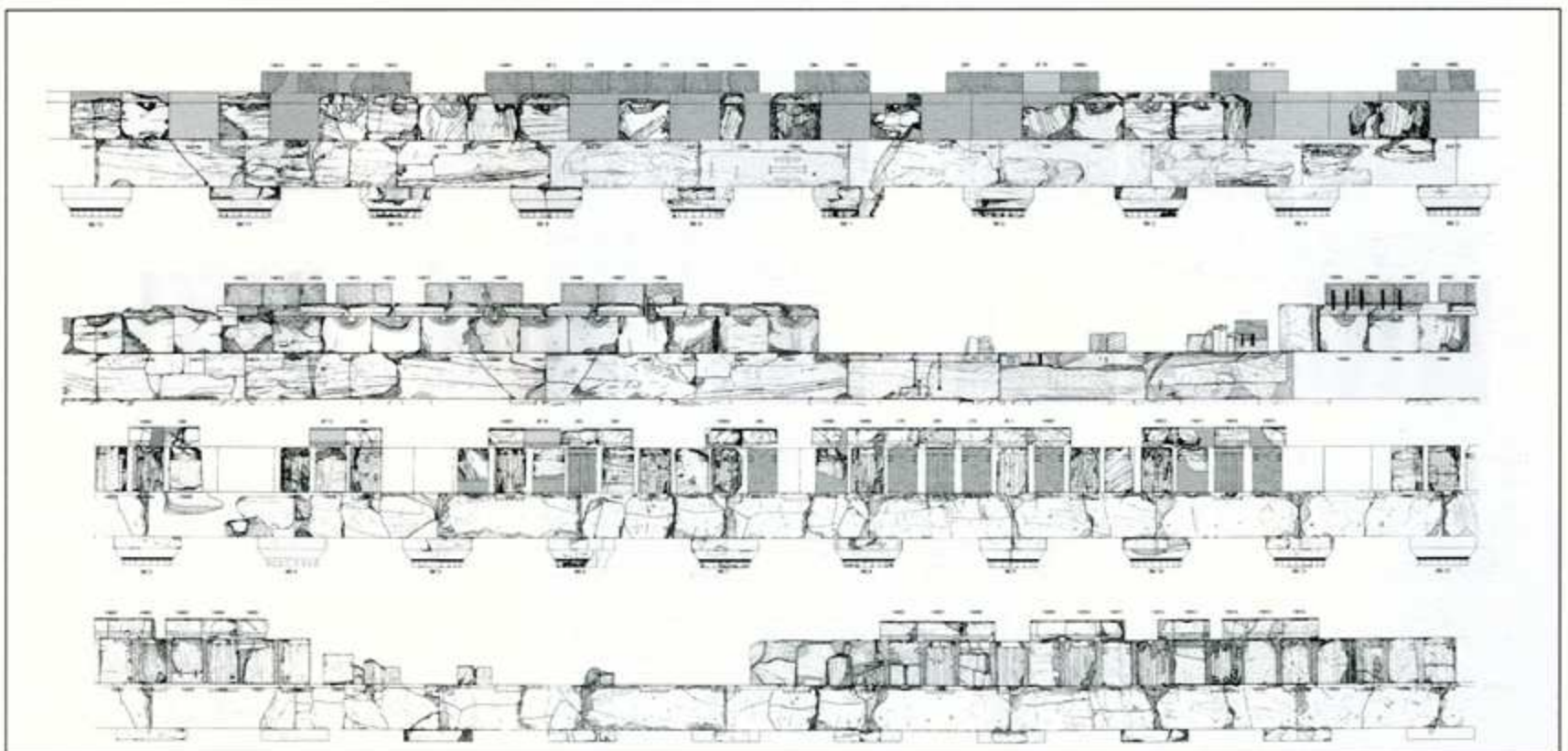
the system used for setting (lowering, rolling, prying) and joining the members (existence or not of joining elements, position of clamps and dowels), briefly, the number and position of the blocks that were set first and last in the layers examined and in the overlying layers as well.

Articulation of the study

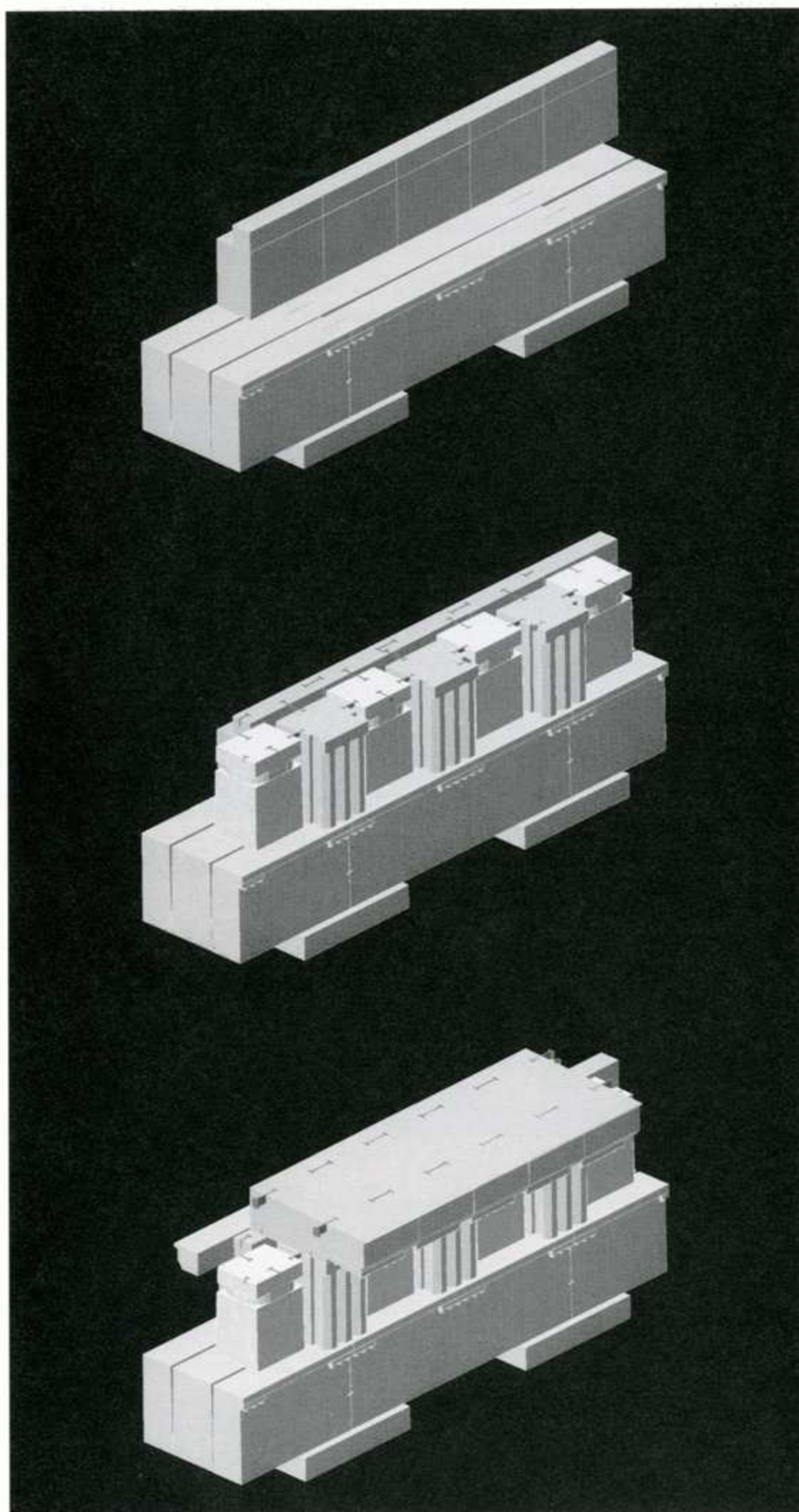
The available architectural members were examined by layer and type. Study of the frieze backers preceded the other groups,



