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The Stoa of Eumenes in Athens: Theoretical Restoration

Manolis Korres | ORCID: 0000-0003-4765-5138
Professor Emeritus, National Technical University of Athens, School of Architecture, Athens, Greece
dr.korres@gmail.com

Abstract

The article offers a detailed discussion of the outline and all essential elements of the Stoa of Eumenes at Athens. It is a preliminary study for a more trustworthy reconstruction of this central architectural monument. Themes discussed are Doric columns, Ionic columns, Pergamene columns, double half-columns, examines the height of all architectural orders, prefabrication with Prokonnesian marble, and issues of transport, letters as mason marks, important horizontal dimensions, construction of the floor, particularities of the roof geison, roof type, diagonal beams, corner supports under diagonal beams, alterations on the stoa's west end, and the reuse of geison blocks on the proskenion of the Dionysos Theater.

Keywords

Pergamene columns – double half-columns – prefabrication – letters as mason marks – woodwork – diagonal beams

1 Introduction

Erik Hansen, who was, in our field, by far the best master of free-hand accurate linear drawing and at the same time, an amazing investigator of ancient structural methods, with many great contributions in the relevant studies and the presentation of outstanding architectural masterpieces, achieved the – by any measure – highest standards of scholarly documentation, taught us in many ways and honored us – and me in particular – with his generosity and friendship. When years ago, I had the pleasure and privilege to accompany him on a visit to Brauron and discuss with him some details of the Classical stoa, I realized how well he was acquainted with issues of the Greek stoas and how great was his interest in them. I would, therefore, like in his honor to present a study pertaining to an Athenian stoa and to thank the editors for this opportunity.

The author has been investigating Athenian stoas mainly by chance and, in any event, secondarily with respect to other studies. Therefore, his relevant assertions herein have a thematic character: the Stoa of Eumenes as a phenomenon of prefabrication and overseas transport, the stoa east of the Tower of the Winds as a building from which the architectural members of Parthenon repairs originate, again the Stoa of Eumenes as a cause of urban planning and very large earthworks on the South Slope with a direct impact on shaping the Herodeion (Odeion of Herodes Attikos). Today, decades after his first observations, the author summarises the theoretical restoration of the Stoa of Eumenes, which shows that unlike the Stoa of Attalos, the front angles contained a section of wall with a pilaster probably under the fourth triglyph.

It is understood that where direct measurement between clear points is permitted, the result is accurate to a millimeter per 10 m. Values in meters, centimeters or millimeters are written as consecutive numbers by interpolating a decimal dot before the centimeters and a comma before the millimeters (e.g. 1.11,1).

Where three dots … follow a number, they indicate an omitted or a missing decimal. Numerical values followed by ′ or ″ are the dimensions expressed in ancient feet and dactyls. Since up to now, direct evidence of the exact foot value for this building has not been identified (e.g. an inscribed model), the proposed values are hypothetical, based on examining the multitude of surviving dimensions. Finally, the numbering of columns and other elements is meant east → west or north → south.

2 The Stoa of Eumenes

2.1 *Location, Size and Building Type*

The Stoa of Eumenes[1] (ca. 170 BC), extending between the Theater of Dionysos and the Herodeion, had two

1 Vitr., *De arch.* 5.9.1. The impressive retaining wall backing the stoa, with its characteristic heavy buttresses and the strong

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stories and was in the same style as the Stoa of Attalos (ca. 150 BC), but with a four-sided roof, not a gable roof (see below, section 2.3). Without having shops (in any case, unnecessary in a theater district and sanctuaries), it was 50 meters longer than the Stoa of Attalos (with stairs of ca. 166 m, versus ca. 116 m) and 2.5 m wider in interior space (ca. 15 m versus ca. 12.5 m), and the terrace in front of it, over the entire length, was much wider (average width 28 m versus 7 m). The building also had staircases, originally at both ends, like the Stoa of Attalos, but of a much simpler form, due to the steepness of the terrain. Later in the building's history, the western staircase was removed (see below). The whole setting demanded the expropriation of four city blocks,[2] the excavation of the slope towards the *Peripatos* (the earliest Akropolis ring road), extensive backfilling to the south main street and additional planning aiming to a maximum size within limitations posed by the Nikias choragic Monument and a strongly built wall to the north of it with well joined irregular stones.[3] Due to the size of the excavation behind the stoa, a very strong retaining wall was installed with reinforcing struts connected with arches and rear water drainage systems, about which, however, the author has already commented extensively in other studies, and therefore, it will not concern us here further.[4]

arches above them, rendered visible after the destruction of the stoa in the late 3rd century, was never completely covered by the layers of earth and debris accumulated in the millennia until the middle of the 19th century. During the excavation in the Herodeion (1857–1858) and to the east of it (Pervanoglou 1864, 283), the ground level inside the stoa became clear, but the remaining, much larger, part was uncovered entirely only in the years 1876–1877 (Κουμανούδης 1878, 12–18 with a plan by Mitsakis), directly to attract the attention of archaeologists Köhler (1878), Martha (1878) and of architects working with them, who immediately measured the remnants and made drawings of them with remarkable accuracy (Ziller and Loviot, respectively). The only thing missing, the definitive identification, was soon also cleared by Dörpfeld (1888, 102) and Doerpfeld and Reisch (1896, 11–13). Previously this identification was already conceived by others, including Köhler (1877, 178–179), who soon (Köhler 1878) rejected it for a Roman dating, already favored by Martha (1878) and later by others, including Viale (1921–1922) and Polacco (1954), see also Tofi 2010. After Dörpfeld, some important additions were made by Middleton (1900), Versakis (1909) and Dinsmoor (1910), who also correctly dated the end of the building to the Late Antiquity. In the meantime, the Stoa of Attalos was already studied by Adler (1874; 1875), with successful attribution of the double half columns to the façade's upper story; Bohn (1882) with the successful restoration of inner colonnades and floors, delivering the *comparanda* necessary for the theoretical restoration of the less preserved Stoa of Eumenes. Soon, despite some contradictions in the proposed restorations of the Stoa of Attalos, the Stoa of Eumenes had already its restored form well established: two-storied like the Stoa of Attalos, but with a hip roof (as, for instance, in Durm's perspective, restored view of the Akropolis from the southwest, ca. 1900), or in N. Gouvousis' excellent drawing (ca. 1955, scholarly supported by A.E. Oikonomides, personal communication) with a gabled roof, like the Stoa of Attalos, then in the process of reconstruction. Around this time, a new architectural study of both Pergamene stoas started (Fiandra 1958, with research collected in 2012) but without continuation. The generally correct restoration proposed for the Stoa of Eumenes by the aforementioned scholars was further elaborated in the restored transversal section drawn shortly before 1971 by Travlos, the restorer of the Stoa of Attalos (Travlos 1971, 523–526). In the following years, the multi-thematic study of a great number of stoas (Coulton 1976, Stoa of Eumenes: 12, 14, 69, 70, 79, 107, 112, 119, 121–122, 124 n. 3, 127–128, 139, 225, fig. 33a, pls. 12, 15, 16) created a new basis for any further particular research. Early in the next decade, new observations (Korres 1983 and here sections 2.6, 2.7 and 2.24) revealed important aspects of the methods applied in planning and carrying out the Eumenes Stoa project, while other studies (Schalles 1985; Habicht 1990; Schaaf 1992; Corso 1997; Mercuri 2004) greatly contributed to a more profound knowledge of the political and historical aspects of this and many other similar projects.

2.2 *Parts Preserved, the Axial Spacing*

Except for the retaining wall and the lower part of the wall adjacent to it, including wall parts at both ends, the foundation of the façade is preserved over almost the entire length, in places up to the euthynteria level. In contrast, along the axis, the foundation of 18 internal columns are preserved, the distribution of which corresponds to an arrangement of 31 columns with 30 equal intervals and two much larger intervals between the end columns and the side walls. Obviously, the regular intervals each correspond to two intervals of the exterior colonnade, while the extreme interior intervals correspond to three exterior intervals, and therefore the façade contained 66 bays. This generally accepted conclusion has been continually reinforced by all evidence collected so far, and it has always been considered a fact. It is therefore quite interesting that the well-preserved substructure of the façade, a great part of which, due to the gradient of the terrace in front

2 For a different view, see Mercuri 2004.
3 For the technique, see Hansen 1974.
4 Korres 2015, appendix I: The Stoa of Eumenes, 128–149, contains adequate documentation of the geological, structural and functional conditions of the site, including the reduction of the building's length (for just 61 cm) during the construction of the Herodeion, facts that completely abolish any presumptions of asynchronous construction of the stoa and its retaining wall, or an imaginary much greater original length (a view mentioned by Tofi (2010, 194) without names), and likewise, all further hypotheses based on the latter (or inspiring it). Immediately after the excavation, scholars like Köhler or Ziller, correctly reading the structural relation of the rear and retaining wall, excluded any possibility of asynchronous construction (Köhler 1878, 149–150).

of it, was visible to as much as 1.5 m of its height, consists of well-standardized isodomic laid hard limestone blocks with well-fashioned drafted margins, projecting panels and other features of carefully made monumental masonry. Curiously enough, the well-standardized intervals of the stoa's colonnades (2.45 m, 4.90 m) do not follow the well-standardized unit (102.3 cm on average) of its isodomic base, with the result that along its whole length, only in a very few instances a column axis falls on a joint or middle of a block, while in the far greater majority of cases their relation is irregular. But not only that: on the euthynteria of the stoa, dowel holes and pry holes,[5] perfectly preserved over a length of ca. 43 m and again locally some 17 m farther east, precisely define the position of the Hymettian blocks of the krepis' first step and prove the same system of 102.3 cm (!).[6] Such a discrepancy with the first step of a three-stepped krepis does not usually occur in buildings of that type, and it is therefore quite probable that the preparatory work for the stoa, carried out with local materials and technique, thus by Athenian architects and masons, was not from the very start in pace with the plans of the Pergamene architects. and this discrepancy could have been possibly caused by an overall design revision. This question, however, exceeds the scope of the present study.

