

# The Restoration of the Athenian Acropolis

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Ladies and Gentlemen, good evening.

First of all I would like to express my warmest thanks to the Director of the Modern Greek Program at the University of Michigan Prof. Vassilios Lambropoulos for the great honour in inviting me to give this lecture to this distinguished audience and to present to you the Acropolis restoration project.



The significance of the Athenian Acropolis and what it stands for in the history of human endeavour is so well-known that I hardly need to speak of it here. Allow me, however, to recall the words spoken by Perikles, who inspired the amazing building program carried out on the Acropolis in the second half of the 5<sup>th</sup> c. B.C., words which best convey the spirit of the age, the city and the society which created the Propylaea, the Temple of Athena Nike, the Erechtheion and the Parthenon. I quote “we live under a form of government which does not emulate the institutions of our neighbours; on the

contrary we ourselves are the model, which some follow rather than the imitators of other peoples. Our government is called a democracy because its administration is in the hands not of the few but of the majority”.

Perikles proudly proclaimed this message in his funeral oration for the men who fell in action in the first year of the Peloponnesian War. He went on to describe the distinguishing marks of the democracy; where all men are equal before the law, where the citizens are advanced on the basis of personal merit; where intellectual freedom and tolerance prevail in both public and private life; where citizens obey the laws, not because they are forced to, but following the dictates of their own conscience; where the mind is refreshed and refined through Art, through the quest for beauty and simplicity, through philosophy. These are the traits which made Athens, as Perikles says, “the school of Hellas”.



Paraphrasing Perikles’ words we may say that at the end of the 18<sup>th</sup> c.A.D. the splendid and glorious relics of the Acropolis and the other ancient Greek monuments became “the school of Europe”. It is then that Europe discovered ancient Greece as an Idea and Vision of high moral stature and liberty, of democracy, of equality and of justice. Along with the ancient land the modern Greek world came to light too, with its monuments, its landscape and its inhabitants, worthy successors – in their struggle for

freedom against the Ottoman dominion – of their glorious ancestors. This encounter between Greece and Europe proved to be exceptionally beneficial to both sides: Europe discovered its roots and underwent intellectual and architectural renewal, while Greece was helped to regain its Independence.

The interventions on the Acropolis began immediately after the formation of the Greek state in 1830 and continued throughout the whole 19<sup>th</sup> and the first half on the 20<sup>th</sup> c., until the second World War. The restoration of the Acropolis has always been closely connected with the monuments' eminent position and specific function as national symbols of modern Hellas and aimed always at revealing the monuments archetypical and emblematic character as well as restoring a part of their original grandeur and magnificence.



The restoration of the monuments began in 1835/36 with the re-erection of the Temple of Athena Nike, which constituted the first restoration of a “classical” monument, in the literary sense of the word, in Europe. In the following decades extensive operations of general clearance, of removal of debris and of demolition of the later, medieval, additions to the Rock – which were considered, by the classicist spirit of the age as unimportant creation of

barbaric invaders and examples of decadent art – took place along with the first reconstructions of the monuments. In 1875 the Frankish Tower of the Propylaea, which since the 15<sup>th</sup> c. dominated the Acropolis landscape, was demolished, while from 1885 to 1890 the entire Acropolis had been excavated down to bedrock.



From 1898 onward and for forty-five years the civil engineer Nicolaos Balanos had been restoring all the monuments of the Acropolis, giving them their actual aspect, familiar all over the world: the Parthenon (1898-1902, 1922-1933), the Erechtheion (1902-1909), the Propylaea (1909 to 1917), the temple of Athena Nike (1935-1940).

In the post-war period minor interventions took place on the monuments, for ex. the restoration of the SW wing of the Propylaea, in the 1950s by Anastasios Orlandos, a leading figure in restoration in the post-war Greece.

But during this period and in the following decades the most serious concerns are the drastic change of the Acropolis surrounding due to the transformation of Athens to a contemporary metropolis. These events affected directly the monuments and their appearance due to the unfortunate choice of methods and materials. A well known example is the use of iron clamps during the Balanos restoration. These problems which led to an accelerated dramatic aggravation of the monuments condition force the Greek State to undertake anew, in 1975, large scale conservation and restoration works on the Acropolis.