North colonnade of the Parthenon after completion of the ESMA intervention (2009). Photorealistic rendition R. Christodouloupoulou, Pl. Konstantopoulos, June-November 2007



Application study for proposed rearrangement of the members of the upper entablature of the Parthenon north colonnade: fillings and new members. R. Christodouloupoulou, June-November 2007



Stages in the construction of the entablature of the north colonnade of the Parthenon. Photorealistic rendition. R. Christodouloupoulou, A. Kafourou, June-November 2007

since their disposition (the identification of their original positions) could be resolved independently and would yield at the same time information about the original positions of the members in front (triglyphs-backing blocks), through their horizontal joining, and the identification of the original positions of the overlying members (cornice blocks – crown blocks), through their dowelling.

We may note that for all the groups of blocks, simultaneous study was made of the corresponding members of the south side, so that each block that could be attributed to the south side could be set with certainty in its original position.

Identification of the original position of frieze backers, triglyphs, backer and cornice blocks

In order to find the original position of the blocks of the frieze-backer layer, among many other criteria, the following were examined:

- the height of the members to the cutting for the ceiling bearing beams, which increases toward the ends of the layer because of the curvature of the entablature.
- the dowelling system on the architrave blocks.
- the dowelling system of the cornice to the frieze backers.
- the dowelling system of the crown blocks to the frieze backers.

The system of setting and dowelling the frieze backers to the architrave was deciphered on the basis of the side dowelling of the members and the finding of the position of the first block to be set –towards which the members thrust– and the two terminal blocks (lock-stones).

Likewise helpful in the redistribution of the members along the length of the missing section, was the discovery of the position of the terminal block of the cornice, and the first-set block of the wall crown.

Once the problem of the frieze backer blocks was resolved, the original position of all the members belonging to the north side, including those retrieved from the south side, could be identified. To the 28

empty spaces out of the total 45 positions in the frieze, which were reexamined, 19 ancient members were attributed, 15 of which came from Balanos' restoration and the other 4 from the scattered members.

For identifying the positions of members from the series of triglyphs and their backers, the following basic criteria were examined:

- traces of erosion, roots and joining elements on the upper surfaces of the architrave blocks.
- the dowelling system of the cornice.
- the correspondence of the transverse clamps with the frieze backers.
- the correspondence of the lateral clamps between the triglyphs and the backers.

In the initial phase, all the triglyphs, the positions of which were known from the *regulae*, were examined in plan, in relation to the frieze blocks already identified, on the basis of the continuity of the transverse clamps between them. In the second phase, all the backing blocks were investigated for their connections to the frieze backers, as well as for the lateral clamps with the indicatively placed triglyphs.

On the basis of the examination of the traces on the architrave blocks and given the position of the locking-stones of the cornice, which separated the members into the east or west section, one third of the available members were attributed to their original positions with absolute certainty. On the basis of the joining elements, another third of the members were attributed to corresponding positions (positions fulfilling many of the criteria for identification). The remainder could be assigned to conventional positions.

With the acceptance of all the members in the north side—since none could be attributed to the south side—of the 13 triglyphs restored, 11 were returned to their original positions, as were all (11) the backers.

To identify the original positions of the members of the cornice layer, the following were examined:

- the correspondence between the dowel

holes of the cornice and the members of the Doric frieze.

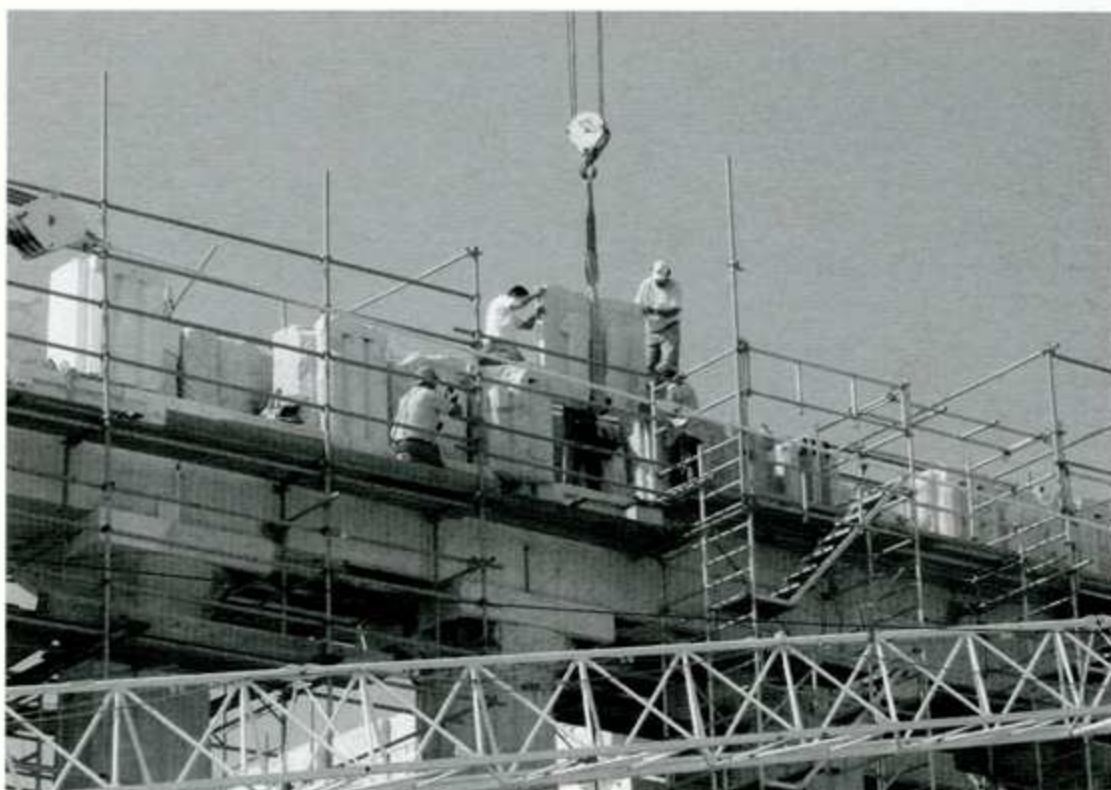
- the correspondence of the cornice blocks
- on the basis of their width with the underlying *regulae* and the spaces between them.
- the continuity of the lateral clamps between the cornice blocks.
- the system of dowelling the tiles to the cornice.