2.3 *Intercolumniation Axial Spacing and Roof Type*

Widely spaced internal columns, corresponding to the 2nd, 4th, 6th, etc., external columns, are common in stoas and are typically combined with a pitched roof ending in pediments, e.g. the Stoa of Attalos. The additional increase in the end intercolumniations of the internal columns of the Stoa of Eumenes, corresponding to the 3rd, 5th, 7th, etc. external columns, best serves the fashioning of a hipped roof because it provides a column approximately at the meeting point of the axis with the bisection of the angles of the building. This would be visually reasonable for those standing directly under the roof, i.e. on the upper floor, but not for those walking on the ground floor, for whom, however, this provision offered more comfortable movement at the ends. As aptly noted by Coulton, a pitched roof with gables at the ends is the most common type for Greek stoas.[7] He also cites cases of the exception to the rule: a terrace instead of a roof in stoas of some cities[8] and a shed roof (sloping toward the façade in stoas with the rear side attached to structures of greater height).[9]

To the extent that they are not preserved, or data are unpublished concerning the corners of the entablature, etc., the position of the extreme internal columns is the only indication of a hip roof configuration, but a strong one, provided there exists corresponding base blocks. Apart from the Stoa of Eumenes, good examples are the South Stoa in the Agora of Magnesia on the Meander and the West Stoa in the Sanctuary of Delphi, where the extreme interior columns abstained from the end walls one-half times more than between them.

2.4 *Why a Hip Roof?*

The preference for the Stoa of Eumenes to have a hip roof instead of the usual pedimental type is perhaps connected with the great depth of the excavation of the ground, which increases continuously toward the west, ultimately far exceeding the height of the stoa, bringing its western extremity almost in contact to the much higher ground. This condition would significantly reduce a pediment's visibility or its aesthetic value. But a four-sided roof poses serious technical issues (see sections 2.28 & 2.29): that of the structurally and optically correct form of meeting diagonal girders with the axial epistyle and transverse beams and that of larger loads of the corresponding end epistyles and diagonal beams (when they are supported only on the ends – i.e. with no additional columns placed halfway between each corner and the corresponding end column of the interior colonnade).[10] These issues are addressed below (see sections 2.28, 2.29 & 2.32).

2.5 *Building Material* **in situ**

The parts of the stoa surviving *in situ* bear witness to the use of local materials: the foundations are conglomerate and externally Πειραϊκός ακτίτης (hard limestone from Piraeus), the retaining wall is conglomerate on a base of limestone from Piraeus; the buttresses and arches of it are also of limestone from Piraeus; the toichobate and orthostates are of Hymettian marble; the other layers of the wall are of Aiginetan stone, a rather soft but very homogenous calcareous sandstone (when the stoa was being built Aigina was already a Pergamene possession),

5 At points, pry holes occur in pairs due perhaps to a (rather limited) application of the method of preliminary positioning discovered by Erik Hansen (1991).
6 Korres 1983, 205–207, n. 11.
7 Coulton, 1976, 153.
8 Coulton, 150.
9 Coulton, 151–152.
10 As for instance, in the Stoa of Antigonos in Delos, with an additional column under each valley beam, see Coulton 1976, 155.

while at first glance it is not clear whether in the krepidoma Hymettian marble was used or the sort of marble used for the columns (the former is more likely, see section 2.19).

2.6 *Prefabrication with Prokonnesian Marble*

Outside the building, numerous small fragments of Doric and Ionic architectural elements of the façade are gathered. They are collected on the South Slope of the Akropolis and in an excavation much further north of the Akropolis.[11] Two intact bases and many more fragments of interior columns are preserved, thanks to their reuse nearby, especially in the Theater of Dionysos. Some of the cornice blocks of the roof are also preserved almost intact in the Bema of Phaidros (see sections 2.21, 2.23, 2.26 & 2.27), with characteristic Doric mutules without guttae alternating with square soffits. These marbles, initially considered to be Pentelic marble, are, as first observed by Dinsmoor, quite different from it.[12] In fact, they are like those of most Pergamene monuments and bear carved letters (for letters on geisa blocks, see section 2.24) identical to those on Pergamene monuments, as already stated in the first presentation of the case.[13] The type of marble, the absence of chip layers of this material to the site, the form of letters and the presence of letters only in these marbles, but not in the stones of the stoa coming from Attika, are elements manifesting a fascinating and admirable process of the work's production: the façade and interior columns, that is, the most valuable stones of the building, were prefabricated by Pergamene craftsmen and transported by ships and carts to Athens for final assembly.[14] The latest research has shown that the main marble source for the Pergamene building programs, including that of the Stoa of Eumenes at Athens, was Prokonnesos.[15]

2.7 *Letters as Mason Marks*

Quite interestingly, on the roof geison blocks letters were carved solely on the underside (see section 2.24).[16] The two nearly complete elements of Doric frieze, an isolated triglyph and another one united with the metope to the right-hand side of it, bear no letters, but the possibility that such letters had existed on areas now effaced or broken, though small, cannot be excluded. The bases of the double half-columns bear no letters. This is perhaps due to their small size, low proportions and high standardization, rendering them handier and easier interchangeable. On the two complete ionic bases, letters occur only on top: at the one, an A, at the other, found in the Library of Hadrian, a K (two other letters KP on the underside of the latter are modern).

In the Pergamene capitals, letters exist on the underside near the middle but not on the top. This absence could be attributed to any last moment adjustments made by trimming the bearing surface during the positioning of the architraves, but this is true only for the Doric capitals. In contrast to them, the top of the Pergamene capitals observed still preserves its elevated surface surrounded by a strongly beveled margin. This fashioning, like in the case of geison blocks (preserved on the one from the southwest corner), ensures safety for any handling of them if kept upside down (a position which at the same time completely excludes overturning). This system has been applied, possibly for the same reasons on cornice blocks and column capitals of the Roman *scaenae frons* in the Theater of Messene.[17]

The fragments of the column shafts, despite their availability in hundreds, still represent less than a hundredth of the original mass of marble, so mathematically

11 Korres 1980, *ArchDelt* 35 B1, 19; 1983, 206, n. 3.

12 Dinsmoor 1910, 482 n. 2.

13 Korres 1983, with reference (n. 25) to the Ionic temple at Pergamon's "Theaterterrasse" (Bohn 1896, 61).

14 Korres 2015, 139–140. Also Korres 1983, 204 and 206 for the aim of the prefabrication. See also Habicht 1990, 563 and n. 10. Weber (2013, 46–50) is right in questioning the feasibility of moving completely fluted column drums (although Ganzert has discussed this in the case of the Temple of Mars Ultor in Rome), but in Korres 1983, there is not a single claim of such an extreme procedure for column pieces transported with flutes finished! Generally, the utilization of excessive thickness (Werkzoll, Mantelfläche) as a protective device of carved stones during their transport is almost strictly imperative solely in the case of multi-partite bodies. In all other cases, completely prepared monolithic forms (unfluted Roman column-shafts, ionic capitals of any size, etc.) or polylithic, properly fashioned to conceal a joint (large Corinthian capitals with a median joint, triglyph-metope units with side slots, bevels, etc.) were very often transported in a finished state. At any rate, precautions like protective margins near the joints (Schutzstege), as sometimes applied also in contemporary practice, do not seriously alter the essence of prefabrication. For any discussion concerning the different architects' particular range of control, or the circumstances of prefabrication, one should first know the peculiarities reported in section 2.2 (design discontinuities), section 2.7 (distribution, positions, and form – simple or combined – of the marks), or section 2.24 (more letters on the under-side of the geison blocks).

15 Cramer 2004, 237–238.

16 Their absence from the top is being manifested by the southwest corner block (see section 2.23), the only one with preserved upper side. By all other blocks (in the Theater of Dionysos), the upper side is reworked.

17 Sidiropoulos 2015, 223–224, figs. 18, 19 (where full words complement the system). As for the columns, he observes (2015, 224): "… the same letter is used to mark the base, the shaft and the capital and the complete columns in fact run in continuous numerical sequence from east to west …"

speaking, the probability of any possible combination of them (say by tenths) to form a complete drum is very little. Nevertheless, some conclusions can be drawn as follows:

1. The ground floor column shafts were made up of three or four pieces, those with the Pergamene capitals of two,[18] perhaps of equal height, while the double half-columns were monolithic.
2. Letters occur on the upper side of drums as much frequently as on their underside (!)
3. Moreover, they form different combinations of two, like IB, IΔ, MB, PB, ΛB (the first letter denotes the column, the second one the parts of it) and when they appear to be single, like A, Γ, Δ, Θ, K, M, P, ω, it is really only in few cases so,[19] while more frequently their very close proximity to a neighboring fracture's edge impedes us to say whether they are accompanied by a (missing) letter or not. It is also not to be taken for granted that the system was uniform for all columns.[20]

2.8 *Not Preserving the External Lines of the Building*

Given the position of the stoa, the north (i.e. the rear) wall was externally visible only in the uppermost part of its eastern half, which is far from being preserved. Therefore, the more extended lower section of this wall, abating at the retaining wall, had a highly irregular contact surface in its small and only surviving part, which does not show precisely what the normal thickness was. The western wall, rebuilt at a 61 cm setback, rendered necessary when the Herodeion was built, survives only in its part that was fused with the Herodeion's easternmost wall. On the east wall of the stoa are preserved only some toichobate and orthostate blocks, belonging, however, only to the inner side of it. Finally, in the euthynteria of the façade, as mentioned in section 2.2, sufficient evidence of the position of the first step of the krepidoma is preserved, with no direct evidence for the exact position of the stylobate. The calculation of this position is based on the expectable equality of the beams from both sides of the (well preserved) axis and on the assumption that the columns were vertical with a setback from the stylobate's edge similar to that of the Stoa of Attalos' columns. Therefore, the theoretical restoration of the plan of the stoa is carried out within this framework of commitments and suppositions and, where reasonable, recourse to metrological assumptions. The results are most probably safe within a 2 cm range, while they are stated to the millimeter as simply the most likely version of the assigned metric value.

