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The Restoration of the Propylaeum of the Sanctuary of Artemis in Jarash: Methodology and Perspectives *

The Propylaeum, at the crossing of the Sanctuary of Artemis' Via Sacra and the Main Colonnaded Street – giving access to the Intermediate Terrace of the sanctuary complex– has attracted the attention of the restorers since the earliest days of scientific research in the ancient city.

The monumental gates, framed on either side by two rooms which formed a part of the multistorey rows of shops as retainers of the artificial terracing higher up, were consolidated and partially restored, between 1928 and 1931.[1] Of the four pedimented gigantic columns ('Tetrastyle Gateway') corresponding to the propylaeum at the western side of the colonnaded street, only two of the pedestals and the *imoscapus* of the northern one were preserved *in situ*. This was a result of recurrent earthquakes which caused such destruction of the gateway. The collapsed elements of the pediment's *cyma* had already been lined up along the east side of the street by Horsfield in 1925 (technical adviser of the Department of Palestine and Transjordan at the time) who cleared most of the Main Colonnaded Street from the collapse of the buildings along its sides. Unfortunately, no record was taken of the dislocated architectural elements that could have represented a key for future study and restoration works.

It was not until the early 60's that the Department of Antiquities of Jordan resumed new restoration works. With the assistance of army engineers, more than 180 columns flanking the main streets were re-erected, among which are the columns of the 'Tetrastyle Gateway' The work was, however, left unfinished with only the four lower drums of the six originally forming the column shafts, re-erected.

A second resumption of the restoration work on the Propyaleum took place 20 years later, with the introduction of the Jarash Project for Excavation and Restoration, forming part of the Government's five-year plan. From 1976 on, H. Kalayan was entrusted by the Department of Antiquities with the follow-up of the aforementioned work in Jarash. His work at the Artemis Propylaeum consisted of the demolition of the service ramp that was built by the army for the erection of the four gigantic columns, and of the rebuilding of the four free-standing columns framing the three gates of the santuary's access west of the colonnaded street. Pretensed iron bars were inserted and cemented in the column cores with the intention of introducing an anti-seismic device, without considering the structural logic of the original architectural concept. Also noteworthy, upon careful observation, is the imperfect development of the columns' *enthasis* as well as the incompatibility of the four Corinthian capitals with the typical pattern that can be recognized throughout the sanctuary complex. In reality the style of the four capitals in question must be associated with the ones of the North Theatre to which, in all probability, they belong.

Having studied the architecture of the Sanctuary of Artemis since 1977, it was inevitable to focus particularly on the Propylaeum building whose architectural composition and articulation can be considered among the most remarkable in the Roman East. Restoration started in 1985 with the consolidation of the shops/retaining structures at the sides of the Propylaeum.[2] The question of restoration of the 'Tetrastyle Gateway', posed itself for a conspicuous number of architectural elements were available for *anastylosis*.

The study of each element pertaining to both the Propylaeum and the 'Tetrastyle Gateway' allowed a reconstruction on paper which in turn gave rise to problems (listed hereafter) to be solved before commencing restoration work (FIG. 1).

Propyleum

- no architectural element is available of the three-gated building attic nor of the entablature of the angular pillars framing the Propylaeum, which are of the same module as the 'Tetrastyle Gateway' columns;
- judging by: 1) the extent of cracks and fissures (especially in the bottom part of the building), some of which are of recent date, 2) by the exposure of the iron bars of the northernmost gate's reinforced concrete lintel built

* Posters exhibited in the hall of the auditorium of the "Centro Congressi della Cassa di Risparmio di Torino" as part of the Sixth Conference on the History and Archaeology of Jordan, June 5-10 1995.

1 C. H. Kraeling, 1938, *Gerasa: City of the Decapolis*, New Haven: 4-5.

2 R. Parapetti, 1983-84, 'Architectural and Urban Space in Roman Gerasa', *Mesopotamia:13-14*; 1986, The Italian activity within the Jarash Project 1982-83, *JAP I, 1981-1983*, Amman; 1989, Scavi e restauri italiani nel santuario di Artemide 1984-1987, *JAP II 1984-1988*, Paris.

1. JARASH, The Sanctuary of Artemis, *the Tetrastyle Gateway of the Propylaeum on the Main Colonnaded Street*; the missing architectural elements are indicated in black.