In connection with the underlying identified layer of the Doric frieze, we tested the criterion of identification of the dowels between cornice and frieze, mainly in the rear sections that were preserved, and the back-

possibilities of interchange between the empty positions and positions where the underlying members are missing or are to be found in conventional places.

Understanding the dowelling system of the overlying tiles, with the location of the position of the first and terminating members, was of assistance in rearranging the members along the length of the missing section.

Study of the cornice layer was extended to the entire length of the façade. This enabled us to return to the north side 13 of the 16



Setting a copy of a metope in the west end of the entablature of the Parthenon north colonnade.
Photo V. Eleftheriou, May 2009

ing blocks between the cornice and triglyphs.

On the basis of the criterion of correspondence of the width of each cornice block with the length of the underlying *regulae* or interval in the architrave, and the criterion of continuity of the lateral clamps between adjoining members, all the cornice blocks west of the lock-stones were attributed to their original position, as were the blocks immediately east of them. The rest, except for a large group in the middle, were attributed individually or in pairs to conventional positions, that is, to positions documented by the above criteria, with limited

dismantled blocks of the Balanos restoration and 11 scattered parts of the cornice, 3 of which are fragments from the rear part of the block. In addition, 2 incorrectly placed members were identified in the restored edges of the layer.

On the basis of the interchangeable setting of the members of the upper entablature that are proposed for conventional locations—mainly cornice and backing blocks—for the section of the 3rd to the 7th column, four final rows of the cornice blocks, triglyphs and backers were set, since in the western section the members cannot be interchanged.

For choosing the best series, the criteria for evaluation were:

- the most correct attribution of the members of the layer to their original position.
- the least possible amount of new material needed in the monument, in fillings or new members, for a secure setting on the underlying members.



Interior view, during anastelosis of the upper part of the entablature of the west end of the Parthenon north colonnade. Photo V. Eleftheriou, April 2009

- the compositional completeness of the proposal.

Proposal for construction of fillings and members of new material

The decision was made to fill in all the members of the frieze-backer layer that had been cut, especially in their upper parts, so as to join them securely to each other and to the front members of the layer. To achieve coherence of the side and since the architrave layer will also be filled in with new members, it was proposed to fill all the empty positions with members made of new marble, so as to create a sufficiently stable interior face, to which the remaining members could be attached vertically and horizontally. Of the 28 positions, 19 are occupied by ancient and 9 by new members. In the façade of the frieze, since nearly all the triglyphs and backers available were used, it is not necessary to introduce many new members, excepting in a few cases,

where it is required for the support of the overlying cornice. It is thus proposed to make 3 new triglyphs and 5 new backers. Of the 38 positions, 22 are occupied by ancient members and 8 by new.

Conclusions

The destruction of the features of the origi-

nal working of the surfaces of the architectural members of the upper entablature of the Parthenon north colonnade, through explosion, scattering and re-use of the members, as well as the interventions they underwent in the course of previous restorations, has made the study in many cases difficult if not impossible.

It was possible to assign to their original positions the members that still had or had preserved most of the traces, with relative certainty. The other pieces were set in corresponding positions, some of them covered to greater or lesser extent by the criteria that had been established during examination of the members according to type.

Yet the scholarly gain from the study for resetting the architectural members of the upper part of the entablature, is significant. In addition to returning a considerable number of members to their original positions,

the system and the technique of constructing these lesser known layers of the monument were made clear. It was also seen that the usual classification according to size, forms, method of moving and joining, was often abandoned in the course of the work, always with the best result in mind.

The study for the anastelosis was in practice based on a documented proposal to reset the ancient members, the basic criterion being that they be placed in their original positions. It provided also for filling the voids with members of new marble, mainly for reasons of static efficiency of the building and, secondly, for reasons of form and aesthetic of the composition. For these same reasons it was determined to use as little new material as possible in filling the ancient members, which overall does not exceed 20% of the total surface of the upper entablature.

In the final proposal for the anastelosis of the north façade of the monument, it is notable that the ancient stones are scattered along the entire length of the entablature of the frieze, in opposition to their being concentrated at the ends in the Balanos restoration, which attempted to emphasize the area that had suffered the greatest damage from the explosion and was conceived in the context of a «stage setting» rather than a «scholarly» effort to restore the building. The image of the embellished ruin has been transformed with a new outlook, approaching more its original form, and emphasising the independence of the architectural members, which was a basic principle of the ancient system of construction.

Rosalia Christodouloupoulou
Architect
1st Ephorate of Prehistoric and
Classical Antiquities

It has been written that, because of the hundreds of inscriptions and graffiti that have been cut into the columns of the colonnade, the Parthenon is a «chronicle in stone» of the city, that is, a great archive of information about the mediaeval history of Athens. The games, on the other hand, that are incised on the crepis, throw light on Athenian society, since the game is a cultural resource and an expression of society.

The games incised on the steps and floor of the Parthenon are echoes of a past, a time when people walked freely through the colonnade of the temple. Today, 50 incised games can be detected, probably out of larger total that is hidden because of the works of restoration. These games are found mainly on the west and south sides of the temple, where the weather conditions allowed for repose and relaxation playing games of strategy and skill on the marble. Twenty games are visible in the west colonnade, 25 in the south, 4 in the east and 1 in the north.

Information about the ancient games and their names are found in the ancient written sources, the «Onomastikon» by the Greek orator and lexicographer, Polydeukes, who collected and commented on some 50 games, and also from other contemporary researchers.

Out of the total of the games of the Parthenon, 47 are incised games of skill and 3 are games for counters or pawns (*nines* or *diagrammatic*), that is games of strategy in which counters or pawns are used. As pawns, little pebbles or stones could serve, small round potsherds or sea shells, even small seeds.