2.9 *The Thickness of End Walls*

The aforementioned preserved sections of walls, one at the north and one at the west (the latter as rebuilt in 165 AD), have a thickness of ca. .80 m, though they are not representative of the plan of the building since they abut on other structures. Since, however, there are no individual blocks preserved of free-standing wall parts, the only data are the surviving fragments of the façade, by means of which one may calculate, on the one hand, the thickness of epistyles of the ground floor and upper story (respectively 73.7, rounded up to 74 cm and 0.59,4, see sections 2.14 & 2.16) and, on the other, the exact length of the intercolumniations of the façade (see the next paragraph), and the consecutive or corresponding divisions in intervals of triglyphs (.33) and metopes (.48,6) or of mutules of the roof cornices and their intervals (respectively .24,5 and .36,7, see section 2.11). The thickness of the sidewalls of the ground floor, immediately under the entablature, is calculated as follows: The distance of the east or west wall's inner face from the center of the respective end interior columns (ca. 6.91) is smaller than the sum of three axial spacings of the façade (3 × ca. 2.45, see below) by ca. .43, while the distance of their exterior face from the same point, should not exceed the sum of three axial spacings (ca. 3 × 2.45) plus the half of the width of the triglyph (ca. 16.5 cm). Therefore, the thickness of the sidewall (immediately under the entablature) was ca. .43 + 16,5 = ca. .59,5.

2.10 *Length*

Today the interior length of the stoa at the level of the floor (from the east toichobate to the west toichobate) is 160.37 ½ m. With the projection of the toichobate being slightly less than 4,5 cm, it follows that the length from wall to wall was 160.47 m. This distance, before the construction of the Herodeion, was 160.47 + .61 … = ca. … 161.08 m. After this, with the addition of the thickness of the sidewalls, the above the toichobate overall length of the main building (excluding stairs) is calculated as ca. 161.08 … + 2 × .59,5 = ca. 162.27.

2.11 *Axial Spacing*

Due to the complete destruction of the marble krepidoma and highly fragmentary preservation of epistyles, the determination of the axial spacing is based on the convergence of three indirect methods:

18 On the underside of an inner upper column is written ΘΓ; on another underside, an A with a small hook.

19 As for instance, in the case of an E supplemented with a small hook in its upper end (making it equivalent to 29 or rather to 30).

20 On the underside of a Pergamene capital is written KA.

1. On the basis of its equality to half of the average of the intervals of the internal colonnade (34.25 / 7 = 4.89,3): 2 = 2.44,6. At this point, it should be mentioned that one spacing after the 24th column was ca. .25 greater than normal (5.15, … versus ca. 4.90, …), probably because it corresponded to the fountain in the stoa.[21] According to this amount (ca. .25 = ca. 14″) an increase was necessary at the interval of the external columns (50th and 51st) facing the fountain.
2. By division of the total length into 66 equal parts, after subtraction of the width of a triglyph as well as the above 25 cm accretion: (162.27-.33-.25): 66 = ca. 2.45.
3. By quadrupling of the average of the intervals of mutules of the roof geison: c1 in the geison of the southwest corner (1.22,4 / 2) × 4 = 2.44,8, c2 in the geisa re-used in the Bema of Phaidros (see section 2.21) (1.83,4 / 3) × 4 = 2.44,7 and (1.22,4 / 2) × 4 = 2.44,8.

On the basis of the above and the dimensions of triglyphs and mutules, it is concluded that the intercolumniation contains three periods of 1st story triglyphs and metopes with widths as much as possible, approximating the ratio of 2 to 3, but also four periods of upper story mutules and corresponding soffits with width also as much as possible approaching the ratio 2 to 3. This is met largely by individual dimensions of the above elements, all of which are convertible to integers of dactyls of a foot nearly .29,7 long, as follows:

> width of triglyph 18″, metope 26″ (ratio of 20 to 29), mutule 13″ and soffit 20″ (ratio of 200 to 307)
> (18 + 26) × 3 = 132 = (13 + 20) × 4
> 2.45 / 132 = 1,856 cm = 29.69 / 16

On this basis, the length of the stoa measured on outside edge of the ends was 132″ × 66 + 14″ + 18″ = 8744″ = 5 46 ½′ or (547 ½′) on the level of the stylobate. The use of an Ionic foot and of its 16th is controlled in a multitude of small dimensions, deductible from two Ionic bases, a Doric capital, an Ionic capital, a Pergamene capital, and a section of the geison.

2.12 *Height up to the Epistyle of the Ground Floor*

The height of the columns is not directly restored. Unfortunately, as already stated, there are only fragments preserved, and despite their very large number, no one single column has been made by the fragments fitted together so far. Fortunately, secure indications can be found on the walls of the stoa. On the rear wall, although above the orthostate the stone construction belongs to the Late Roman fortification, a small part remained as it was because a tower of the said fortification standing there rendered the replacement of the original masonry unnecessary. A portion of this part, attached to the twenty-second buttress of the retaining structure, is still preserved up to a height of nearly 5.24 m from the lower edge of the toichobate. It consists of eight even courses of orthogonal stones coming from the quarries of Aigina (see section 2.5). In the west wall, which has been refashioned simultaneously with the construction of the Herodeion, eight not even courses of orthogonal stones from Piraeus quarries, largely in secondary use,[22] are preserved above the marble orthostate,[23] while higher up, there remain only traces of a 9th, a 10th and an 11th course, quite clear indeed, left on the well-preserved mass of Roman concrete of the Odeion. In this, the imprint of a stone of course nine is preserved, which shows that it reached the same height as the section of the north wall's original masonry with the eighth standardized courses. It is therefore concluded that the wall epistyle of the ground floor went in this for both walls' common height, which actually is practically the same in the Stoa of Attalos. Further support for this conclusion is the observation that the addition of another course of stones in each of the two systems would make their overall heights uneven.

2.13 *Doric Columns*

The columns of the ground floor, therefore, had practically the same height as those of the Stoa of Attalos. The numerous fragments of them[24] allow accurate calculations of the lower diameter (ca. .76 ½), the upper

21 To the west of this enlarged intercolumnium, as far as preserved, the base blocks bear strong evidence of a revision of the plan during construction, in any case, related to this enlargement. This was originally still bigger (perhaps equal to a triglyph's width). Then new dowel holes for the ionic bases were carved to enable an eastward shift of the columns, progressively increasing towards the enlargement in order to moderate it by diminishing it to the width of a mutule of the upper story.

22 From the underside of toichobate to the upper side of the eighth layer, the height is ca. 4.79 m.

23 This wall is depicted by Versakis (1912, fig. 19) but with layers of equal heights.

24 In 1980–1981 the author saw many hundreds of them in the Library of Hadrian, where they were stored after a rescue excavation in the plot at Pandrosou Street 9–15 and Mnesikleous Street (*ArchDelt* 35 B1, 1980 [1988], 18–19) and had many of them successfully fitted together. Until 1984 all fragments were transferred to the south of the stoa, and soon new fittings were made thanks to the talent and patience of Mr Vasilis Anastasias (chief technician).

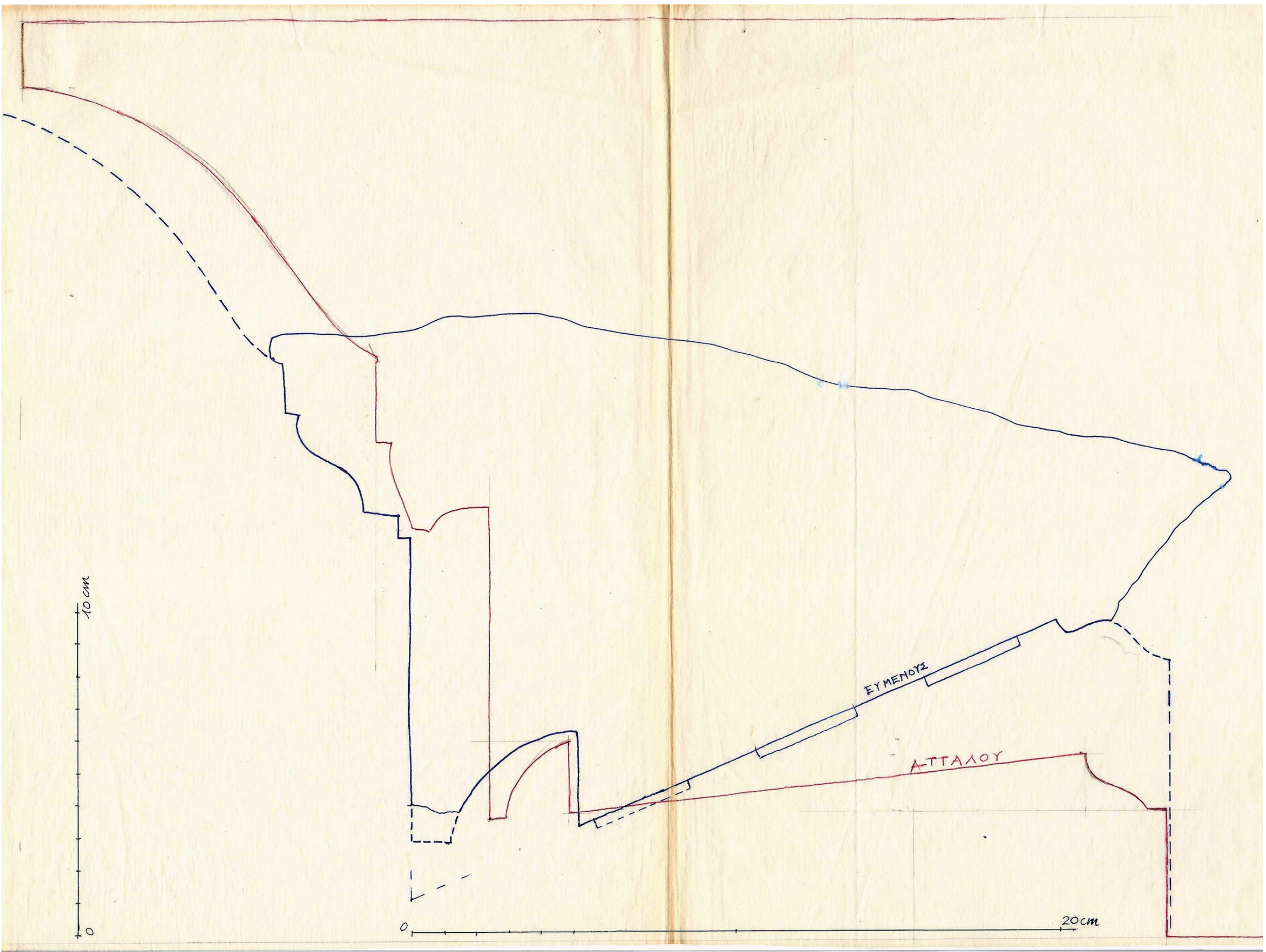

FIGURE 1 The Doric cornice of the stoa compared with that of the Stoa of Attalos
DRAWING BY THE AUTHOR IN 1982

diameter (ca. .64 ½), and the diameter at the height of the transition from the polygonal to the fluted part of the shaft (ca. .76). Of the capitals, there are numerous samples preserved, sometimes fragments belonging together, mostly stored in the area south of the monument and the largest fragment in the archaeological storeroom of the Roman Agora. The capitals have the same form as those of the Stoa of Attalos but are wider (ca. .83,4 versus ca. .77 ½), so as to correspond to a thicker shaft (ca. .76 ½ versus .73,8) and thicker epistyle (see next). This difference must be attributed to a corresponding difference of actual and, consequently, visual weight of the floor above them.[25]