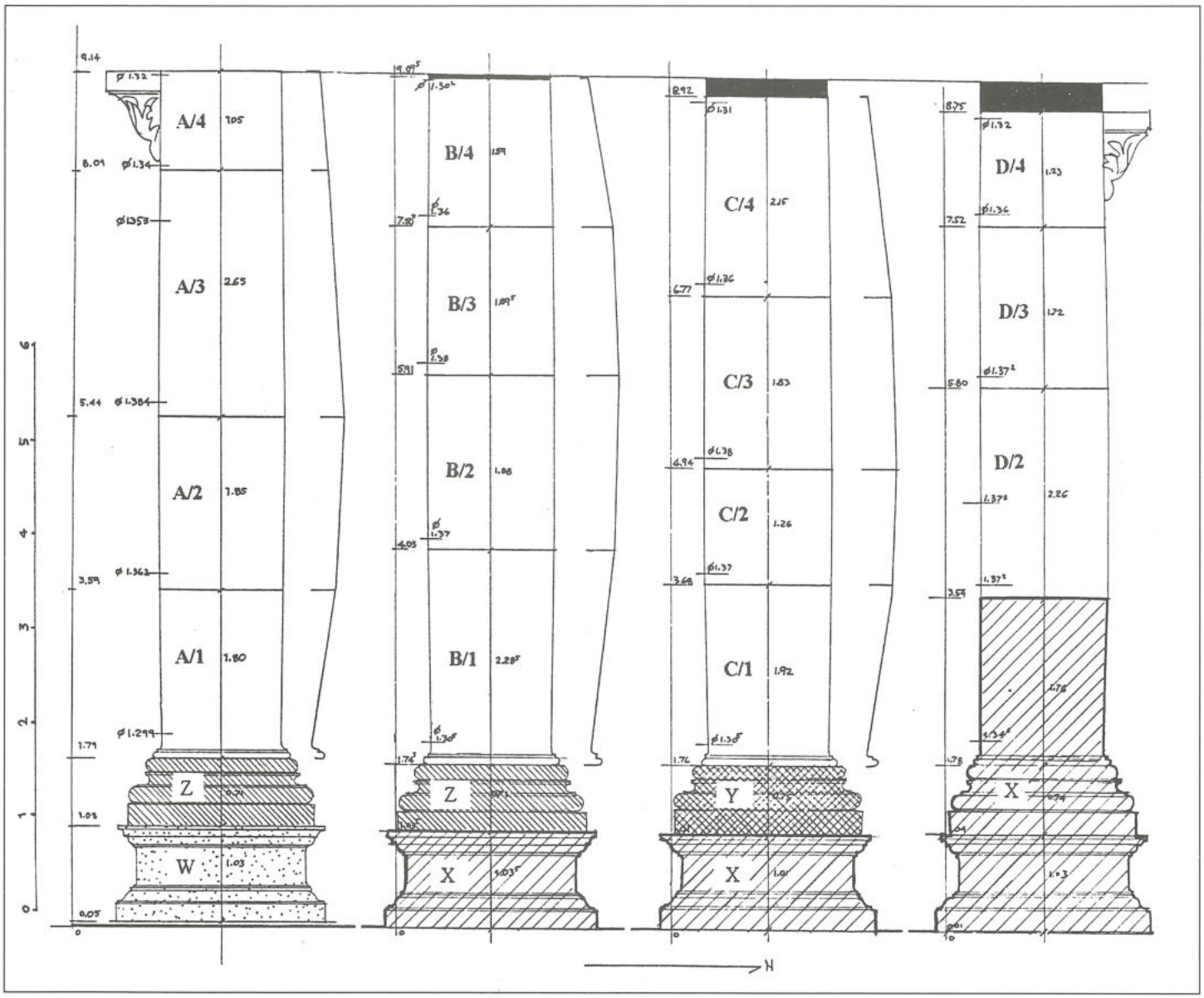
in the 30's and 3) by the fall of small stone particles, the progressively precarious static condition of the monument becomes clearly obvious.

Tetrastyle Gateway

- From the partial remounting work executed in the 60's the following observations can be made: 1) two of the column bases do not belong to the monument and come from the upper Temple of Zeus; 2) the sequence of the overlapping column drums, as they were then put, do not allow for any possible combination with the remaining drums and capitals on ground, to obtain the equal height for the four columns (FIG. 2).
- two column bases are missing;
- one of the 24 column drums is missing;
- no elements of the architrave are available;
- few elements of the frieze, the *geison* and the *tympanum* are missing.

