THE RECONSTRUCTION OF THE TEMPLE OF ZEUS AT NEMEA: 
PROGRESS REPORT AND FUTURE PERSPECTIVES

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PREFACE

The temple of Zeus at Nemea as well as the temple of Apollo in Ancient Corinth are the two most emblematic monuments of classical architecture in the province of Corinthia. It is therefore evident that their protection and conservation is an important and urgent matter.

Specifically, the temple of Zeus at Nemea has been engraved in the memory and the lithographies of past visitors with the image of a monument in ruins which was caused by mankind that was seeking building material during the early Christian period. Recent archeological discoveries have revealed that a large fraction of the original material of the exterior colonnade has survived and its current condition suggests that the monument should be reconstructed. Such a perspective is supported by the need to preserve the ancient material together with the need to project the distinctive architectural elements of the monument.

Early reconstruction interventions to the temple of Zeus were conducted in the early 80’s following the initiative of the director of Nemea excavations, Professor Stephen G. Miller. The reconstruction effort uses as a compass the re-synthesis study of the temple that was conducted by Professor Frederic A. Cooper, which revealed that more than 70% of the original material has been survived. At that time the intervention was limited to the reconstruction of a portion of the north side of the crepida. The original permit was granted for the pilot reconstruction of two columns along the north side of the temple, which due to lack of funding was completed much later between the years 1999-2002. On March 4 2004 following the strong recommendation of the ΑΖ’ ephorate of antiquity of Corinthia, the Ministry of Culture issued a new permit for the reconstruction of four additional columns. The reconstruction effort at Nemea enjoys priority from the newly born ΑΖ’ ephorate of prehistoric and classical antiquities of Corinthia. The intention of our service is to include the archeological site of Nemea with its Sanctuary, the stadium and the archeological museum in the catalogue of monuments of Universal Cultural Heritage issued by UNESCO.

The Director of the ΑΖ’ Ephorate

[Signature]

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ACKNOWLEDGEMENTS

The reconstruction effort of the temple of Zeus at Nemea is enjoying the support of the newly born association “OPHELTIS – the friend of Nemea.” The scope of the association is the promotion of the cultural heritage of the archeological site of Nemea and its immediate goal is fundraising for the reconstruction of the temple of Zeus. The board of the association consists of:

1. Papalexopoulos Theodoros, President
2. Leventi Aspasia, vise-President
3. Delivorias Aggelos, vise-President
4. Samaras Nikolaos, Secretary
5. Georgiadis Alexander, Treasurer
6. Korres Manolis, Member
7. Koronaios Panagiotis, Member
8. Paraskeuaidis Louizos, Member
9. Chronis Vaggelis, Member

The reconstruction team of Nemea deeply appreciates the support of OPHELTIS - The friend of Nemea.
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THE RECONSTRUCTION OF THE TEMPLE OF ZEUS AT NEMEA: PROGRESS REPORT AND FUTURE PERSPECTIVES

Introduction

The temple of Zeus at Nemea was built around 330 B.C. and is notable for the unique slender proportions of its exterior colonnade of Doric style which consists of 32 columns as shown in the plan view of Fig. 1. Among the 32 columns only one has survived (K-31) together with two columns from the entrance of the Pronaos as shown in the 1982 photograph of Fig. 2. The isometric drawing of Fig. 3 depicts the location of the three columns which remain standing from the ancient times.

For centuries the temple remained in ruins with its building elements partially embedded in the ground (see Fig. 4). This situation is most destructive for the integrity and overall conditions of the ancient material since large surfaces are exposed to an adverse environment which includes rain, snow, icing, roots, even microorganisms which have drastically eroded the original material.

Figure 1. Plan view of the temple of Zeus at Nemea. The traces of the three columns standing from the ancient times are shown with orange.
Figure 2. View of the temple of Zeus at Nemea from south-west. Photograph of 1982.

Figure 3. Isometric drawing that shows the location of the three columns standing from the ancient times.
Pilot reconstruction of K-25 and K-26

The preservation of the original building material (see Fig. 4) is probably one of the most convincing arguments for proceeding with the reconstruction of the Temple. The idea of reconstructing the temple was first put forward in 1978 by Professor Stephen G. Miller from the University of California Berkeley. Soon after that he initiated a fundraising campaign to finance a detailed re-synthesis study of the temple. During the period 1980-1982 Professor Frederic A. Cooper from the University of Minnesota led the effort of measuring and recording approximately 1100 ancient building blocks and subsequently conducted the re-synthesis study for the reconstruction of the temple. Following the work of Professor Cooper, the Greek Ministry of Culture issued the permit for the pilot reconstruction of two columns, that of K-25 and K-26, along the north side of the temple. The reconstruction of the two columns was successfully completed in the summer of 2002 and as a result of this effort the temple of Zeus today
consists of five standing columns as the recent photograph of Fig. 5 shows. The isometric drawing of Fig. 6 assists with the understanding of the morphology of the temple as it stands today. More information of the history of the pilot reconstruction can be found in the article by Miller 2000.