2.14 *Doric Entablature*

The epistyle (of which numerous fragments are preserved) like that of the Stoa of Attalos had along the length of its visible underside a plane quite shallow soffit. The width of this zone, measured immediately in various fragments, was 14,8 cm (1/2′) and the distance from the outer and inner sides, also measured directly in various fragments, was 29.6 … cm (1′). Therefore, the thickness of the architrave was 2 ½′ or nearly 74 cm. The taenia, and regulae of the front, as well as the cymation of the inner face, were exactly like the corresponding ones in the Stoa of Attalos. The inner face was also articulated with two fasciae. The height of the architrave is not preserved entirely but is assumed to be equal to that of the Stoa of Attalos. Of the triglyphs preserved, most are fragments, and two are complete, together with part of the adjacent metope. They have a width of ca. .33,1 and a height of ca. 52.2. These dimensions match the triglyphs of the Stoa of Attalos, with similar plastic form, but with one difference: under the edges of the top, there are “ears.” In contrast, the fragments of the Doric geison demonstrate a severe discrepancy to that of the Stoa of Attalos: in the Stoa of Eumenes, the slope of mutule is much stronger (Fig. 1).

25 Korres 1983, 203.

2.15 *Ionic Columns*

The interior columns of the ground floor were like the Ionic columns in the Stoa of Attalos but clearly stronger. This difference has the same reason as the corresponding difference in the thickness of the exterior columns of the two stoas. Unfortunately, the surviving pieces are minimal: rather small fragments of the shaft, which was unfluted to its full height, a base fragment with an estimated lower diameter of ca. 1.04 m, which exceeds that of the Stoa of Attalos by 5 ½ cm, in line with traces on the base slabs and finally some fragments of capitals, of which the complete form is reproduced with high accuracy. Owing to the continuity of the exterior and wall epistyle, their columns both had an overall height of nearly 5.24. The capital had a height of ca. .22 (from resting to bearing surface) and width of ca. .62 (from front to front). The treatment of the upper surface shows that the thickness of the ionic epistyle was also ca. .62.

2.16 *Façade Columns of the Upper Story*

The base of the double half-columns is well preserved: one entire example and various fragments. From the shafts of the double half-columns, numerous small fragments and three large fragments are preserved, allowing secure measurement of the complete profile and height calculations when combined with evidence from a large pilaster fragment (see sections 2.29 & 2.30). Two more large double half-column fragments exist in the ancient agora, built in the foundation of the 1st left giant. They agree well with those of the Stoa of Attalos, as well as with their respective capitals, of which there are also numerous fragments preserved. The height of these columns, found to be equal to that of the corresponding columns of the Stoa of Attalos, is only indirectly restored (see section 2.30), as well as their conspicuously strong tapering (see section 2.29).

2.17 *Interior Columns of the Upper Story*

Of the interior columns of the upper story, many fragments are also preserved: two intact bases already mentioned (see sections 2.6 & 2.7), three capitals joined from several fragments,[26] and an upper column drum joined from two large fragments and most small, yet disconnected fragments. Combining the measurements of these fragments with the evidence of chisel marks on their bearing surface, the width of the corresponding architrave could be satisfactorily restored to nearly 59,8 cm (more than 2′ by just a few millimeters). The height of these columns (Fig. 2) is only conjecturally restored as the result of the exterior column's height and the half-width of the roof space multiplied by its gradient, ca. 20%, estimated after the roughly fashioned upper side of the southwest corner's geison block (see section 2.26).

2.18 *The Width of the Stoa*

The metrical investigation of the width starts from the only precisely known large transverse dimension: the distance of the axial colonnade from the wall at the level of toichobate (7.45,5),[27] which is somewhat greater at the level of the orthostate (ca. 7.50) to be slightly increased above it, due to a small setback of the wall face, and reduced again (ca. 7.50) at the level of the upper wall epistyle, due to its slight overhang.

Since the epistyle of the internal colonnade, as positioned just under the edge of the roof, should be equidistant from the epistyle of the façade and from that of the wall, the distance from the axis of the inner columns to the axis of the outer columns should be 7.50 + half the thickness of the Doric epistyle, i.e. 7.50 + .37 = 7.87. It follows, at this height, that the outer width of the stoa, if it stood free, would have been 2 × 7.87 + half the thickness of the epistyle (.74 / 2) + half the (theoretical) thickness of the rear wall (.74 / 2)[28] = 16.48 ± ½ cm.

At the height of the epistyle of the upper story, where the outline of the building remained free and visible, the width would have been 2 × 7.87 + half .59,8 + half .59,8 (.59,8 being the epistyle's thickness in the upper story) = ca. 16.33,8 m ± ½ cm. The test for an accurate correlation of the theoretical width of the building at the level of the Doric entablature of the façade with the latter's metrical system is inefficient: (2.45: 3) × 20 + twice half an angular triglyph (.33) = 16.66 m. This amount exceeds

26 "Capital a" (Coulton, pl. 12, sawn in background and Travlos 1971, 526, fig. 664), "capital b" (parts in Coulton 1976, pl. 12, sawn in foreground, complemented with fitting fragments by the author), and "capital c" (fragments identified and mounted by Mr Vasilis Anastasias). A photo of Stillman (1882) entitled "Temple & Precincts of Asklepios" taken from the southwest (Harlan, 2008–2009, 123–144, figs. 23a and 23b) includes four fragments, of which three belong to "capital a" and the last one (in the lower-left corner of the photo) to "capital c." The third from left fragment has not yet been identified.

27 Measurable on base slabs with incision or carved point defining the column axis. This was first observed by Benoît Édouard Loviot. Martha (1888, 586), who measured the distance with sufficient precision (7.45).

28 While the theoretical rear wall thickness for the first story is .74, its actual thickness in the portions preserved, always in contact with the retaining wall, is clearly bigger (ca. .80 to .85). Higher up, however, the part of the second-story wall exceeding the height of the retaining wall should have a calculated thickness of 59.5 cm.

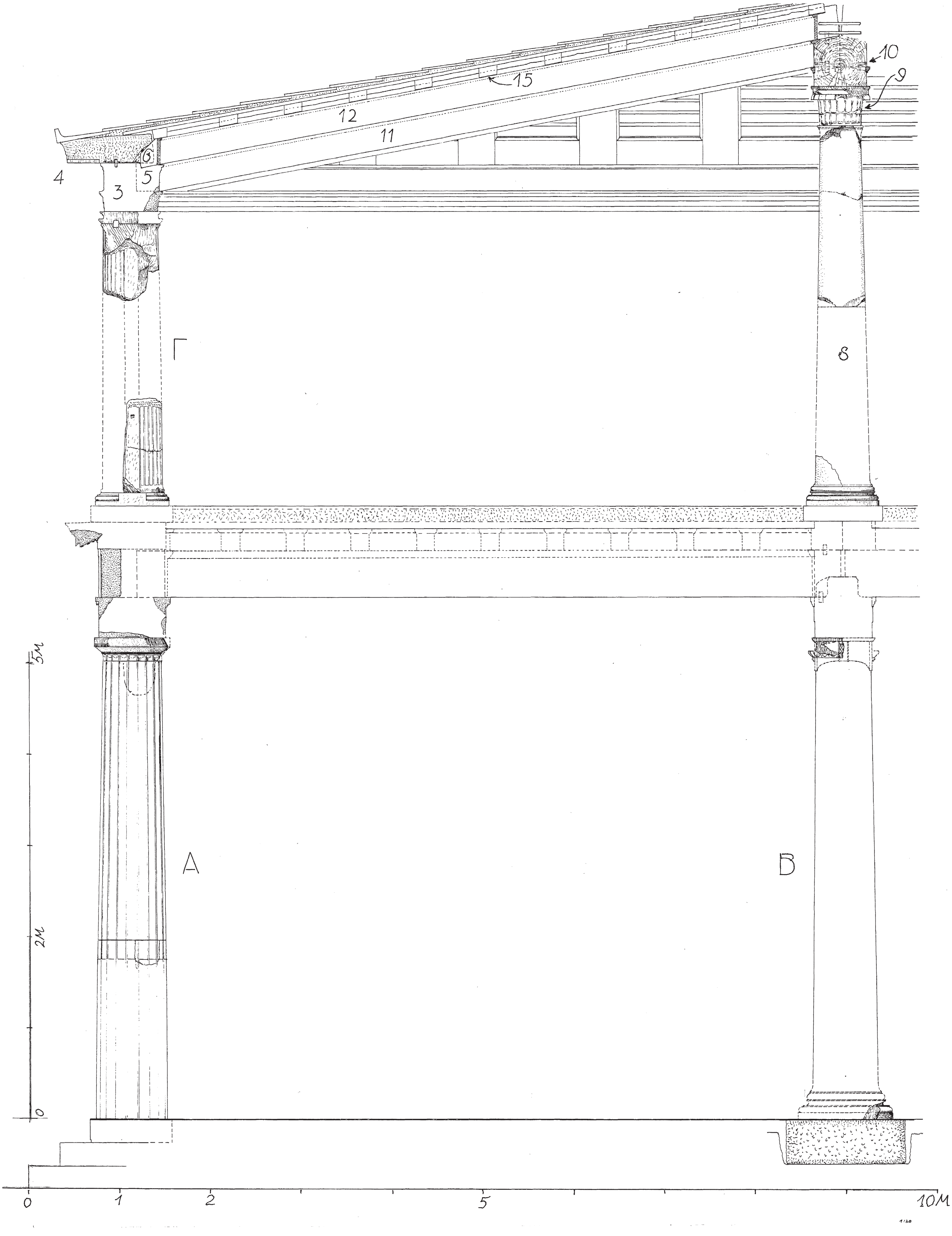

FIGURE 2 Transversal section of the stoa containing its colonnaded part. A: Doric colonnade, B: Ionic Colonnade, Γ: upper floor exterior colonnade, 3–6, 8–13 as in Fig. 4
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by ca. .18 the aforementioned calculated theoretical width (ca. 16.48). But in this stoa, due to the limitation of the excavated slope and because of the stairs, which rested against both ends, a continuous configuration of the entablature at the narrow sides would be pointless. Moreover, this happened also in the Stoa of Attalos, despite the fact that she stands free on all sides.

