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A BRONZE AGE ENIGMA: THE ‘U-SHAPED’ MOTIF IN AEGEAN ARCHITECTURAL REPRESENTATIONS

Dedicated to Malcolm Wiener –
Astute financier, benefactor, scholar, and friend.

Of the many pictorial depictions of the motif under consideration, I illustrate two examples only, given its rather consistent rendering. They show details of once more extensive frescoes from two Late Bronze Age palaces- at Knossos in Crete (Pl. CLXXIIa) and on the Acropolis at Mycenae on the Greek Mainland (Pl. CLXXIIb). The motif, which always appears on façades of buildings, has been compared in the past to the capital letter U,¹ a term I also use for consistency, although the resemblance is not exact. The motif consists of a horizontal band, with two shorter bands rising from its two ends; the letter's upright elements are longer than its horizontal part. The motif never occurs singly; it is repeated at regular and fairly close intervals in a stacked arrangement along vertical surfaces, the architectural identification of which is puzzling. One further feature to be noted is that the vertical elements or strips are usually shown flanking large openings, perhaps representing windows or loggias.

Two main interpretations have been put forward for the vertical strips: 1) that they represent posts;² 2) that they represent wall antae.³ The wall in the latter case must be understood as being transverse, but since Minoan representation does not use foreshortening, only its narrow end is shown. This explains the difficulty of determining which is the correct identification, though there are other representational clues that can help us decide, as will be discussed with reference to specific examples below.

Neither of the two suggestions above, nor other interpretations offered in the past have had the advantage of offering a concrete example that would match and explain the motifs details. My wish to attempt a solution to this iconographic enigma, which to my view has not yet been satisfactorily explained, stems from archaeological evidence I uncovered some ten years ago in excavating in the Civic area of the Minoan site of Kommos. First, however, I shall review the pictorial evidence, starting with Crete, where both the actual architectural technique and the artistic conventions for representing the particular architectural feature probably originated.

I. Depictions in the Frescoes

The motifs under consideration are illustrated in frescoes only, specifically from the Palace of Knossos and from a number of Mycenaean palaces. The architectural façades in these frescoes are rendered in miniature scale, a style that allows the artist to provide great detail, especially of the physical settings (including architecture) of scenes involving human activity. Why the U-shaped motifs do not appear in other artistic media, such as stone carvings,⁴ embossed metalwork,⁵ and miniature glyptic art, such as seals and signet rings,⁶ is open to debate. One explanation maybe the lack of color, which in the case of frescoes helps define the minute details. Other explanations are even more speculative. It is

¹ Cf. G. RODENWALDT, “Fragmente Mykenischer Wandgefäße” AM 36 (1911) 221-250, at 224-25 and T. NÖRLING, Altägäische Architekturbilder (1995) 55, 75, pl. 18, both of whom concerned themselves with the meaning of the motif. For my own study presented here, I would like to thank Professor J.W. Shaw, Dr. D. Cain, and L. McKeon for reading and making helpful comments on my ms.
² T. FYFE, “Painted plaster decoration at Knossos, with special reference to the architectural schemes,” The Journal of the Royal Institute of British Architects (1903) 114.
³ RODENWALDT (supra n. 1) passim.
⁵ S. MARINATOS and M. HIRMER, Crete and Mycenae (1960) pl. 205, middle row.
⁶ MARINATOS and HIRMER (supra n. 5) the 3rd and 4th rings in pl. 206.
possible, for instance, that different types of buildings appear in frescoes and other media, and it is only
the former that depicted structures incorporating the U-shaped motifs. Equally tentative is the explanation
that the U motifs were rendered in a more simplified way in glyptic art, perhaps merely as a thick
horizontal line without the upward projections. Such a line, however, could easily be confused as joints
between blocks in successive wall courses, something the artists would have known.