Figure 5. The temple of Zeus at Nemea from north-west. The two front columns are those reconstructed by the pilot reconstruction. The three ancient columns are distinguished in the background.

Figure 6. Isometric drawing that shows the present layout with five columns standing.
The reconstruction of K-27, K-28, K-29 and K-30

The shape of the temple in the near future

Following the successful reconstruction of K-25 and K-26, the reconstruction team of the temple of Zeus at Nemea submitted via the American School of Classical Studies a reconstruction study for four additional columns in order to complete the north-east corner of the temple. The re-synthesis study conducted by F. A. Cooper was carefully re-evaluated in order to confirm the precise location of the ancient building components in association with recent discoveries of ancient material. For each building element (column drums, capitals, architraves and frieze) it was prepared an individual file which describes its pathology together with the retrofit proposal. Fig. 7 shows two among the many detailed drawings that were submitted to support the reconstruction proposal. The new reconstruction study of columns K-27, K-28, K-29 and K-30 was approved by the Greek Ministry of Culture in March 2004 and the new cycle of reconstruction works is already under way. The isometric drawing of Fig. 8 shows schematically the morphology that the temple of Zeus at Nemea will assume once this second reconstruction phase will be completed. The future morphology of the temple (Fig. 8) will improve appreciably the understanding of the architecture of the temple since its current view creates some confusion to the visitor (see Fig. 5). With the reconstruction of the four columns of the north-east corner (K-27, K-28, K-29 and K-30), there is a closure of the exterior colonnade starting from the two recently reconstructed columns, K-25 and K-26 to the solely standing column from the ancient times, K-31. The closure of the north-east corner will also offer to the visitor a sense of the interior space and magnitude of the monument.
Figure 7. Re-synthesis of architectural elements and reconstruction proposal of the north side of the temple (top) and of the east side (bottom). Drawings No. 18 and No. 22 from Katerina Sklere’s architectural studies.
The reconstruction of the crepida

Before reconstructing the columns it is necessary to reconstruct the wings of the base of the temple which consist of four layers of massive rectangular stones which support the gravity loads of the monument. Fig. 9 (top) shows the four layers to be reconstructed at the north-east corner of the temple while Fig. 9 (bottom) shows the major damage of the stylobate and of the second layer in the vicinity of the support of column K-31. Fig. 10 shows ancient stone blocks from the base that needed to be pieced together while Fig. 11 shows new stone blocks of the crepida which have been positioned in place and receive final adjustments. In order to complete the section of the crepida and the area where the four new columns will be erected we need to prepare and install 70 new stones with dimensions that exceed $2.0 \times 2.0 \times 0.4$ m and weight that exceeds 3.5 tons. In addition to this work 15 ancient blocks need to be pieced together. It should be emphasized that the reconstruction of the crepida has consumed a substantial fraction of our reconstruction effort mostly because the rectangular blocks of the crepida were much more attractive to the subsequent
occupants of the nearby area than the cylindrical column drums. The limestone that we use for the preparation of the new stones is extracted from nearby area, very close to the ancient quarries. Large masses of stone are transported at the periphery of the archeological site and they are sliced with an electrical wiresaw at the desired dimensions. Fig. 12 shows the sawing of a large stone mass while Fig. 13 shows new stone blocks that have been prepared for the reconstruction of the stylobate.

Figure 9. Top: The north-east corner of the crepida where the four layers which need to be reconstructed prior to the erection of the columns are distinguished. Bottom: The poor condition of stylobate and the 2nd base layer at the vicinity of the support of column K-31 which remains standing from the ancient times.
Figure 10. Left: Two pieces of ancient stone of crepida that have been bonded. Right: Two fragments of an ancient crepida block that have been retrofitted with new stone.

Figure 11. Final surface finishing of the new stones of the crepida after they have been positioned in place.
Figure 12. Wire-sawing of a large formless stone to produce new rectangular stone blocks.