The most usual of the games in the temple was the *tropa*. The name came from the hole (*trypa*) cut into the surface, into which the players tried to throw a knuckle bone or a small seed. The aim of the game was for the two players in turn to throw the little sphere (acorn, astragalos, little stone) into all the holes in specified order. *Tropa* is still played today under other names, holes (*trypa*), shallow cutting (*lakka*), groove (*goubitsa*) or hazel (*leftokarya*). This specific game is found in

the temple 47 times, especially on the south and west sides and the holes vary in number, size and arrangement. The round holes are sometimes quite deep, reaching 5 cm. Contemporary researcher, D. Loukopoulos, describes in detail how the game is played today in modern Greece. It is played by

two children, who first make as many little holes as each wants along his line and there must be three times as many pebbles as holes. Exactly how *tropa* was played in antiquity we cannot know precisely.

Enneada or nines, was played by two play-



Holes for the game «tropa» cut into the south part of the Parthenon crepis. Photo E. Karakitsou, June 2009



Holes for the game «tropa» cut into the west part of the crepis of the Parthenon. Photo E. Karakitsou, June 2009

ers. Each player had nine counters or pawns of a different colour from those of his opponent. The game-board was easily incised as shallow grooves, and the corners of three concentric squares were connected by a straight groove. This game has been found incised twice on the south colonnade, between the 14th and 15th columns, and in the northeast side of the temple.

The game found incised once in the west colonnade of the Parthenon (between the 2nd and 3rd columns from the north), is known as a *diagramme* game. It belongs to the category of intellectual games and it is likely to correspond to the modern game of checkers. As an intellectual game, in antiquity it was played on a board or *abacus* with linear geometric designs. Each player had 16 counters, which he arranged in two rows, leaving behind him an empty row, while between the opposing ends there were two empty rows. The aim of the game was for the player to take all the coun-



Holes for the game "tropa" cut into the floor of the Parthenon south colonnade. Next to these are holes for the doorpost. Photo E. Karakitsou, June 2009

ters of his opponent and to place his counters in the last row behind his opponent's alignment.

The ancient Greek game of *polis* or *poleis*, which is the distant ancestor of chess, must have been played in similar fashion on a



"Diagramme" game incised on the stylobate in the west colonnade of the Parthenon. Counters have been added. Photo E. Karakitsou, May 2009



Games cut into the west crepis of the Parthenon. Photo E. Karakitsou, June 2009

board designed with squares but with special counters, each of which will have played a specific role. This too was an intellectual game and was probably played in successive moves the purpose of which was to isolate or trap the opponent. The Roman continuation of this game was the exceedingly popular *ludus latrunculorum* (game of generals) or *latrunculi*. For the game in question, we know that a square board was used with 8x8 little squares and sixteen counters for each player. What is certain is that the game in the Parthenon was played on a square incised with 8x8 little squares formed by crossing vertical and horizontal lines.

The rules for the two strategic games described above are not clear, despite there being ancient descriptions or illustrations on vases. How was each variety of game played and which ones are the most difficult to understand precisely? The original use of these specific games was certainly by adults, as the hardness of the marble makes it impossible for the incising to have been done by a child. Children who happened to be there could, of course, have played the games, once they had been incised by



"Nines" on the crepis of the north wall of the Erechtheion. Photo E. Karakitsou, June 2009

adults. Incised on occasion but permanently on the stone, they awaited the believers who thronged the area and tried to pass time amusing themselves.

Just when the games were incised is difficult question, since the wider area has been inhabited through many historical periods. Five centuries and more after the temple was completed, it was still new, as is clearly reported by Plutarch. It seems most unlikely that during the years when the temple flourished cuttings or incisions would have been made in its crepis and floor.

Decline and the passage of time, however, are parameters that would have favoured incisions or cuttings. It is very likely that in Late Antiquity there will have been occasions when people took refuge in games to escape anxiety, upset and the uncertainty of the times. For these people the game will have been an opportunity to avoid the loneliness and fatigue of everyday life. Precisely this action of incising on the crepis of the temple of some divinity or public building for individual enjoyment, demonstrates the beginning of an ancient attitude, at a time when temples and public buildings

no longer enjoyed the respect of classical times.

When the temple housed Christian worship, some time in the 6th century A.D., it underwent various changes and additions. The inter-columnar spaces were blocked up with strong, tall walls so that the open colonnade was turned into a closed perimetrical corridor. This probably provides the chronological *terminus* for the incision of the games, since many of the incised games coincide with the traces of these walls. Moreover, one of the games of *tropa* is incised at the boundary of the doorway in the south colonnade, as shown by the adjoining cuttings for the turning of the door panels. That particular game, therefore, was incised when the stylobate was free and before the area where it was found was used as a threshold.

Similar games are found also on others of the Acropolis monuments, such as the Erechtheion or the Propylaia. Elsewhere we see them in the temple of Hephaistos (Theseion) in the Ancient Agora and in the Propylon of the Sanctuary at Eleusis. Yet these

do not show the variety seen in the Parthenon.

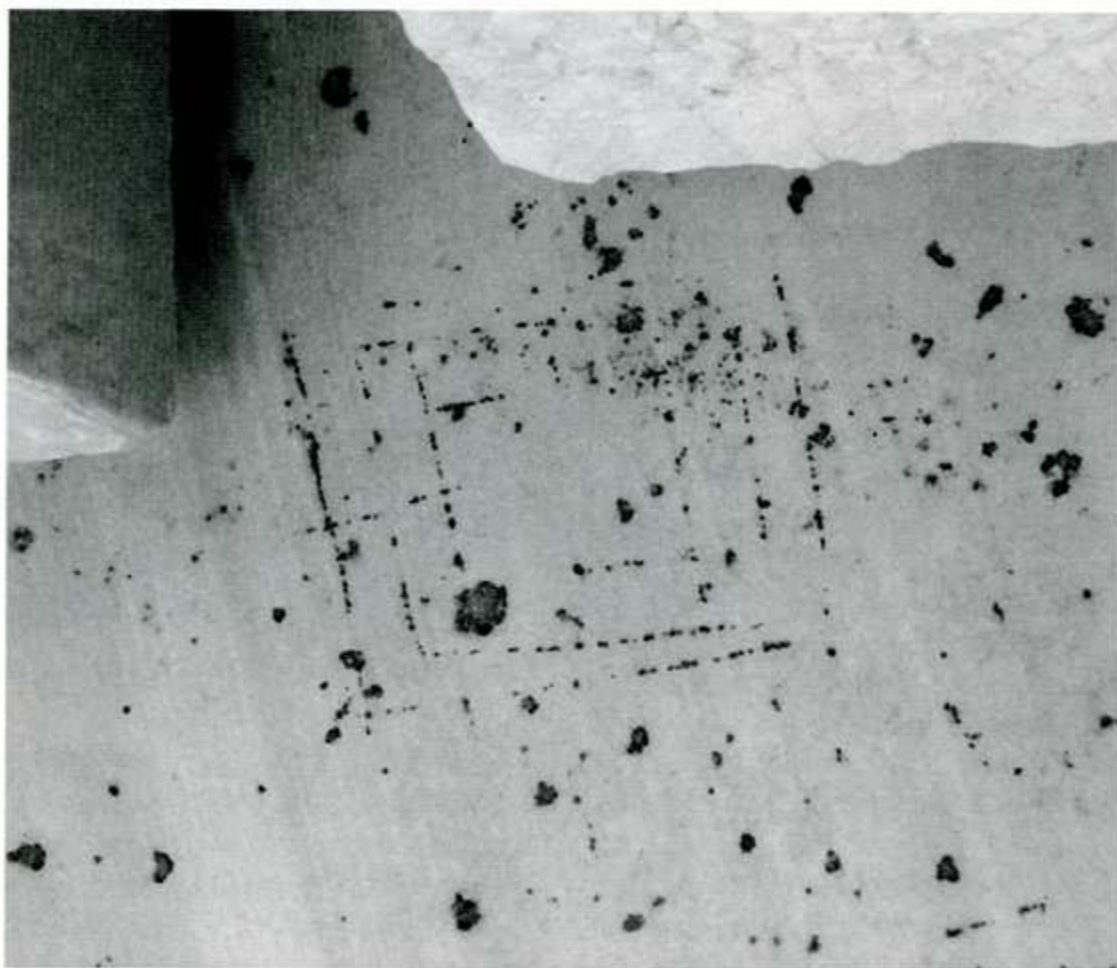
The chronological framework of the incised games remains a problem, since the games themselves are timeless, beginning in Mycenaean times and continuing on until today. The games reveal an aspect of the everyday life of people in antiquity and that allows us to understand them all the more.