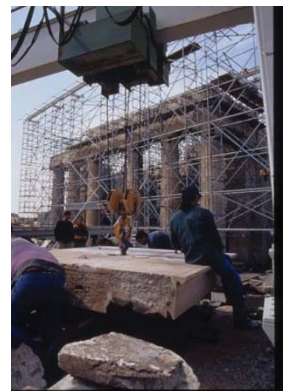
Responsible for the execution of the works is the Acropolis Restoration Service, a special service of the Ministry of Culture established in 1999. The works have always been scholarly supervised by a joint committee of experts, the

Committee for the Conservation of the Acropolis Monuments, whose members are specialists of authority in various fields, archaeologists, architects, civil engineers, chemical engineers and conservators. The president of the Acropolis Committee is Charalambos Bouras, Professor Emeritus at NTUA. The Acropolis Restoration Service, the YSMA as we call it in Greek, is organized in various departments, comprising the technical offices and Worksites of the main monuments (Propylaea, Athena Nike, Parthenon), including one for the extant blocks on the site, conservation-, casting- and photographic laboratories, administrative offices (Secretariat, Accounting), a Documentation and an Information and Education Offices. The personnel of YSMA consists of architects, civil engineers, archeologists, chemists, draftsmen and conservators (we are about 250 in total). There is also, on site, a highly trained staff of marble workers, most of whom come from the Aegean islands, in particular Tinos, an island with a long tradition on marble working. The Acropolis conservation project constitutes a national programme and is financed primarily with funds from the Greek State. From 1983 there is a considerable financial contribution by the European Community. Actually the Acropolis project is incorporated in the programme “Culture” of the 3<sup>rd</sup> Community Support Framework with a cost for the period 2000-2006 approximately of 27. 500.000 euros.

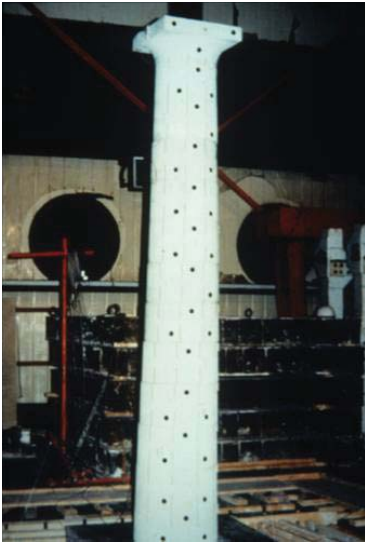


When work began it was of a rescue nature. The main problems of the monuments were: the fragmentation of the marble due to the rusting of the iron elements that had been introduced during earlier interventions. The erosion of the marble surface of the monuments on account of the effects of atmospheric pollution and other biological and natural factors, the reduced load bearing capacity of the monuments because of their ruined condition and the wear of the footsteps of millions of visitors on the Acropolis rock, itself a monument bearer of valuable traces of an age-old history.

Gradually, the nature of the work was expanded and directed towards a more comprehensive restoration of the monuments; the task now is to correct mistakes of the past (especially the faulty positioning of the architectural members) and to re-integrate in the monuments dispersed ancient material, which has already been documented. The development in the character of the interventions, from rescue to restorative ones, means that the authenticity of the monuments in terms of form and structure can to some extent be recovered. Their scientific, historic, aesthetic and environmental values are enhanced and the ruins can be better understood by the general public.



The restoration project on the Acropolis is distinguished for its quality: the critical multidisciplinary approach, the publication of complete studies on the restoration of the monuments prior to any intervention (till now 15 volumes of these studies have been published). The submission of the studies to the scrutiny of the international scholarly world at regular meetings of specialists (till now 5 International Meetings for the Restoration of the Acropolis Monuments have been organized), the enrichment of the established theoretical framework of the International Charter for the Restoration of Monuments and Sites of Venice. The use of traditional materials and techniques during the interventions directly on the monuments and at the same time the application of modern technology during the study of the monuments, the organization of the work-sites, the management of documentation. Examples: study of the load capacity and of the anti-seismic behaviour of the columns of the Parthenon with experimental tests