Taking into consideration the high degree of seismic activity in the region, the anastylosis of the 'Tetrastyle Gateway', could only have been feasible by applying a non-conventional anti-seismic structural system that 'ties' the four columns to the Propylaeum. The complexity of the project that involves both the consolidation-restoration of the Propylaeum and the new structural system requires the employment of a highly specialized contractor for its realization. However, the limitations set within the terms of the present 'cooperation project', have led us to conclude that only a partial anastylosis could be achieved within this first stage of operation, that is the reassembly of only the four columns.

In accordance with the cooperation between Italy and

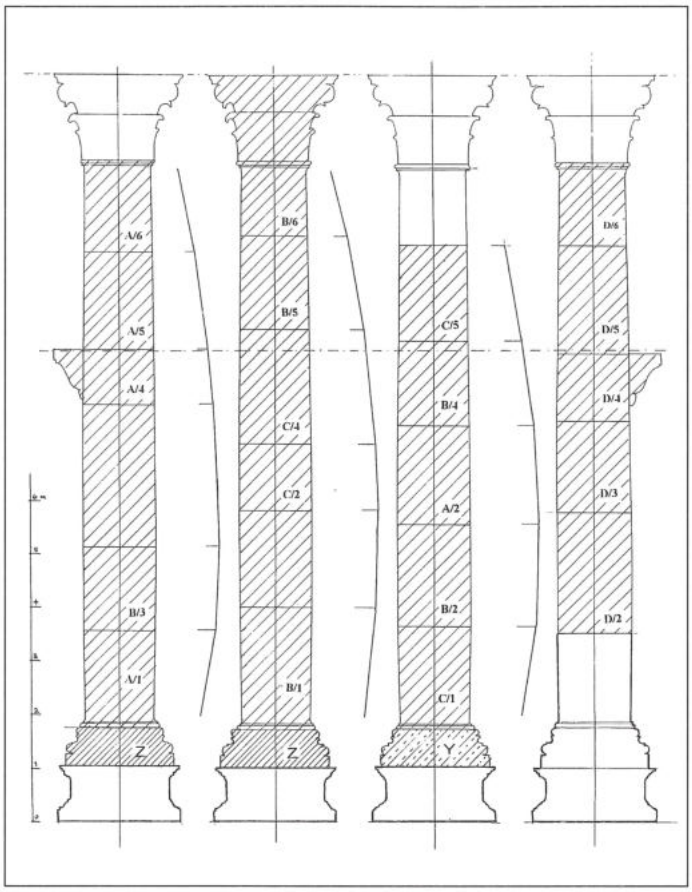


2. JARASH, The Propylaeum of the Sanctuary of Artemis, *the Tetrastyle Gateway* , the four columns as restored in 1962: X *in situ*, Y reassembled, Z originated from the temple of Zeus, W rebuilt making use of stone blocks from the Northern Theatre *summa cavea.*

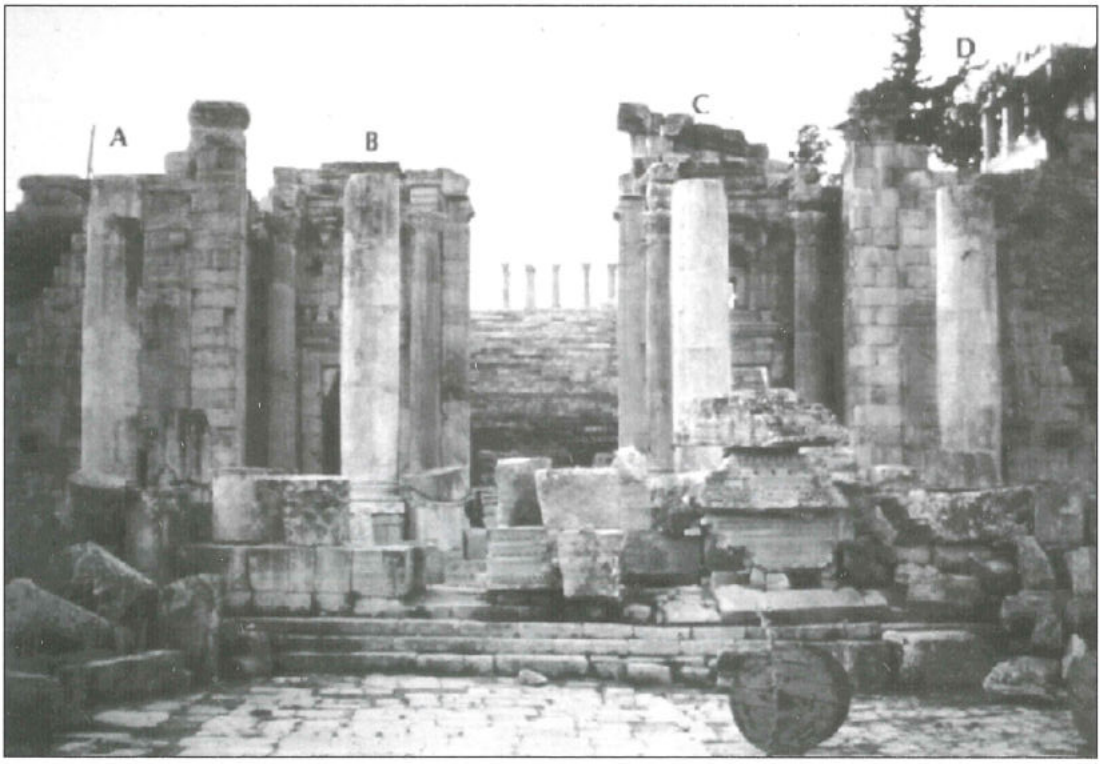
the Department of Antiquities of Jordan, the work from 1993 till the end of 1995, can be divided into three main operations: a) dismantling, b) reintegration of the single architectural elements, and c) reassembly.