Elena Karakitsou

Archaeologist

Parthenon Work-site

Documentation Office of YSMA



"Nines" incised on the floor of the Parthenon south colonnade. Photo E. Karakitsou, June 2009

In the YSMA Department of Information and Education, we have focussed continuously over the years on the Parthenon frieze, not only because of its great significance but because it has vast educational possibilities to offer. Thus special educational programmes have been designed around the theme of the frieze, the book «Parthenon Promenades» was published, presenting all the preserved sculptural decoration of the temple, and a variety of educational material and educational games were created. All this material was incorporated in one of the educational museum kits, entitled «The Parthenon Frieze», so that it would be better known and understood by the general public.

In 2002, the museum kit was enriched by an educational tool that was especially valuable for the general public and for specialists alike. This was a photographic recomposition of the frieze by some 400 photographs at a scale of 1:20, 8 metres long, made by the YSMA photographer, S. Mavrommatis. It provides the fullest possible image of the whole.

In 2003, in the spirit of new technology, another visual tool was made, a CD ROM entitled «The Parthenon Frieze», which was issued by our Service in Greek and English, in collaboration with the National Documentation Centre (EKT). In June 2003, the CD ROM was entered in the Web, on the EKT site. Since then, this application has been consistently in the first place out of 50,000 postings in the list of world-wide searches conducted through Google.

Five years after completing the application on the subject of the frieze, we are proceeding with its renewal and upgrading, with games in digital form for the Internet. This

new application of our Service was carried out, as before, in collaboration with the National Documentation Centre (EKT) of the National Institute of Research (EIE). Coordinators of the work from the YSMA were C. Hatziaslani and I. Kaimara, and on behalf of the EKT, E. Sachini. Valuable also has been the contribution of the arche-

frieze, both as a data base for scholars and as digital games, for schools and their pupils. The designing of the new application was developed in accordance with contemporary ways of presenting and displaying cultural subjects on the Internet, making use of new technologies and the new educational programmes that have been de-

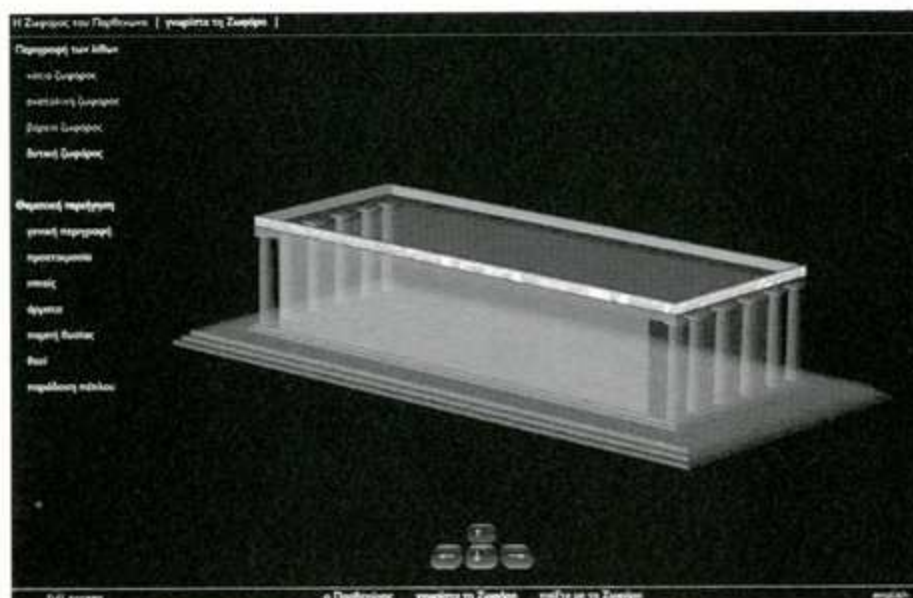
veloped by the Department of Information and Education and have to do with the description and deepening of knowledge about the Parthenon frieze.

The contents have been organised in three units, entitled: *The Parthenon/ Know the Frieze/ Play with the Frieze*.