carried out on the seismic table of the National Technical University and in *situ*, on the monument; mechanical equipment in the worksites for hoisting, lowering and transporting the marble: portal and bridge-cranes, a Stiffleg Derrick crane in the interior of the Parthenon and a second slewing structural crane with luffing jib installed at the north side of the monument for the intervention in the north colonnade, a retractable folder crane capable of projecting 20 m. outward from the SE corner of the Acropolis wall, for lifting the loads from outside the Acropolis hill, marble cutters and mechanical pantographs, in order to accelerate the coarse elaboration of the new marble (but always the final elaboration of the restored ancient architectural members of the

monuments is made by hand in the traditional way); also machines and devices invented and designed especially by the engineers in charge of the interventions in order to meet particular needs of the works, as for ex. the special machine for the creation (carving) of the flutes on the new marble columns drums, the steel wagons traveling on rails for the horizontal joining of the architectural members or special cramps for hoisting architectural members of particular shape. Also, computerized management of the documentation of the whole restoration project through the creation of a specially conceived and designed Data Base.



The works consist of interventions aiming at the structural restoration of the individual architectural members or of larger sections of the monuments as well as of those concerning the conservation of the monuments surface. During the interventions the parts of the monuments that had been restored in the past – and in those, which had been left untouched, but which have significant preservation problems, are dismantled. The articulated system of construction, characteristic of greek classical monuments, greatly facilitates this sort of work. For they are made up of independent architectural members in dry assembly, with iron clamps and dowels, without the use of mortars. The dismantled pieces undergo conservation; the rusted metal reinforcements are removed and replaced by others of titanium, the broken pieces are rejoined with titanium reinforcing and a special cement based mortar.



This was the first time that titanium has ever been used in monumental restoration, based on late Prof. Theodore Skoulikides research. Titanium was chosen because it is stable even in aggressive environment such as the maritime one of Athens. Also because it is compatible, in its mechanical properties, with the pentelic marble of the monuments (the same coefficient of expansion-contraction). Where considered necessary, missing parts of the architectural members are infilled with new Pentelic marble so as to restore their original structural

efficiency. The new infills are made using sculptural pointing devices to match exactly the fragmented surface of the ancient block. This reduces further deterioration of the ancient member and guarantees the reversibility of the operation (reversibility is one of the main theoretical principles of the project): eventually if an ancient fragment is found it can be re-integrated in its correct place in the building fabric.



As to the surface conservation of the monuments it involves joining of fragments and flakes, filling of cracks and joins, grouting internal void and surface consolidation. Only inorganic materials are used, such as white cement low in sulphates, quartz sand, lime, lime-water with calcite additive and titanium rods, with reversible and stable long-term behaviour. In order to avoid irreversible damage to the monuments' sculptures, they gradually are being moved to the Acropolis Museum and replaced on the monuments by faithful copies. These are cast in artificial stone, based on cement, quartz sand, aggregate and inorganic pigment, for durability in outdoor conditions.

The Acropolis restoration project is not only limited to the four main monuments on the hill, but it comprises also work of re-arrangement and protection of the Acropolis plateau as well as of consolidation of the rocks on the slopes of the Acropolis hill. The thousands of scattered stones on the Acropolis Rock, broken blocks from the monuments, fragments of sculpture, inscriptions and other ex-votos, as well remains from later, post-classical times, are all recorded, catalogued and rearranged in the general area of the Acropolis plateau. At the same time walkways have been constructed over the Acropolis plateau to protect it from the wear it would otherwise suffer from the millions of visitors who tread on its surface.