2.19 *The Krepidoma*

Following the above width calculations and taking into account the semi-diameter of the outer (Doric) column and the projection of the stylobate (ca. 6 to 7 cm), the front of the latter must be restored at a distance 7.45,5 + 7.87 + .38 ¼ + ca. .07 = 15.77,5 m ± ½ cm from toichobate. The position of the front of the first step is identified as a clear trace on the *in situ* preserved euthynteria (see see section 2.2), spaced ca. 16.48 ± ½ cm from toichobate. Accordingly, the steps have a width (tread) of (16.48 ± ½ cm – 15.77,5): 2 = ca. 35 ¼ cm ± ½ cm. Based on the height difference of the euthynteria, krepidoma and toichobate (ca. .73), the height of the steps and stylobate is estimated to be ca. .24,3. Among the fragments of steps still preserved in the area, only one has the above metric characteristics and the technical characteristics of the stoa (type of treatment, dowel mortise, pouring channel). The marble, Hymettian, confirms the preliminarily expressed opinion for the material of the krepidoma.

2.20 *Dimensions in the Upper Story*

While the Doric entablature does not assume the width of the building, it is reasonable to think that the geison of the roof, as it is prominent and uninterrupted by staircases, should exhibit the same form on all sides with the result that it would have a binding relationship with the width of the building. The test is as follows:

> (2.45: 4) × 26 = 15.92,5.
> 15.92,5 + .24,6 = ca. 16.17.

This amount is below the calculated width (ca. 16.33,8 m ± ½ cm) by almost 17 cm. However, with the addition of only a few millimeters in each mutule and interval, the end sides (east and west) of the roof would be compatible with 27 mutules and 26 intervals. This is not unlikely: The west side of the well-preserved southwest corner geison was at the level of the mutules by 7 mm longer than the sum of two regular mutules of the façade and space between. Finally, based on the width difference of the first story triglyph and upper story mutule (18″ vs 13″), the retreating sides of the upper story, that is, the external reduction of the thickness of the side walls (east and west), would be only 2.5″, a similar reduction on the inside would not have been necessary. Therefore, the thickness of each of the sidewalls on the ground floor was 2′ + 1.25″ (= ca. 62 cm), while on the upper story, it was 2′ – 1.25″ (= ca. 57 cm). The latter calculations are very theoretical and presented with caution. This thickness is equally likely to have been given to the sidewalls as to the rear wall. This simply would cause a small reduction in the recess of the wall surface against the antae/pilasters. The pilasters must have had a thickness of ca. 76 cm on the ground floor and ca. 61 to 64 cm on the upper story (see section 2.30).

2.21 *Identification of Roof Geison Blocks*

The preserved geison blocks of the roof came to light during the excavations of 1862: three residing in the Bema of Phaidros, as its floor, three others on the ground, not far away,[29] and one by the Herodeion. The first was commented on by Versakis in 1909 as supposedly authentic elements of Neronian proskenion, but very soon their true origin was recognized by Dinsmoor:

> … These geison blocks are assigned by Versakes[30] to a hypothetical proscenium of Nero, of which they form the only evidence. They are of a peculiar dull gray, fine-grained marble, which is used for interior columns and for those in the second storey of the façade of the Stoa of Eumenes. In form the geisa are almost exactly like the peculiar geisa of the Stoa of Attalos[31] – low geisa suited to the smaller order of the second storey but with a disproportionately great overhang to crown the whole height of the façade; the mutules without guttae, and the clamps, dowels and workmanship resemble those of the Stoa of Attalos. The spacing of the mutules averages 0.613 m, which is exactly a quarter of the intercolumniations of the Stoa of Eumenes (2.451 m), and has nothing in common with any triglyph spacing of the theatre …[32]

The same geison blocks are included in the publication of Theater of Dionysos by Ernst Robert Fiechter,[33]

29 One was found in the eastern part of the scene and two in the stoa of the sanctuary (Fiechter 1936, 25).
30 Versakis 1909, 204–224.
31 Adler 1874, pl. 6; Bohn 1885, pl. 2.
32 Dinsmoor 1910, 482 n. 2.
33 Fiechter 1935, 47, n. 1 (in which Fiechter suspects a rather modern placement of the geison blocks on the bema) and 91, pls. 8, 9.

which contains drawings of them,[34] but curiously they are declared as being of unknown origin without reference to the previous study.[35]

2.22 *Roof Geison Blocks and Their Lengths*

In themselves, the geison blocks of the roof constitute a very important field of study: the preservation of their dimensions, almost entirely intact, is in sharp contrast to the strong fragmentary nature of other materials. These large marbles exhibit varying lengths: 1.22,4; > 1.42 (originally 1.60 or 1.84 or 2.21); ca. 1.60; ca. 1.60; ca. 1.84; ca. 2.04 (2.20); 1.66 (corner originally 2.27). These lengths are not random: They contain each time a total of two or three mutular widths ca. .24,6 m and two or three or four soffits. Obviously, these major blocks do not exactly correspond to the entire or half axial spacings, and their joints may have fallen in one or sometimes two of the theoretically eight per bay places available. The use of the geison blocks in the theater, not only explains their better quantitative and qualitative preservation but is also an important chronological indicator of the history of the stoa.

2.23 *Geison of the Southwest Angle and Phases of the Roof*

Curiously, the geison block found near the Herodeion was also preserved complete, although not used in the Bema of Phaidros. Until 2000 it was still leaning on the western pilaster of post-Roman nymphaeum near the Herodeion, in the area where it was found during the excavation of 1864. This specific geison belongs to the southwest corner of the roof of the stoa in its original form, as well as the modified form: It shows characteristic re-carving of the left end whereby the length was reduced by removing the original corner soffit and last mutule, so that the next soffit became its new corner soffit. The length removed (ca. 61 cm) exactly corresponds to the reduction of the internal colonnade's westernmost intercolumniation.[36] Besides the re-carving of the upper surface, along the length of the new west side, is an indication of a change in the roof's form from its hipped to the gable version at this end, that had to touch the east wall of the Herodeion and to prevent the flow of rainwater to it. The small part of the new termination of the roof that remained free south of Herodeion appeared to the right and was the only visible part of a pediment attached to the eastern wall of the Herodeion.

2.24 *Roof Geison and Letters as Mason Marks*

A common feature of most of the geison blocks of the roof is that they bear mason marks, which curiously, instead of being on the upper surface, are located on the lower surface. There are two kinds of these letters: those first documented by Fiechter,[37] 6 to 8 cm high, placed on each block near both ends and denoting numbering increasing from left to right, and a set of extremely large letters, with a height of 18 to 20 cm, at seemingly random distances from the ends, consisting of an A with a B (in the following *AB*), attached to the right arm.[38] The position of said *AB* is not entirely random: It always corresponds to one of the mutules of the geison. Based on how frequent this symbol occurs and which particular mutule corresponds, the experienced observer will restore a rhythm repeating that at every fourth mutule of the geison, or in other words, with the columns. This is supported by the observed correlation with the recarving of the rear and underside, which created space above the ends of the rafters of the roof (see section 2.25). The huge size of the symbol and its positions are interpreted thus: during the erection of the façade, cranes should be used, moving parallel to it (by means of rollers). The workers had to push or pull the crane to the east or west, so the symbol *AB* was brought above the proper column. Therefore, it was so large that they could easily see it from the ground.

The incising of the numerical letters also on the underside has a completely different explanation: as is known, the under-side is that which is prepared before positioning, while the top is still unworked. For the purposes of prefabrication and testing, the blocks, which were still in Pergamene workshops of Prokonnesos, had to be put on the suitable ground in an upside-down position (leveled say with wooden planks underpinned with wedges), aligned with stretched cords and matched to one another as well with those of epistyles, which would also have been lined up and made parallel to the geison blocks. At this stage, the dowel cuttings should have been prepared. This is so as not to interrupt the numerical letters despite the close proximity to them. It is understood that, during transport, the blocks would have been kept on the cart or on the ship in an upside-down position so as not to damage their finished edges.

34 Fiechter 1936, pl. 2, fig. V1–5.

35 Fiechter 1936, 20–21, "hellenistische Gesimsstücke," hypothetically attributed to an unknown elongated building of the 1st century BC (with at least 21 such members or more), 82, fig. 28.

36 Korres 2015.

37 Fiechter 1936, pl. 2, fig. V1–5.

38 Curiously, the large letters *AB* escaped the attention of scholars, while Fiechter (1936, pl. 2, fig. V1–5), recognized only some of the smaller letters.

2.25 *Geison Blocks of the Roof: The Layout*

While less than one-tenth of the façade's geisa blocks are preserved, the trial of putting them in a sequence using their numbering, the estimated size of vacancies and the juxtaposition between *AB* markings and columns reveals as very likely that each time four consequent blocks occupied three consequent axial spacings (with shifting by half the width of a mutule), which, along with the above criteria, enables the determination of the position of the geison blocks with excellent approximation. In this, the previously mentioned re-carved back parts help since they correspond to every other mutule, indicating that the ends of the rafters correspond to columns and the middle of the intercolumniation (curiously, these re-carvings have not been previously noted). Also, with good approximation, if not absolute precision, it is estimated that 88 geison blocks, including the corner ones made up the whole course along the façade. Thus these blocks should have demanded four consecutive alphabetical series. The surviving letters belong to the first three series: simple letters without distinguishing features, letters with a discrete horn rising upward and bent to the left, and letters with such a horn at the edge of which a little circle has been added. Letters of the fourth series are not preserved but must have been no more than six or seven or perhaps eight.