Equally difficult to explain is the absence of the U-shaped motifs in Theran wall painting. An
instance where one might have expected the motif to appear is on the two tall, upright, post-like supports
– or perhaps antae of transverse walls – seen on the lowest story of the building shown at the left end of
the so-called Departure Town in the Miniature Fresco from the West House. Yet, all we see there are
thick horizontal lines alternating with what may be squared stone blocks. The thick lines are darker than
the blocks and they may represent squared beams, and here we must recall that timber re-enforcement
was used, though rather sparingly and erratically, on the facades of actual houses discovered in the
settlement of Akrotiri in Thera – assuming, of course, that this is the place represented in the fresco.
Possibly, the system used in incorporating timber in construction in Thera was different from that in
Crete. It should be noted that U-shaped forms are also lacking in the miniature frescoes from Kea, which
also depict buildings.

Whatever the exact reasons for these omissions – and whether they are due to artistic choice
adhered to by Knossos and its Mycenaean imitators, or a faithful rendering of actual local architecture in
the two Cycladic islands – we are reduced to an examination of depictions in Minoan and Mycenaean
wall paintings only. Rather than proffer a formal Catalogue of such frescoes, I submit selective
observations on the most instructive examples.

I. 1. Buildings in Minoan Frescoes

Of the rather limited examples from Knossos, two will be examined. One is the well-known
Tripartite Shrine Fresco (Pl. CLXXIIa). An aspect of possible importance in this fresco is its extensive
polychromy, the purpose of which, I believe, is partly to render the building festive and decorative, and
partly to distinguish its three contiguous spaces visually. These are painted (from left to right) red, blue,
and yellow ochre, and appear to be separated by walls of which we see only the antae, that is, the vertical
strips with the U motifs. Columns in each room, (single ones on the two sides, a pair centrally) are set in antis.
Theodore Fyfe, the architect of Sir Arthur Evans's excavations at Knossos, interpreted the vertical
strips as wooden posts with “mortised cross-beams.” Though I cannot visualize the construction of such

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7 C. DOUMAS, The Wall-Paintings of Thera (1992) figs. 28-29, 35-38. For the building mentioned, see figs. 28 and
6.
8 The interiors of these houses, by contrast, use timber extensively and systematically, but fresco convention
favours the depiction of exteriors. For timber construction in Thera, see: J.W. SHAW, “Consideration of the site
PALYVOU, Ακρωτήρι Θήρας. Οικοδομική Τέχνη και Μορφολογικά Στοιχεία στήν Υπεροκλαδική Αρχιτεκτονική, Dissertation submitted to the University of Athens (1988) 42-43, 110-193; PALYVOU,
“Architectural Design at Late Cycladic Akrotiri,” in D.A. HARDY, C. DOUMAS, J.A SAKELLARAKIS, P.M.
44-56, in particular, cf. figs. 6 and 7.
10 PM III, Col. pl. XVI.
11 FYFE (supra n. 2) 114. Fyfe based his theory of wooden posts on the yellow colour used in the
painting. In this respect, he may have been right in suspecting the use of wood, but only if the entire
Tripartite Shrine were made of wood, in imitation of regular buildings made of a combination of materials
including stone as well. As I argued recently, there are a number of reasons why the Tripartite Shrine may
represent a maquette of a building displayed as a pageant on special religious occasions (M.C. SHAW, “The
Bull-leaping Fresco from below the Ramp House at Mycenae: A Study in Iconography and Artistic
Transmission,” in BSA 91 [1996] 167-190, at 187). This would explain in part the Shrine's excessive
polychromy, and the disproportionately large size of the human figures shown seated around it, as seen in PM III,
col. pl. XVI.
posts myself, my main objection to Fyfe's view is that the building was clearly partitioned, rather than enclosing a continuous unbroken space, like a stoa fronted by a series of posts.\textsuperscript{12} 

The next Knossian fresco does not have the strong hieratic character of the Tripartite Shrine which has openings in each room adorned with horns of consecration, as is the roof. As can be seen in a published drawing of the one fragment preserved,\textsuperscript{13} a woman is shown standing in a loggia or balcony, of which we see the right part. The vertical strip with the $U$ markings preserved on the right could be interpreted as a wooden post in this case, if we imagine a veranda open both at the front and the right sides. Alternatively, the strip with the $U$ motifs could be the anta of the exterior facade wall closing the space in which the woman stands on that side. We know that the area to the right of the building is outside, because of the traces of a crowd of spectators (only their heads preserved), who are usually shown in Knossian frescoes watching festive activities outdoors.