The work of consolidating the Acropolis rock in 22 areas around the Acropolis slopes has been realized from 1979 to 1993. It consisted of consolidation of the unstable rock by means of anchoring done under tension, with anchoring rods and heads of an alloy of stainless steel, in the mass of the rock and of sealing up the cracks and fissures and filling in the rock discontinuities with special cement injections. *(here, you can see the elevator for the disabled persons installed last year on the north slope of the Acropolis).*

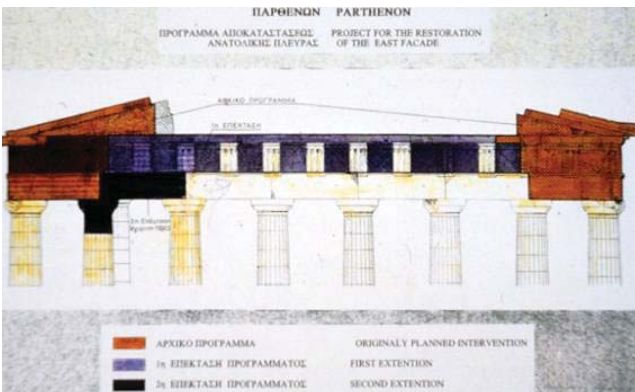


The restoration of the Erechtheion had been the first intervention of the Acropolis Committee so far completed, carried out between 1979-1987. During the operation the Caryatids have been transferred to the Acropolis Museum and replaced on the monument by faithful copies. Also, all the previously restored parts of monument have been dismantled and the members conserved on the ground. During their anastelosis on the monument the errors of the previous intervention concerning their position on the monument have been corrected *[it had been proved that 23 blocks of the N.wall had*

been used for the restoration of the south wall. These blocks have been re-placed in their original positions on the N.wall and the relevant gaps on the S.wall have been filled with new marble. With the repositioning of the blocks to the N.Wall its height has been considerably raised (by 4 courses at least)]. Also, for structural and formal reasons a copy of the NE column of the monument, removed by Elgin and being now in the British Museum, as well as the members of the entablature above have been repositioned on the monument. Works continue in the Parthenon, the Propylaea and the Temple of Athena Nike.



The Parthenon restoration project is divided into twelve piecemeal programmes involving the various parts of the monument, the four sides of the exterior colonnade, the walls of the sekos (the temple's interior), the pronaos and the opisthonaos (the front and the rear interior porches), the steps (crepidomata) and floor surfaces of the temple. In charge of the intervention on the Parthenon is the architect Nikos Toganides. The intervention on the monument began from the east façade, which had been seriously damaged during the earthquake of 1981 and which has been restored from 1986 until 1991. Work began with the dismantling of the remaining segments of the pediment and



the entablature at the corners of the façade (the parts coloured in orange) and proceeded with the dismantling of all the cornices, in order to remove the 14 metopes along with the three most eastern of the north side to the museum, and to repair the upper drum of the 7<sup>th</sup> (from the north) column (the parts coloured in blue and black). The extension of the initial programme was made necessary by the state of preservation – much worse of that expected – of the ancient parts constated after the dismantling of the two corners of the façade)..

The dismantled architectural members were replaced on the monument after conservation. On the monument copies of the metopes in artificial stone and the remaining pedimental statues have been placed. At the end of the work the precise geometrical form of the Parthenon east façade, disturbed in the past by earthquakes and the explosion of 1687, had been restored.



In the Parthenon in the parts preserved *in situ* since antiquity, the structural accuracy is amazing, and the contact and adhesion of the architectural members, what ancient Greeks called *harmonia*, is nearly perfect. For this reason particular effort is made in order to respect the structural authenticity of the building and to avoid disturbing it during the operations. Special devices are designed and original ways are invented for the intervention on parts of the building never dismantled in the past. Such an intervention was realized in 1992, the restoration of the fifth (from the east) column on the South colonnade of the Parthenon. The column had suffered a displacement from the second drum and above during the explosion of 1687. A third of the first drum had been destroyed and the equilibrium of the area was extremely precarious, in particular after the quake of 1981. In order to solve this problem the entablature was dismantled and the entire column, which had also shifted during the explosion, was clamped, lifted, turned and moved almost three metres towards the interior of the temple, by means of a patent system, designed by the architect Manolis Korres. The first drum was filled with

new marble, the bedding surfaces of which were leveled off with extreme accuracy. The column was then restored to its original verticality and placed back on its now restored base drum. It should be noted that the entire column, weighing about 60 t. was lifted by using purely frictional forces and not by the more common methods of hoisting.