a. The first operation, that of dismantling, was deemed necessary because of the incorrect sequencing of the overlapping column drums explained above (FIG. 3). It was also evident that there was an absence of mason marks, utilized to identify exact drum positioning, often recognizeable in Classical stone architecture. Only the presence of sockets for the lifting, except in one case, supplied at least the upright position of the drums. The identification of the original overlapping sequence was, therefore, only possible after a thorough geometric examination of each element. Only five of the 23 drums preserved, had a sure *'a priori'* location according to the design of the monument:
   - one element was preserved, *in situ,* at the northernmost of the four pedestals;
   - two elements with an incorporated bracket to hold the architraves of the colonnades, of a smaller module, had to be located at either sides of the gateway;
   - two elements, that were to be placed above the two aforementioned elements, are recognizeable by a groove for the insertion of the iron clamps that tie the architraves mentioned above;

   The careful measurement of the diameters of the top and bottom surfaces combined with the different heights of drums and capitals, allowed for the preparatory reconstruction on paper of the original sequence of the column drums (FIG. 4).



4. JARASH, The Propylaeum of the Sanctuary of Artemis, *the Tetrastyle Gateway*, Reasssembly project.



3. JARASH, The Propylaeum of the Sanctuary of Artemis, *the Tetrastyle Gateway*, view from east of the monument (from 1962 to 1993).

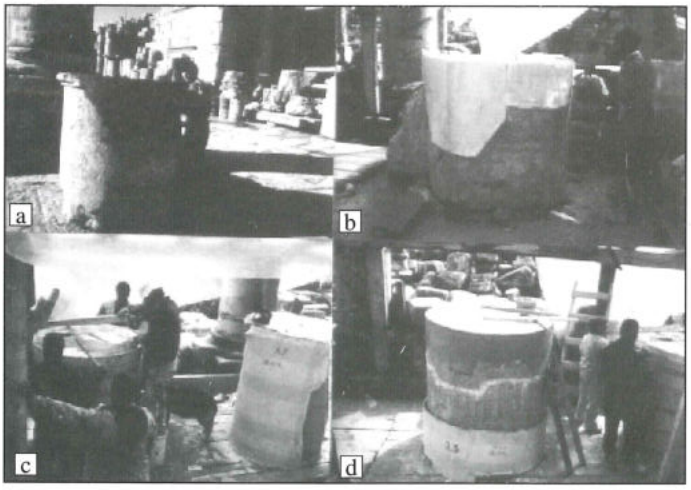
b. The second operation, that of reintegration, was planned to bring back the original static and volumetric characteristics to those column drums that were fragmented due to rocking, shaking and final falling due to recurrent earthquakes. In this operation the combined efforts of architect G. Rizzi, engineer D. D'Ayala and the restorers S. Volta and F. Beretti, led to the final solution for the artificial replacement of the missing parts of the columns. The building of an appropriate artificial stone out of reinforced concrete was found to be the most suitable solution to achieve the required objective. The insertion of iron bars in the column shaft as a strengthening measure was rejected as our aim was, in addition to the 'restoration of the elevation', the restoration of the original structural concept. The absence of connecting pivots in the column drums, as in most of the buildings in ancient Gerasa can, on the other hand, most likely be assumed as an empirical measure designed to minimize the devastating effects of earthquakes: Overlapping stone elements free to rock independently are relatively less affected by average seismic activity. The example of the pronaos' columns of the Temple of Artemis is an excellent proof of this theory. Left without the entablature and pediment, the columns have resisted collapse so far and the drums show only limited shifting from the axial alignment.