2.26 *Geison Blocks of the Roof: The Question of the Upper Surface*

The upper surface of the geison blocks found at the Theater of Dionysos is not pronouncedly inclined as in the Stoa of Attalos. Instead, it has a nearly horizontal and smooth inclination. This misled Versakis to ascribe them to a proskenion, but also Dinsmoor speculated that the Stoa of Eumenes had a flat roof instead of a sloped one. Fiechter later reached a similar conclusion as well. However, none of the aforementioned scholars had the southwest corner geison in mind. This block has a very rough upper surface, as it came from the quarry, while from the front upper edge and to a distance of 30 cm, this surface, re-carved after positioning with a fine point, shows an upward slope of ca. 1:6, appropriate for a roof slope of 1:5, assuming normal tiles with a free length of ca. 50 cm and thickness of ca. 2.5 cm. The height of this geison block on its face is at least 23 cm, while in the middle of its upper surface, it reaches 30 cm. The geison blocks located in the theater have a height of 22.5–23.5 cm on the face, 24–25 cm in the middle and 25–27 cm at the back. Besides, their upper surface is very smooth. It is therefore certain that these geison blocks were re-carved when placed in the proskenion of the theater, whereby they acquired a notch on their backside appropriate for the end plank of a wooden floor. This careful work clearly predates the time period of Phaidros. This is readily demonstrated by their present disorderly position: The one to the west is placed longitudinally, but with the notch of the plank towards the outside, the middle one is placed transversally with the notch likewise transversally and the inscription (of Phaidros) towards the exterior on the narrow side, interrupted by two preserved clamp cuttings rendered useless in this present position of the stone, the easternmost is placed like the middle one. This block, being longer, has been cut off at the back (at the southeast corner) to enable the positioning of a now missing thin slab, if not a plank. Another orthogonal cutting in the southwest corner of the middle geison block has a similar explanation.

2.27 *Geison Blocks of the Roof: Phases of the Proskenion of the Theater*

Whereas the primitiveness in laying out the stoa's geison blocks on the Bema of Phaidros leaves no doubt about its execution at a very advanced age of decline, the initial reuse of them in the theater is another problem. A convenient solution would be to link this phase with the refashioning of the stoa's west end that took place during the construction of the Herodeion. But the alphabetic numbers of the geison blocks indicate an origin from the long, middle section of the façade, and therefore, the reuse of the geison blocks requires extensive or total destruction of the stoa. It would not have been possible for this to occur before the completion of the Herodeion, during which such a careful reshaping of the end of the stoa was done. It follows that most likely, the dismantlement of the stoa happened soon after the Herulian invasion (ca. AD 267) when the area north and south of the Akropolis was fortified (ca. AD 280) and the stoa's rear wall (mostly with new masonry) together with the retaining wall behind it became a part of the new enceinte. To the east of the stoa the Theater of Dionysos was left outside the new fortification (only its western *Peripatos* ramp was utilized for this purpose[39]), and while certain stretches of its retaining walls were initially being used as a source of building material needed for other public works in the city, the lower part of it was repaired in order properly to serve its old theatrical function. It is probably during this undertaking that the

39 This resulted to the preservation of that part to almost full height.

proskenion was repaired with the systematic use of the geison blocks of the stoa.

This situation would have been maintained for more than a century until the arrival of Alaric and the subsequent new disasters. After this invasion and some necessary time had passed, what followed was a modest revival and flash of light in the early 5th century, during which the lower part of the theater, including the area of the skene, was fenced with a strong perimeter wall, in which architectural members of the Neronian period were reused, but also other phases of the skene, and even statues. In the middle of the length of both the parodoi stood strong built gates with heavy door leaves and deliberate incorporation of preserved large pedestals. Within this bizarre structural arrangement, destined primarily to serve as the city's assembly place, the old proskenion, very poorly maintained, accepted one more, completely primitive intervention, in which the geison blocks of the stoa appeared once again useful, but in an unorganized arrangement, including the still preserved very poorly made stair.

2.28 *Structural Function and Shape of Beam Ends and Diagonal Slant Beams*

Finally, the questions concerning the structure of the floor and the parts of the roof at the ends of the stoa are far from easy. As already mentioned (see section 2.3), both issues arose from the condition: 1) to increase the length of the end beams and 2) to fashion the meeting of the diagonal slant beams with the axial epistyle as well as the meeting of a number of rafters with the diagonal beams:

1. Increasing the length of the endmost axial epistyle by nearly 50%, combined with a corresponding increase in load, increases the bending moment by 110% (!) and the corresponding deflection by nearly 300% (!).
2. The load and stressing of the diagonal beams is somewhat more complex. Each diagonal, as the main structural element of an approximately square area of ca. 50 m^2, had to bear half the weight corresponding to this square, transmitting a third of it at the corner and two-thirds onto the endmost interior column. Each diagonal beam carried a load equal to only two-thirds of the load born by the common axial beams, but at the same time, it was incomparably longer (ca. 11.10 m versus ca. 4.90 m). Consequently, the development of bending moment in this was nearly 50% greater, while the deflection (with its maximum in ca. 20 cm from the middle toward the column) would for this section have been approximately six times greater. For the avoidance of greater tension on the diagonal beams, it should have been necessary to increase their cross-section by at least 10% in comparison to the axial epistyle. With such assistance, the aforementioned large deflection would be reduced by up to 40%.
3. The problem of crossing and bearing a diagonal slant beam has some well-known solutions tested on simple roofs, but it requires special attention if it needs to be resolved in terms of the design of classical architecture, that is, only with simple supported beams (i.e. without trassed completion) so as to ensure static efficiency and stylistic satisfaction:
   I. Perfect visible edges and surfaces.
   II. Simple mountings safe from slippage, even without using nails, which should be inconspicuous.
   III. Visual accentuation of structural articulation both lengthwise and vertically. Under these principles, the solution to the design problem consists in forming four successive zones on all sides of the space and the axial colonnade, respecting the static and visual function of the epistyles (peripheral and axial), the diagonals, the rafters and battens.

2.29 *Corner Supports under Diagonal Beams*

In larger stoas with enlarged interior intercolumniation at the ends, the combination of the above 1, 2, 3 (see section 2.28) will cause problems with the size and height of the bearing surfaces of the diagonal beams, and perhaps it is no coincidence that their colonnades on the façade contained at their ends a short wall length instead of a simple corner anta or even pilaster:[40] A normal pilaster does not have a bearing surface capable of simultaneously mounting two epistyles forming a right angle and a diagonal element, epistyle or beam, two feet thick, placed between them. The placement of the diagonal element not between the epistyles but above them is not impossible in terms of space available over a simple corner pilaster, but it is still accompanied by an unsatisfactory relationship of components, which, even if sufficiently treated structurally, remains as a not unimportant visual problem: The end of the diagonal element is projected partially within and partially outside of the contour of the underlying solid bearing mass (Fig. 3A).

40 South Agora Stoa in Magnesia on Meander; West Stoa in the Sanctuary of Delphi.

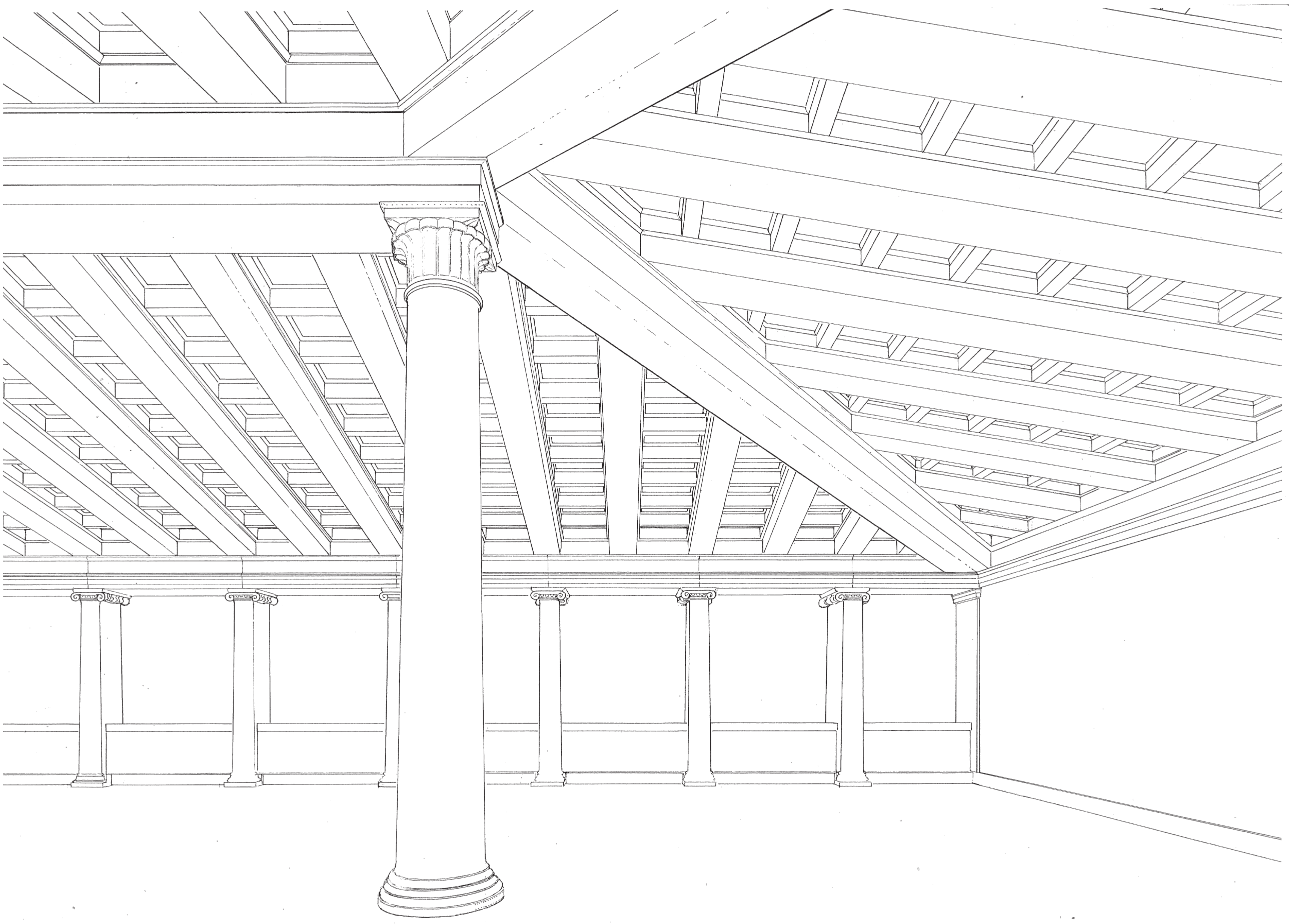

FIGURE 3A Perspective restored view inside the 2nd story, showing: a. position and inclination of main bearing components and position of secondary components: crowning moldings and sheathings masking the gaps between the ends of rafters or battens. As always in Classical or classicizing roofs, these secondary components transform the underside of the structurally necessary woodwork (see Fig. 4) into a visually more desirable coffered ceiling (in this case, hypothetical but highly probable). The hypothetical number of battens is realistic, but their section should be rather flattened, as shown in Fig. 4. The interior wooden architrave (span 4.90), which for more bending strength, could be merged with the next zone above to form a square-sectioned massive entablature nearly two feet thick, quite similar to the entablature of the façade. c. A structurally and visually feasible disposition of the diagonal beams over the end of the entablature's architrave zone, e.g. in continuation of its upper zone. d. The structural weakness and visual problem of disposing of the other end of the diagonal beam over a usual corner anta
DRAWINGS BY THE AUTHOR IN 2015/2016

Therefore, the theoretical restoration of the Stoa of Eumenes with simple antae or pilaster at the corners must be reviewed: at each end of the façade, under the corner epistyle, there must have been a section of the wall and not an opening in the colonnade (Fig. 3B).