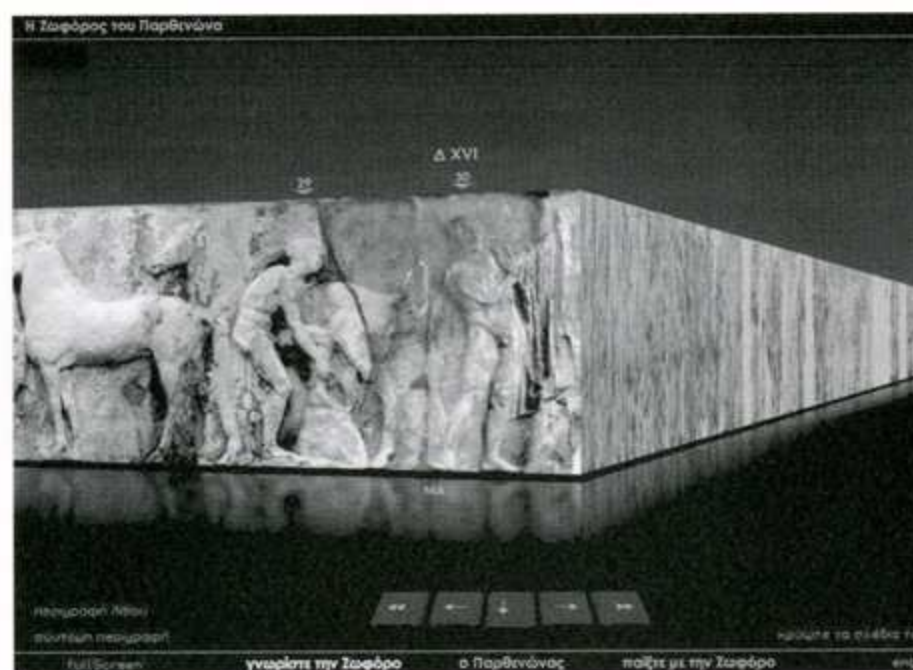
The unit *The Parthenon* includes a text and illustrations that show the architecture and sculptural decoration of the temple. The sculpture comprises the statue of Athena Parthenos, the pediments, the metopes and the frieze. The frieze is analysed under the following units: the Theme, the Panathenaia, Interpretive Theories, Designing and Construction, History, Conservation, Bibliography. The contents are presented through three-dimensional cards, that include the relevant texts and accompanying pictures.

The unit *Know the Frieze* is based on a three-dimensional model of the Parthenon, on which the four sides are distinguished. The user has two possibilities in this unit. The first possibility is to know the

frieze according to side. If you choose the north side, for example, the three-dimensional model revolves and on the screen appear the preserved blocks of that side filled in by the drawings of Carrey. An explanatory text appears at the top of the screen, describing the entire north side. If you se-



The initial page of the new digital educational application "Know the Frieze"



Digital application "Know the Frieze", transition from the west to the south side

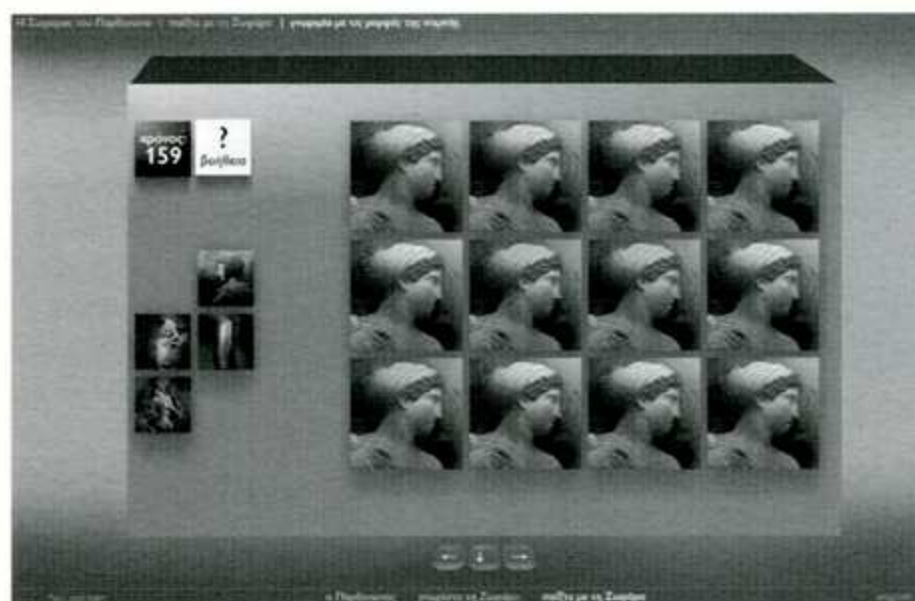
ologists of the Acropolis Education Department Assimina Leonti and Sylia Paraschou. Artistic editing was done by K. Antoniadis, and the designing and development of the application by G. Koutsoukos. The application in its new form provides the possibility of immediate access to the

lect a specific block from that side, it is enlarged and it moves into centre-screen. The user can see it from close-up and can read a text that describes the scene on the block in detail. The numbers of the blocks, the figures and the inventory numbers of the museums where the blocks actually are, accompany the picture. With the navigation buttons the user can move to the next block. All the texts have terms that are distinguished in colour, enabling the user to interpret them. With a «click», for example, on the word «petasos», a card appears with the interpretation of the term: «a wide-brimmed hat». Moving to the next side of the frieze is accomplished by the double navigation arrow (for example WF); The model revolves and the West Frieze appears on the screen.

The second possible choice, *Know the Frieze*, is entitled «thematic tours». Here the user can approach the frieze through its various themes: Preparation, Horsemen, Chariots, Sacrificial Procession, Gods/Goddesses and the Handing over of the peplos. Placing the pointer on the titles emphasises the corresponding areas of the three-dimensional model of the frieze. By selecting, for example, the unit «Gods/Goddesses», the corresponding area of the East Frieze is enlarged on the screen and the tour begins. The relevant text appears at the top of the screen and depending on the content of each phrase, the corresponding areas of the frieze are highlighted.

The third level of the application is entitled *Play with the Frieze* and it is intended for children. It begins with an introduction accompanied by a video lasting about 1 min-

ute. The user, whatever his age, can understand very quickly what the frieze was, where it was, what it represented, and he can see a number of statistical facts as well as the games contained in the application. After this, a yellow box appears. This is the museum kit of the frieze: it appears, it opens and out come the games.



“Play with the Frieze”. Game “Acquaintance with the figures in the procession”



“Play with the Frieze”. Game “Observing the horses”

The games «Acquaintance with the Figures in the Procession», «The Procession to the Altar», and «Observing the Horses» are games of memory and they are designed to attract children to closer observation of the details of the frieze.

The game «Acquaintance with the Figures

in the Procession» has five parts and the child can see more carefully the faces of the figures of the frieze, the garments of the men and women and the military dress of the horsemen. In the game «The Procession to the Altar», the children observe the animals being led to sacrifice and the ritual utensils that were used in the sacrifice. In

the game «Observing the Horses» they can inspect the horses that took part in the procession, and which were more than 200 in number. The heads of the horses, their manes and their movements are of great interest.

For each of the units of the above games, 12 closed cards appear that show on their reverse 6 pairs of similar illustrations. The children have to match the cards that are similar, in the time allotted according to the degree of difficulty chosen. In this same category of games, in which the children are asked to exercise their powers of observation, there are two puzzles entitled «The Hidden Chariot» and «A Gift for the Goddess Athena». The children choose a representation and are asked to put together the corresponding puzzle.

The game entitled «Colouring a Block of the Frieze» is intended to enliven the relief scenes of the frieze and to help the children to imagine their colours. To begin with they observe carefully a coloured block. The block is then shown as it is today, together with a palette of colours and a paint brush. The

children can paint it with any colours they like.