Eventually, the destructive and non-destructive analysis of the physical and mechanical characteristics of the original stone (a calcareous stone of 2900 Kg/m3, 5 % porosity, 45.5 N/mm2, E = 40,000/mm2) led to the use of a reinforced concrete, having the same parameters, that included an appropriate amount of stainless steel and an appropriate cement mixture (white cement with minimum content of soluble salts, five types of sand and two types of gravel were selected both for colour effect and for obtaining a better particle distribution. Finally, in order to reduce the bleeding effect as well as to slightly emeliorate the stress capacity, propylene fibres were added to the mixture).

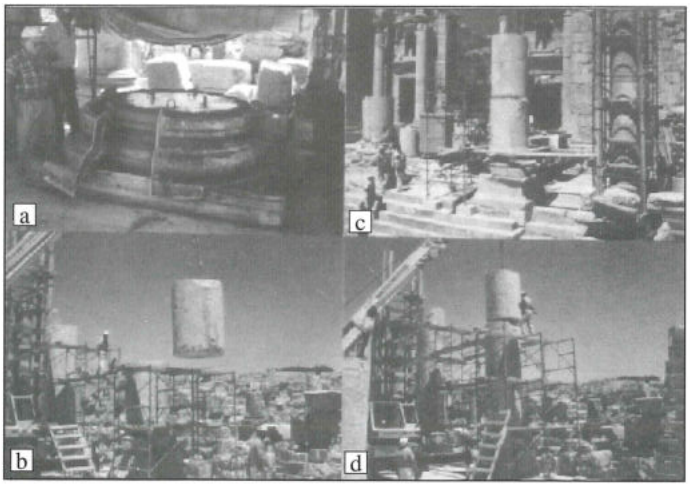
The following procedure was applied to replace the missing fragments,

- preliminary cleaning of the stone surfaces from microbiological aggression and consolidation of the fissures, cracks and slits;
- repair of the most conspicuous missing parts of each column drum by modelled clay (FIG. 5a);
- formation of a fiberglass mould on the clay matrix of the restored parts (FIG. 5b);
- removal of the fiberglass mould and of the clay;
- preparation of the stone surfaces for better adherence and for the insertion of threaded stainless steel bars for the anchoring and reinforcement of the artificial stone casting;
- repositioning of the fiberglass mould and casting of the cement mixture (FIG. 5c);
- removal of the mould after setting and reworking of the concrete to expose the aggregates (FIG. 5d).

c. The reassembly of the restored drums, in progress during the Sixth Conference on the History and Archaeology of Jordan, was eventually completed, at this point of the project, in December 1995 (FIGS. 6a-d, 7, 8).[3] Of the four co.lumns we expect to remount the uppermost drum of column C, because it is missing, as well as capitals A, C and D because they require particularly accurate consolidation and restoration. The missing bases of columns A and B have been completely reconstructed utilizing the artificial stone



5. JARASH, The Propylaeum of the Sanctuary of Artemis, *the Tetrastyle Gateway on the Main Colonnaded Street*, a) the fragmented drum remodelled in clay, b) the formation of the fiberglass mould, c) the casting of the cement mixture, d) the repaired drum ready for reassembly.



6. a-d. JARASH, The Propylaeum of the Sanctuary of Artemis, *the Tetrastyle on the Main Colonnaded Street*, reassembly in progress.

[3] Operations on the site and training of labour force have been followed up from the very beginning by F. Cardilli. P. Battino shared that task during the final phases of the work.

7. JARASH, The Propylaeum of the Sanctuary of Artemis, *the Tetrastyle Gateway on the Main Colonnaded Street*, reassembled by December 1995, from the east.

described above (see FIG. 4).

Through future cooperation projects, the 'restoration of the elevation' of the four columns of the Tetrastyle Gateway is foreseen together with the remounting, on the ground, of the preserved parts of the entablature and pediment, according to their original design.

8. JARASH, The Propylaeum of the Sanctuary of Artemis, *the Tetrastyle Gateway on the Main Colonnaded Street*, reassembled by December 1995, from the south.