2.30 *Left Pilaster of the Upper Story*

Valuable data for the above proposed new restoration is offered by one stone reposing in the south of the monument. It is the upper part of a pilaster of coarse marble, with a preserved height of 1.12. The block had undergone partial re-carving on the backside when at some time, it was reused in a doorway as a threshold. Fortunately, this intervention did not eliminate its essential characteristics, which show that the pilaster had three visible faces, a wide front and two narrow sides so that it was a terminal element of a wall, not capable of simultaneously being a corner of a building. The reduction of the width and thickness toward the top, well measurable over a distance of 80 cm, approaches nearly 3% and therefore is so pronounced that in itself, it prevents the thought that this pilaster might belong to a remarkable building of architectural quality. However, it has the same treatment as the other marbles of the stoa, and most importantly, it has the exact same dimensions and the same diminution or tapering as the double half-columns of the façade's upper story. The width and thickness at the molding of the upper termination are .62 and .35,

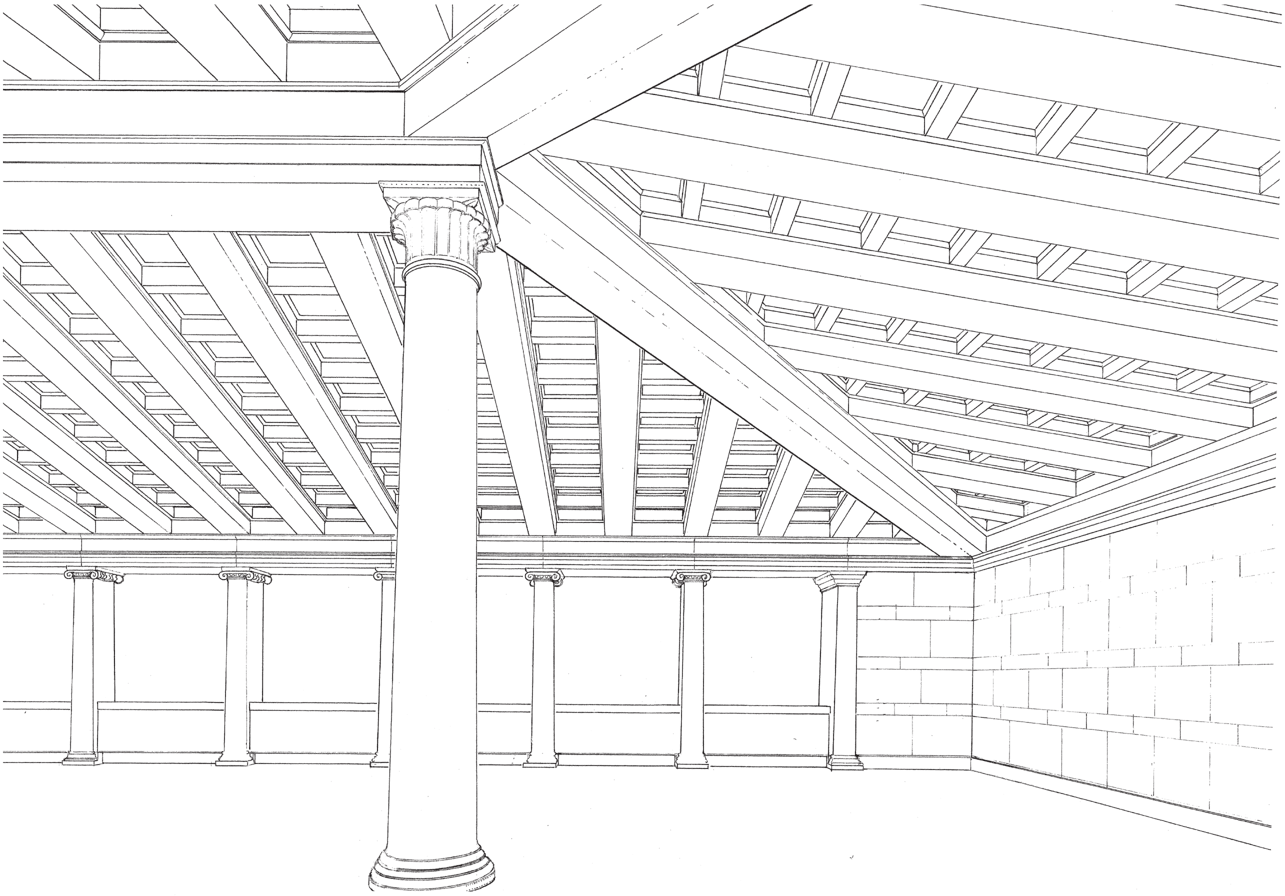

FIGURE 3B Perspective restored view inside the 2nd story, showing the same as Fig. 3A, but with a stretch of the wall under the endmost architrave of the façade, to enable a structurally and visually satisfactory bearing of the diagonal beam. The wall's end, a partially preserved monolithic pilaster of the same thickness as the double half-columns, has been recently identified. On it, the pseudoisodomic configuration of the wall's masonry is well traceable.
DRAWING BY THE AUTHOR IN 2016

while a few centimeters lower, where the taper stops is .58 and 0.31. Accordingly, given the strong ratio of taper, as best observed in the double half-columns, the missing lower end will have the same dimensions as the lower end of these double half-columns.

2.31 *Structure and Height of the Upper Floor's Sidewalls and Double Half-Columns*

The fourth side of the pilaster exhibits discrete zones of treatment, and within their limits are sockets for horizontal connecting elements suggestive of the wall structure. This was built in a pseudo-isodomic system like, for instance, the walls of the Stoa of Attalos. Easily calculated is the arrangement of four double rows of blocks (height .57,5), alternating with as many rows of cross (bonding) blocks (height .22,5), providing a total height of the upper story wall from floor to epistyle of 3.20 (equal to four times .57,5 + .22,5), i.e., exactly as in the Stoa of Attalos. By detracting from this the height of base and capital of the Ionic double half-columns (see section 2.16), i.e. 3.20–14,5–11,5, there remains an amount of 2.94 as the height of their shafts. This exactly corresponds to the well-preserved height of the Stoa of Attalos' double half-column shafts. However, in the Stoa of Attalos, the series of blocks of pseudo-isodomic masonry is by type three instead of four with correspondingly greater height. This difference, however, would not be reasonable if Πειραϊκός ακτίτης were attached to the pilaster of the Stoa of Eumenes, as in the Stoa of Attalos, or Aiginetan sandstones, such as the posterior wall of the stoa under study. The smaller scale of the allowable shapes in the contact surface, the fineness of the treatment and the type of cuttings for horizontal clamps are data that overall indicate that at the ends of the façade and a small or large part of the sides of it, the masonry, pseudo-isodomic as it turns out, was in marble. But what kind of marble was it: Prokonnesian or Hymettian? Located in the area are a few fragments not yet securely identified as being from that part of the building.

2.32 *The Construction of the Roof*

The rafters positioned every 1.22,5, had a length of 8.10 and a structurally effective span ca. 7.60. Unfortunately, the rear cuttings of the geison corresponding to them do not have a clear geometric form, and therefore they do not show exactly what the width of these timbers was and to what height exactly their backs reached. In any event, the rafters could easily have a width ca. 1 ¼′ or 1 ½′ (ca. .37 m or .44 m). In itself, the existence of the cuttings shows that the rafters were positioned much higher than in the Stoa of Attalos in order to leave space for the diagonal beams. For this purpose, it was necessary for the cuttings to exceed upwardly (i.e. within the height of the geison blocks rear side and leave above them sufficient space only for flattened battens). Also, they (the rafters) themselves must have been flattened, with an apparent height of the cross-section not exceeding one foot (nearly .30), under the condition that for greater strength (and economy of labor) the initial rough cross-section of the rest of the wood would be retained as a ridge between the ends of the battens – with the latter not exceeding the length necessary for adequate seating. With the rafters positioned much higher than in the Stoa of Attalos, the ca. 53 cm high[41] entablature of the façade remained in its rear part undiminished (like some similar architectural members of the stoa near the Tower of the Winds). But how could the diagonal beam be integrated with the subjacent architrave into a zone ca. 53 cm high? Bearing far more than the rafters, the diagonal beams, with a length of 11.10, a structurally effective span of ca. 10.50, and a width not exceeding ca. 1′ ¾ (in order to fit over the end of the axial epistyle above the endmost column), must have had a sufficient height, i.e. not less than the said width, or even more. To easier satisfy this condition, they better should have been given the composite cross-section common for the entablatures of the upper story (hypothetical Case a). But this would cause severe difficulties in nesting the ends of the diagonal beams onto the capital of the end interior column. Therefore, these beams had to be seated higher in order not to interrupt the ca. 22 cm high epistyle zone of the axial entablature and of the peripheral entablature likewise. In this way, only a nearly 30 cm tall zone could have been left for the diagonal beams or more precisely, for their apparent height. The only solution to the demand for far more strength would have been given by diagonal beams of much higher cross-section, with only a small lower part of it representing the architectural form, a median part containing spacious sockets for the rafters and an uppermost part necessary to restore the beam's continuity above these sockets (hypothetical Case b, which is actually preferable, Fig. 4). It follows that the architectural articulation above the capitals and the walls likewise had to be fourfold: epistyle zone of the entablature → diagonal beams, and frieze zone of the entablature → rafters → battens. As in many similar cases in ancient architectural construction, here too, for more strength and economy, whether in marble or in wood, the epistyle zone and the frieze zone had to be structurally united into one compact element almost square in cross-section, nearly two feet wide.