The next game is entitled «Be a Conservator». It offers the children the possibility of using a model of the laser equipment used for cleaning the blocks. The children are



"Play with the Frieze". Game "Colouring a frieze block"



"Play with the Frieze". Game: "Be a conservator"

provided with a frieze block to be cleaned by laser. With the pointer they move the head of the instrument and place it on the surface of the stone, cleaning it in stages. When they have finished their work successfully, on the monitor, which appears in the right hand part of the screen, they watch a video showing the actual process of cleaning the block by one of the YSMA conservators. They then have the possibility of watching another short video about the history of the damage to the block. Three phases of damage are shown, ending with the appearance of the block before it was cleaned.

In the game «I Compose the West Frieze»,

the children try to find the correct position of the 16 blocks of the west frieze that represent the preparation for the procession of horsemen in the Great Panathenaia. Each block appears randomly in the centre of the screen. The user observes the block and then tries to find which of the 16 blocks it is, reading a short description about each block that appears on the upper part of the screen with the relevant number. When the user makes the right connection between picture and text, the block appears in its correct position and at the end the user can see the entire west frieze, just as it was on the monument.

Likewise in the games entitled «Olympian

Puzzles: Find the Gods/Goddesses» and «Contests that Remained... on the Vases», the children have to match text with picture. On the right of the screen a text describing briefly the god or the contest wanted appears randomly each time. The child reads the text and then hunts in the cards, which appear at the left of the screen, for the picture that belongs with it. When he chooses the right picture, the image enlarges and he can see it more clearly. The card is then replaced by a new card so that the game can continue, until all the cards are finished. In the first game, the children hunt for the gods and at the end they see them as they are illustrated on the east frieze of the Parthenon. In the second game, the children learn about the contests that were included in the Great Panathenaia, and they try to identify them on the Panathenaic Amphorae. At the end of the game another screen appears showing some of the Panathenaic contests as they were represented on the Parthenon frieze.

In addition to the video already mentioned, the unit «Play with the Frieze», has also been enriched by an animation entitled «And Suddenly my Horse became Marble». Here, one of the riders of the frieze has come «alive» and, galloping, tries to find his place in the procession. The moment he finds his place, he turns into marble.

Included in the unit of the games are materials in digital form (leaflets in pdf style and a presentation of slides in power point). These are intended mainly for school classes to provide greater depth on the subject of the frieze.

While the museum kit has been used by a total of some 35,000 pupils and has been given to 120 institutions in Greece and 90 abroad, the new application provides the possibility of practically open access to all who are interested.

Cornelia Hadziaslani
Architect-Archaeologist, Head
Irini Kaimara, Assimina Leonti
Archeologists

Department of Information and
Education of the YSMA

Educational Activities

In 2008, the Information and Education Department of the YSMA carried out educational programmes based on the theme of «Let's go to the Acropolis» for 2,200 pupils and 88 schools. The programmes were held in the Centre for Acropolis Studies. In the context of the educational programmes was a visit by the school to the New Acropolis Museum, where the pupils «search for the gods of Mt. Olympus» on the pottery in the exhibition «ΝΟΣΤΟΙ/ΝΟΣΤΟΙ». A special leaflet has been issued for this exhibition, entitled «Looking for the Gods of Mt. Olympus».

Likewise in the New Acropolis Museum, Sunday educational programmes were held for 480 pupils of the 4th, 5th and 6th classes of Primary School on the subject of «The Parthenon and its Sculptural Decoration».

Educational programmes were also carried out in Washington, in the USA, in the framework of the festival «KidsEurofestival», from October 9 to November 9, 2008. The festival was organised by the French Embassy and the 27 countries of the European Union as well. It was intended for children and their families. The purpose of the exhibition was to acquaint the younger generation of the United States with the common tradition of Europe and America. Our Section, representing Greece, held 2 educational programmes for 80 American pupils in the National Gallery of Art in Washington, on the theme «Searching for Ancient Gods in Painting and Sculpture of the Renaissance». Another programme on «The Twelve Gods» was carried out in a public school and a seminar was held for educators of that area. Museum kits and educational material connected with «The Twelve Gods» were distributed.

The Department's Museum kits were lent in 2008 to 278 schools (835 classes) from 22 different prefectures throughout Greece where they were used by 16,816 pupils. In addition, this year, 40 museum kits have been given to institutions both in Greece and abroad.

During the past year, as well, the Department participated in symposia both in Greece and abroad, and organised lectures and seminars for 300 educators and stu-

dents. On invitation from the World Bank in Washington, a lecture was presented on the subject of «Education and Cultural Heritage Partnership: Contribution to Local, Social and Human Development. The case of Educational Programmes of the Museum of Acropolis» by Cornelia Hatziaslani to the Committee of the Bank's Urban Development Network Cultural Heritage and Sustainable Tourism Thematic Group.

Two digital films were also made, the first on the subject «Let's Go to the Acropolis» and the second «An Ancient Temple». Both were based on educational books of the Department on the corresponding themes. Each film is accompanied by two digital games.

Finally, in 2008, in collaboration with the National Documentation Centre (EKT) of the National Research Institute (EIE), the digital application of the theme «The Parthenon Frieze» was re-designed for the Internet. It too has been enriched by the addition of twenty digital games.

Events connected with the Acropolis Works

During the past year, the well known photographic exhibition of the Acropolis restoration works by the YSMA photographer, S. Mavrommatis, was presented in Germany, at the University of Heidelberg, from

October 30, 2008 to January 30, 2009 and at the Institute of Archaeology of the University of Freiburg, from April 29 to June 10, 2009.

In the context of the exhibition, lectures or one-day conferences were organised on the subject of the restoration works of the Acropolis. Thus, on 30 October 2008, the President of the ESMA, Professor Emeritus Ch. Bouras, spoke at the University of Heidelberg on the subject of the Acropolis Works, and on 29 April a Scholarly One-day Conference was held on the Works at the Albert-Ludwigs University of Freiburg, in which the following presented papers: M. Ioannidou (The Works of Restoration on the Acropolis and The Restoration of the Propylaea), F. Mallouchou-Tufano (The Restoration of the Erechtheion), N. Toganidis (The Anastelosis of the Parthenon), D. Michalakopoulou (The Restoration of the Athena Nike Temple), E. Papakonstantinou-Zioti (The Conservation of the Surfaces of the Acropolis Monuments – Cleaning by Laser), Sp. Oikonomopoulos (The Technology of the restoration Works of the Acropolis), and C. Hatziaslani (The Restoration of the Acropolis in Education). The above events were organised in cooperation with the Foundation for Hellenic Culture.