Research by Manolis Korres, the architect who extensively studied the monument and was in charge of its restoration project until recently, had resulted in the identification of 70% of scattered architectural material of the east inner porch of the temple, the pronaos. Based on these new findings Korres presented four alternative proposals, corresponding to four different degrees of intervention, for the restoration of the pronaos. The total reconstruction of the colonnade proposed and supported by Korres gave rise to heated debate about, mainly,



aesthetic concerns regarding the percentage of new marble infill pieces, their chromatic contrast and visual imbalance. The proposal of the total restoration of the three southernmost columns of the pronaos and of the architrave above (but without positioning a copy of the corresponding frieze) and of the partial restoration of the three remaining columns has been finally approved by the Acropolis Committee. The project had been carried on with extensive repair of the drums, using new marble, and had been completed last summer (*what remains to be done is the final flutting on the new marble of the drums of the columns*)



In 1997-1999 the columns of the opisthonaos (the west inner porch of the Parthenon), which had suffered extensive fire damage and presented large interior voids, had been consolidated by grouting in their interior a hydraulic mortar (cement, lime and hydraulic additives) and by implanting titanium reinforcements (*the columns had never been dismantled in the past, so this method of consolidation had been chosen, in order to avoid dismantling them and harming the preserved harmony*). The

opisthonaos restoration project, which had been completed

last summer, included also the dismantling, the structural restoration and the resetting in their original position of all the parts of the porch previously restored or preserved in situ (for ex. all the architrave blocks of the colonnade, the columns capitals, the crown capital of the NW anta, the crown blocks and the backers of the West frieze) as well as the making and the repositioning on the monument of cast reproductions of the west frieze. This intervention has been carried out in accordance with studies by the architects Petros Koufopoulos and Rosalia Christodouloupoulou.

The cast copies replaced on the monument the last remaining in situ section of the Panathenaic frieze which in 1992-1993 had been removed and transferred to the Acropolis Museum. In the following years a major problem had been faced, the cleaning of the blocks from the suit deposits and black crust that had been formed on their surface after the covering of the frieze by a roofing in 1978 (*the shelter had protected the frieze from further*



*loss of the sculptured surface by the action of the acid rain, but facilitated the calcification, the suit deposition and the formation of a black crust*). After a long period of research and of critical evaluation of all the available cleaning methods, the laser method had been chosen, because of the many advantages it presented, compared to the other mechanical and chemical methods of cleaning. It is a dry process and it leaves no waste-materials that could in the long run affect the marble. But its most important advantage is that it is a completely controllable method, that permits the removal of specific layer of a pollution deposit to the desired depth. This self-limiting facility ensures the controlled removal of the pollution deposits without the slightest damage to the stone beneath (*this is very important, because the stone surface beneath the polluted layers preserves features of ancient sculpting,*







*traces of the ancient stone-cutter's tools, the extent of coloured surface layers etc.).* The Acropolis Committee collaborated with the Institute of Electronical Structure and Laser in the Technology and Research Foundation, which developed an entirely new laser system, with

technical features and ergonomic design specific for the cleaning of the west frieze. The system worked on two wave lengths (infrared and ultraviolet) and had the possibility of using one or both of the two nodes together, with various energy ratios. With this system all the 14 blocks of the Parthenon west frieze had been cleaned, in 2003-2004, with excellent results, as the visitor can see in its temporary exhibition in the Acropolis Museum.



The programme for the North colonnade central zone includes the dismantling and restoration of the entablature and the eight columns that had been restored by Balanos in the 1930s. The rusted metal clamps and dowels are to be removed, new marble is to replace the cement fillings of the previous intervention, and the architectural members, especially the drums, are to be restored to their original positions, in accordance to established methodology. The intervention is scheduled

to be completed in 2006 and is being carried out in accordance with the studies of the civil engineer Kostas Zambas and the architects Lena Lambrinou and Rosalia Christodouloupoulou.