2.33 *The Construction of the Floor*

The beams of the floor, with a structural span of ca. 7.50, as lying behind the triglyphs and metopes, should have nests of ca. .52,5 height. In the Stoa of Attalos, the corresponding beam cuttings have a width of ca. .50 and a height of ca. .52,5. During the restoration of the stoa by Travlos,[42] beams with a height of ca. .45 were placed, leaving the upper part of the beam nests free, for the solid part of the floor above, supposedly consisting of a continuous array of wood with a thickness of ca. .12, a sub-paving thickness of ca. .40 and a hard flooring that would be exceedingly heavy (almost 1000 kg per m²). In Bohn,[43] beams had to occupy the entire height of the beam nests, resulting in a sub-paving system and a hard floor not thicker than (estimated) .11 or .12. This proposal, involving a permanent load not exceeding 300 kg per m² is more realistic, and it is indeed accepted by the present author for the Stoa of Eumenes. Within the above sub-paving base slabs should be built for seating the inner columns of the upper story. This conclusion is reached on the basis of dowel cuttings on the underside of the surviving bases. The seating of marble columns on stone base slabs born on wood structure seems to be a deviation from the principles of stone construction; however, the type of interior columns of the ground floor was not suitable for the insertion of stone support, as in the Abaton of Asklepios at Epidauros, nor for marble epistyles with a length of nearly five meters. The epistyles of the axial colonnade, wooden like in the Stoa of Attalos, all had a length of 4.90, excluding the two ends, which had a visible length of 6.90 (actual length ca. 7.30) and the one with a length of 5.15. The floor beams, placed at

41 Like the corresponding element in the Stoa of Attalos.

42 Travlos 1971, 38, figs. 7 and 8.

43 Bohn 1888, pl. 5.

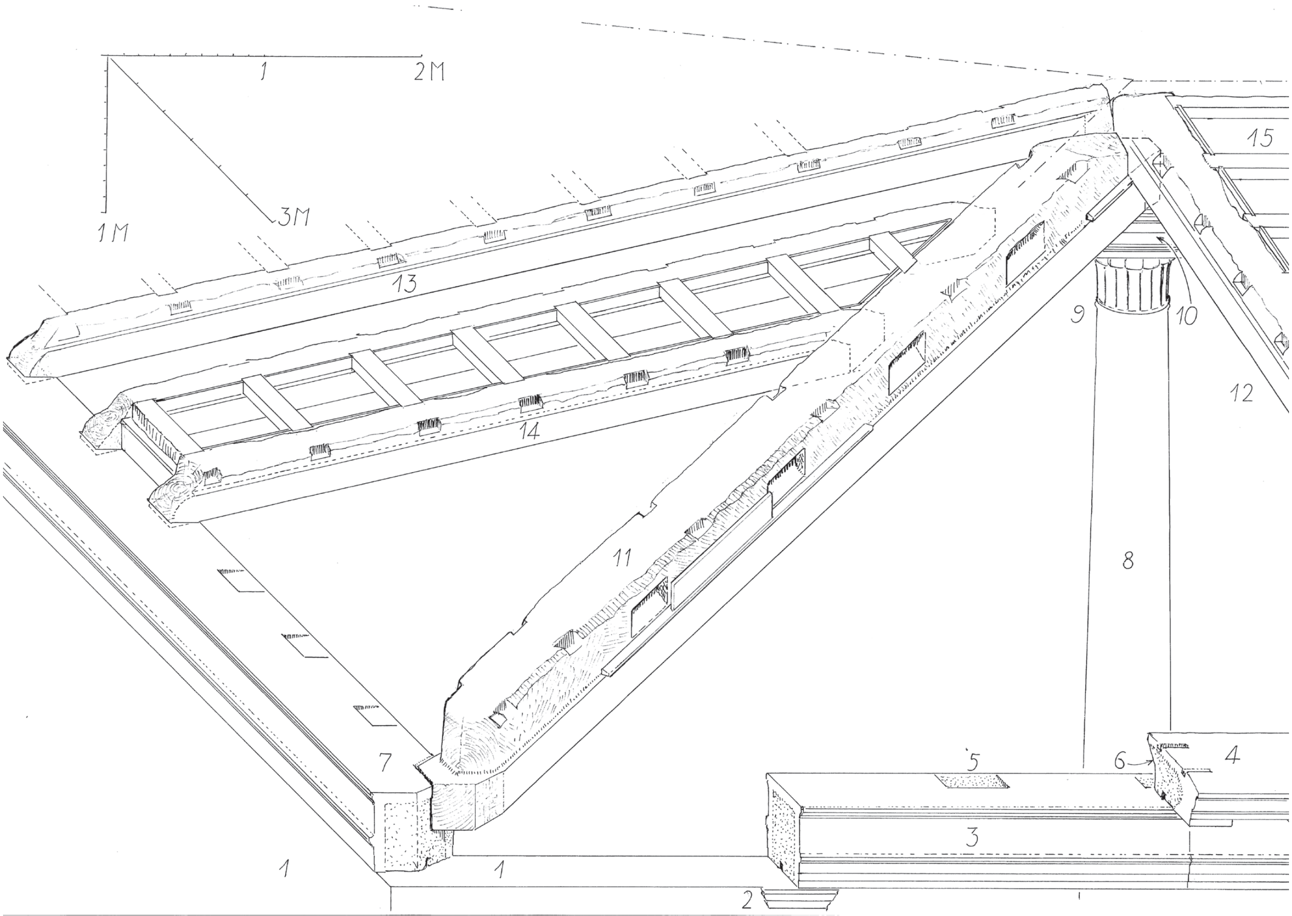

FIGURE 4 Hypothetical details of the roof's woodwork at the west end (for the same as viewed from below, see Figs. 3A and 3B): 1. west wall and its continuation over the southwest corner, 2. Anta capital, 3. architrave block, 4. geison block, 5. bottom of socket following the inclination of the rafters (restored like those preserved on architrave blocks of a similar stoa, stored near the Tower of the Winds), 6. upper part of beam sockets preserved on the rear side of geison blocks, 7. theoretical form of wall architrave (joints are not shown), 8. shaft of Pergamene column with unusually strong taper, 9. Pergamene capital, 10. lower zone of a massive wooden entablature, 11. theoretical form of a massive diagonal beam 11.10 m long, with a nearly square cross-section 53 cm wide, of which only the lower part corresponds to the architectural articulation of the roof (thus its smooth dressing), while the rest adds mechanical rigidity. The latter is restored with a continuous recess for a crowning molding of the lower part and a fine sheathing above (parts of both are shown), fitted between the rafters (of which only the sockets are shown), 12. a normal rafter of the long side of the roof, 13. the median rafter of the short side of the roof, 14. other rafters of the short side of the roof with their battens. The battens are restored with their ends nested in shallow cuttings made on the rafters or occasionally on the diagonal beams, 15. normal battens and light sheathing filling out their intervals to mask the void and, more specifically, to serve the fashioning of the whole as a coffered ceiling (see Figs. 3A or 3B)
DRAWING BY THE AUTHOR IN 2016

axial intervals of 122.5 cm, stood above columns on the ends of each epistyle and on three other points, dividing its length into four equal parts (permanent load per point = 4 tons!). In the longer end epistyles, there were five such points (load ca. 20 tons, excluding that resting on the ends!). Against these loads, the width of epistyles (ca. .62) was adequate, but not their height (ca. .45), which, especially in the case of the ends, would probably have made an inevitable and visually intolerable bending. This problem would be much less if the height of the epistyle was equal to the width or bigger, in order to maintain the original external convex surface of the tree shaft. In this case, the beams would be supported within side recesses of sockets of the epistyle, with penetration on the order of ca. 20 cm, so a sufficient portion of it would remain statically active. The same method, but with even thicker wood, would allow the acquisition of beams with an actual height almost twice the apparent or visible height, certainly sufficient for the end spans with a length of ca. 7.30 and structurally effective length of ca. 7.00 m (and a load exceeding 20 tons). From the above, it becomes clear that the woodwork of this building was the most important if not the most expensive part of the project.[44]

At the time of its destruction, the building was nearly 450 years old, and one may wonder about the state of preservation of its heavy wooden parts. The absence of absolute indoor conditions was not necessarily a disadvantage for this. Contrary to that, given the Athenian climate, natural ventilation combined with the void space of the retaining wall, like in the Stoa of Attalos at Delphi,[45] and the arrangement of the fountain (see sections 2.2 & 2.11, with n. 21),[46] must have greatly contributed to the removal of moisture coming from the earth behind. In any event, the fire took part in the destruction (layers of ash found during the excavation),[47] but the rather limited extent of thermal fracture at the walls and on fragments collected so far does not exclude the possibility of systematic removal of wooden beams etc. in any time before AD 267 – or after, if only parts of them had been affected by the fire.

2.34 *Restored Drawings*

On the basis of the above theoretical discussion, it is now possible to restore the stoa and its respective wooden structure in more realistic drawings. In the perspective view of the stoa's east end by the author (first exhibited in 1985 and then used several times in publications from 2000 on), the easternmost bay in both lower and upper colonnade has to be replaced now by a stretch of solid pseudo-isodomic wall.

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44 Indicative listed lengths and thicknesses in feet and quantities of cypress logs or other similar quality trees (almost six hundred trees of rare size):
floor architraves (25′ / Ø3 ½′) × 2 and (16 ½′ / Ø3 ¼′) × 30,
floor beams (26′ / Ø2 ¾′) × 262,
floor architraves (16 ½′ / Ø2 ¾′77) × 30,
diagonal beams (37 ½′ / Ø2 ¾′) × 4,
rafters (26 ½′ / Ø2 ½′) × 264.
Obviously, after the fashioning of these large beams from the thicker portion of the logs, the remaining part of them would be easily sufficient for the production of other wooden elements: about 3 km of lesser floor beams (joists), 3 km of battens, and about 5,000 m² of boards.

45 Roux 1987.

46 For details Korres 2015, 138 and n. 37, fig. B6.8.

47 Κουμανούδης 1877, 267.

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