A special conference dedicated to the Acro-



Educational programme about the Acropolis, conducted by C. Hatziaslani at the National Gallery of Art in Washington D.C., USA, October 2008

polis, entitled «Recording and documenting the Acropolis of Athens. From classical, ancient Greece to modern Olympics» was included in the international congress on «The International Archives of Photogram-

ed there: D. Moullou, D. Mavromati, B. Tsingas, K. Liapakis, L. Grammatikopoulos, S. Raikos, A. Sarris, E. Baltsavias, F. Remondino, J.-A. Beraldin, S. El-Hakim, L. Cournoyer, M. Picard, «Recording, Mod-



Photographic exhibition of the Acropolis restoration works at the University of Heidelberg, October 2008-January 2009



Photographic exhibition of the Acropolis restoration works at the University of Freiburg, April-June 2009

metry, Remote Sensing and Spatial Information», organised by the ISPRS (International Society of Photogrammetry and Remote Sensing) from 3 to 11 July, 2008, in Beijing. The following papers were present-

ing, Visualisation and GIS Applications Development for the Acropolis of Athens», S. El-Hakim, J.-A. Beraldin, M. Picard, L. Cournoyer, «Surface Reconstruction of Large Complex Structures from Mixed Range

Data – The Erechtheion Experience», F. Remondino, E. Baltsavias, S. El-Hakim, M. Picard, L. Grammatikopoulos, «Image-Based 3D Modeling of the Erechtheion, Acropolis of Athens», D. Englezos, D. Moullou, D. Mavromati, «Geostructural Analysis of the Athenian Acropolis Wall Based on Terrestrial Laser Scanning Data» and B. Tsingas, K. Liapakis, V. Xylia, D. Mavromati, D. Moullou, L. Grammatikopoulos, K. Stentoumis, «3D Modelling of the Acropolis of Athens Using Balloon Images and Terrestrial Laser Scanning».

Finally, the Acropolis Works (the interventions on the Parthenon, the Propylaea, the Temple of Athena Nike and the Circuit Wall) were presented on a poster at the 2nd Panhellenic Conference on the Restoration of Monuments, organised 21-24 March at the Benaki Museum (at Piraeus Street) by the Society for Research and Scholarly Promotion of the Restoration of Monuments (ETEPAM). The participants were guided around the illustrations of the various works by the engineers in charge.

Lectures

As every year, this year too the members of the scholarly personnel of the YSMA gave lectures and communications in Greece and abroad on general or specific subjects connected with the restoration works and the Acropolis monuments.

In the context of collaboration between the YSMA and the Japanese University MIE on the anti-seismic protection of monuments, M. Ioannidou, presented a paper entitled «The Acropolis of Athens: principles and methodology for the structural restoration of the monuments». She also spoke about current research on the anti-seismic protection of the Acropolis monuments in a paper entitled «Strategies for the anti-seismic protection of the monuments», at a two-day symposium, organised in Athens, 26-27 February 2009, by the Council of Europe, the European Centre for Detering and Predicting Earthquakes, and the Organisation for Anti-seismic Planning and Protection (OASP). In March 2009, she spoke in Athens at the symposium held by the Hellenic Guides on the subject «Application of ancient and contemporary technology to the restoration interventions on

the Acropolis». Finally, M. Ioannidou presented the works of the Acropolis, in Patras on May 15, at an one-day symposium organised by the Technological Educational Institute (TEI) Patras in collaboration with the Technical Chamber (TEE) of West Greece, and, on 28 May, at a lecture organised by the Friends of the Acropolis at the Centre for Acropolis Studies.

T. Tanoulas spoke in February 2008, on the «Problems of the circulation of visitors on the Acropolis: proposals and applications» at the Seminar on the subject of the «Management and Display of Archaeological Sites» in the context of the Interdepartmental Programme for the Protection, Conservation and Restoration of Cultural Monuments of the University of Thessalonike. He also spoke on the «Acropolis and its Monuments under the Latins» at a scholarly conference on «The Latin Domination of Athens» held at the National Historical Museum in Athens, April 2008. Again, in May he gave a talk on the «Byzantine phases of the Propylaia» at the Symposium organised for Cyril Mango's 80th Birthday at the Byzantine Museum of Athens. In October 2008, he presented the «Restoration in the Propylaia» at the International Collaborative Workshop of the University of Thessalonike entitled «Restoration and Re-use of Historical Buildings and Complexes».

L. Lambrinou gave a lecture entitled «The preservation of a ruin: the Parthenon» at the Archaeological Institute of America (AIA) in January 2009. She also took part in the 2nd Panhellenic Conference for Restoration of Monuments, organised 21-24 March 2009 at the Benaki Museum (at Piraeus Sreet) by the Society for Research and Scholarly Promotion of the Restoration of Monuments (ETEPAM) with a paper entitled «Adherence to and Deviation from the Original Form: the case of the Parthenon».

Three members of the technical office of the Parthenon work-site, who have now left the work, also participated with papers in this same conference: R. Christodoulou, who presented the «Study for Restoration of the Upper Entablature of the North Colonnade of the Parthenon», and the civil engineers M. Mentzini and E. Toubakari, who spoke, respectively on «Be-



Conference about the Acropolis, at the University of Freiburg, 30-4-2009. From the top: M. Ioannidou, F. Mallouchou-Tufano, S. Oikonomopoulos, D. Michalopoulou, E. Papaconstantinou-Zioti

haviour in Bend of a Marble Restored Architrave Beam» and the «Analysis of Failures and the Understanding of Structure in the Areas where Joining Elements have been placed in the Parthenon».

D. Englezos presented «Rescue Backfilling of the Arrephorion on the Acropolis of Athens» at the 3rd National Conference on the subject «Mild interventions for the Protection of Historical Constructions», held in Thessalonike in April 2009. At the same conference, D. Mavromati and D. Moulou spoke on the «Application of contemporary methods of plotting and geometric documentation on the Athenian Acropolis».

Evi Lebidaki gave a lecture at the Centre for Acropolis Studies in February 2009 that was organised by the Friends of the Acropolis. Her subject was the cult of Athena Nike on the Acropolis.

In October 2008, F. Mallouchou-Tufano taught the Anastelosis Works of the Acropolis in a post-graduate programme of studies at the School of Architecture of the University III in Rome. She also gave a lecture, in January 2009, on the «Parthenon (the monument and its later fortunes)», in the context of a lecture cycle entitled «Great Monuments» organised by the School of Architecture of the University «La Sapienza» of Rome. In June 2009, she spoke on the Acropolis Restoration (past and present) at the University IUAV of Venice in a seminar on the Conservation of Stone that was organised in collaboration with the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) of Rome.

Fani Mallouchou-Tufano
Archaeologist, Ph.D.

Head of the YSMA Documentation Office



Works being completed during 2009

The restoration of the East Portico
of the Propylaea (above)

The restoration of the north colonnade
of the Parthenon (below)



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