Figure 13. Stack of new stones of stylobate that were extracted via wire-sawing of formless large stones.
Reconstruction of the columns

Along with the preparation of the crepida, significant progress has been accomplished with the retrofit of the ancient drums and the production of new in order to reconstruct the columns. The criteria that govern the state of practice of retrofitting emerge from the need to satisfy structural stability together with the need to achieve morphologic continuity. Numerical and experimental studies have demonstrated that the small material loss at the base of the column drums reduce substantially the dynamic stability of the columns (Psycharis et al. 2000). Further to the issues of the structural stability, the loss of material and the visible discontinuities between successive drums alter the distinctive elements of classical architecture. These two reasons (structural stability and morphologic continuity) make imperative the preparation and bonding of a large number of fillings for the column drums, capitals and epistyles. Fig. 14 shows photographs of new stone bonded on the eroded drums of the columns to be reconstructed. The filings are worked out to the extent that they reach the original surface of the member (see Fig. 15). The edges of the flute are shaped to the extent that the material can sustain the fine workmanship of the stone carvers.

Figure 14. New stone fillings that have been bonded with eroded drums of the columns to be reconstructed.
Reconstruction of the epistyles and frieze

The approved reconstruction study includes the reconstruction of the epistyles and the frieze above. Following a considerable effort we have identified the 10 epistyles (5 exterior and 5 interior) that will connect the top of the four columns to be reconstructed with the column standing from the ancient times located to the east; and the two recently reconstructed columns along the north side of the temple. The placement of the epistyles improves the seismic stability of the solitary columns (Psycharis 2003). Two among the 10 epistyles have survived nearly intact while the rest have been broken in two or more pieces which will be re-bonded and filled. Given that the epistyles are subjected to combined bending and shear their structural capacity deserves attention. A comprehensive analysis of the stresses and strains that develop within the retrofitted epistyles was conducted by Makris and Psychogios (2004). Fig. 17 shows schematic sections of a retrofitted epistyle while Fig. 18 shows the distribution of normal stresses of the retrofitted epistyle under gravity loads.

The shape of the temple today

Fig. 19 shows a recent photograph of the north-east view of the temple which shows the partially reconstructed base and the first drum of column K-30 which has been placed atop the stylobate.
Figure 16. Close view of broken epistyles where the material loss is distinguished.

Figure 17. Ancient stone fragments, new stone fillings and reinforcement with titanium bars of epistyle A.2 external.

Figure 18. Distribution of normal stresses along axis x of external epistyle A.2.
The future perspective of the reconstruction

The perspective for the reconstruction of the temple of Zeus at Nemea is the entire reconstruction of the outer colonnade. This was clearly stated in the “master plan of the reconstruction” that was submitted to the Greek Ministry of Culture (Zambas 2004). The re-synthesis of the ancient material that was conducted by Professor F. Cooper reveals that the large number and the wide distribution of the existing ancient members suggest for the entire reconstruction of the monument (see Fig. 20). In any event, the degree that the reconstruction will proceed also hinges upon the success of fund raising.
Figure 20. Re-synthesis of the four sides of the exterior colonnade from the scattered architectural elements of the temple which were identified and recorded by Professor Frederic A. Cooper and his collaborators.
The reconstruction of the north-east corner of the temple which is under way (see Fig. 8) is a segmental reconstruction which paves the way for further reconstruction endeavors until the entire reconstruction of the outer colonnade (32 columns total). The possibilities for expanding the reconstruction are illustrated in the isometric drawings of Figs. 21 and 22. The prioritization is established based on the needs for preserving the monument in association with the desire for the best possible end-result.

The first expansion aims to show a portion of the long north side of the temple. The proposed reconstruction does not reach the north-west corner of the temple since in that area there are documented foundation settlements of the order of 5 cm. These foundation settlements are associated with the presence of nearby drain which was excavated in the early Christian period. Nevertheless, the reconstruction of five additional columns to the west will reveal the majestic character of the temple that the visitor will enjoy while approaching the monument from the south-west.

The second expansion includes the south-east corner (2 columns from the east side and 8+3x(½) columns from the south side). This expansion will better show the volume of the monument and its divine proportions. The perspective for reconstruction does not stop with Fig. 22. It should be emphasized that during the excavations of the last few years they have been discovered along the west side of the temple another 11 drums, one epistyle and two stones from the frieze which are not included in the re-synthesis study by Cooper shown in Fig. 20. These findings increase further the challenge for the entire reconstruction of the temple which we are called to take - each one of us in his capacity.
Figure 21. A proposition for the next expansion of the reconstruction.

Figure 22. Proposed future expansion of the reconstruction of the temple of Zeus at Nemea.
REFERENCES

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