Conservation work has also progressed along the length of the flanking walls of the cella, where almost 300 blocks set there in the 1840s had already been taken down. The restoration of the walls will include not only the correct replacing of these blocks to their original positions but also the repositioning of a large number of the almost 400 stones which were scattered about the Acropolis and recently recognized as belonging to the cella walls. The studies for the identification of the exact location of all these blocks, undertaken by the architects Nikos Toganides, Cathy Paraschi and Cleo Matala have been completed and the intervention is scheduled for the years after 2006. Future conservation



intervention on the Parthenon include also the re-restoration of the south colonnade of the monument as well as the restoration of the lintel (actually made of reinforced concrete) of the West doorway.



In the Propylaea the restored by Balanos coffered ceilings of the central building have been dismantled . The heavy iron rods and the coarse cement joints of earlier restoration have been removed from the large marble beams of the ceilings. At the same time efforts have been made to discover the original position of the ceiling coffers and, in particular, to identify the hundreds of fragments which had been left on the ground during the previous intervention. These efforts have been very successful since they resulted in the identification of the totality of the scattered fragments, offering thus a much larger

quantity of ancient material available to be placed back in its original position. In fact, the approved study for the restoration of the ceiling by the civil engineer Maria Ioannidou, who is also the director of the Acropolis Restoration Service, and of the architect Tasos Tanoulas, in charge of the Propylaea Restoration Project, proposes to extend the anastelosis beyond the boundary of Balanos' intervention.

Specifically the study proposes resetting in the ceiling of the East stoa seven beams, that is four more than those set by Balanos, and the coffer slabs of the first three (from the N.) inter-beam spaces (that is five more slabs than those used in the Balanos intervention). Proposed for the Western hall is the anastelosis of the coffers in the two inter-beam spaces of the NE corner of the ceiling, which had been restored earlier, but also in the two inter-beam spaces toward the S., above the central passageway of the monument (*this is an important intervention, because will change in the future the sensation of the approach of the Propylaea*



*by the visitors – the visitor will pass in the future under a covered space, will have the sensation of the covered space, as originally was*). The restoration of the ceilings of the Propylaea and of the entablature of the East Stoa is in course and its completion is scheduled for the year 2006. Meanwhile, in 1998-2000, the South wall of the East stoa of the central building of the Propylaea has also been restored (37 blocks have been dismantled, conserved on the ground and repositioned on the monument). The main purpose of this work was to correct the displacement and, as far as possible, to restore the original structure of the wall. During the works in the central building of the Propylaea it had been constated



that Balanos had intervened in the past also in 55 blocks of the upper courses of the North wall. As these blocks and courses presented serious problems of structural degradation we had to restore them a new, according to the established methodology (dismantling-structural restoration on the ground-repositioning on the monument).

The temple of Athena Nike is under restoration for a third time. Works begun in 1998 with the removal of the frieze to the Acropolis Museum. On the monument will be replaced by artificial stone casts. The project includes the dismantling, restoration

and reassembling of the some 300 architectural members of the monument following the study of the architects Demosthenes Giraud and Kostas Mamaloungas. After the complete dismantling of the temple came to light again the small earlier classical temple, beneath the later one. The project includes also the replacement of the slab of reinforced concrete (of the Balanos restoration) that covered the entire floor on the cella of the temple with a stainless steel grid. The completion of this intervention is scheduled also for the end of 2006.



Finally, the work of anastylosis being carried out today on the Acropolis has been the fuse that has rekindled scholarly research on the monuments of the Sacred Rock. The research and the detailed documentation that accompanies the work has revealed much new information on the subjects of the architecture, the sculptured decoration, the successive historical phases of the monuments and their environment, the various dedications on the Acropolis Rock as well as the previous restoration interventions on the monuments.

Ladies and Gentlemen, the Athenian Acropolis is an archaeological site static, yet extremely dynamic. During its centuries-long history it has suffered a series of *metamorphoseis* according to the time changes and to the new emerging needs. Today's appearance of Acropolis is that of an enormous work-site, preparing the image that will characterize it in the years to come. An image that will reflect the level of the humanistic scholarship and of the technological science of the end of the 20<sup>th</sup> and the beginning of the 21<sup>st</sup> c. as well as our philosophical attitude towards the patrimony of our ancestors. Above all the new image of the Athenian Acropolis will reflect our determination to preserve it for the future generations, not only as heritage of Greece but of the whole world. Thank you very much