I. 2. Buildings in Mycenae Frescoes

One of the earliest Mycenaean depictions maybe a fresco I restored recently on the basis of plaster fragments found under the Ramp House on the Acropolis of Mycenae.\textsuperscript{14} In what seems to have been a frieze divided into panels, scenes of bull leaping are shown along with spectators, including women standing within architectural frameworks. The vertical strips flanking the windows – or whatever the identity of the large openings is – are once again marked by the $U$ motifs, as in the fresco from the Palace at Mycenae referred to above (Pl. CLXXIIb). The latter, and better preserved representation, is part of the Megaron Frieze of the Palace. In it we see a multistoried building of which the facade is divided into vertical compartments, each with rooms wide open on the front or facade side. In the real building the compartments would not have been flush. The facade would be marked by projections and recesses of the type we see in both the Minoan and the Mycenaean palaces.

Since the type of building may be significant in the issue being investigated in this paper, we should note that, while a hieratic occasion or character is likely in the case of the building depicted in the Ramp House fresco, especially given its decoration with double axes, there is little doubt that the building in the Megaron Frieze is in the midst of a more secular and rather dramatic event, for the women looking out of the windows seem to be witnessing a battle raging nearby.\textsuperscript{15} The building facade probably extended both right and left, a fact to take into consideration, since its incomplete preservation might convey the potentially deceptive impression that it is a free-standing tripartite structure, that is, a shrine.\textsuperscript{16}

Frescoes from the Palace of Pylos provide further examples of antae of the lateral walls of rooms with wide windows, the sills of which are often decorated with horns of consecration, and the panel of half-rosettes.\textsuperscript{17} Mabel Lang remarks that what we see is “a gray anta (presumably imitating stone) with

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\item[12] NÖRLING (supra n. 1) 55, pl. 3, 5, sees the strips as antae, but he interprets the $U$ shapes in a manner I find problematic. In his restoration he shows the anta width as the narrow end of a squared beam. A series of such beams is used transversely and morticed into short vertical beams that make up the height of the wall. The difficulty here is that the narrow end of the transverse beams would have to be huge to serve as the anta of a wall, and there is no indication in Nörling's scheme of how the additional materials (stone or brick, presumably) would be held in place within this wooden framework.
\item[13] PM III, 59-60, figs. 35. See also other examples illustrated and discussed by Evans, ibid., 84, fig. 47, and 86, figs. 48, d and e.
\item[15] The restoration of a falling warrior in front of the building by Rodenwaldt is well known (reproduced in PM III, 86, fig. 48 e).
\item[16] Two drawings published by Evans vary in one crucial detail. In one (PM II, 601, fig. 373, d-here, fig. 2) a horizontal element that looks like a cornice extends left and links the three rooms on the right with another vertical strip with $U$-shaped motifs, indicating the building to have extended left. In the other drawing the “cornice” is omitted (PM III, 86, 48 e-our).
\item[17] M.L. LANG, The Palace of Nestor at Pylos in Western Messenia (1969) pl. R, 8 A 3. For the use of the half rosette decoration to perhaps imply palatial building, see M. C. SHAW, “Aegean Sponsors and Artists: Reflections of their Roles in the Patterns of Distribution of Themes and Representational Conventions in the
\end{itemize}
black mortise joints.”

Another and different use of the U’s in Pylian frescoes is on vertical strips flanking the exterior sides of the jambs of a doorway. The doorway is repeated several times in the fresco frieze; each time as a structure that is free-standing and complete in itself, varying only in details. The doorways may symbolize major entrances into and within the palace. Entrances are universally deemed as places that need protection, hence the pairs of guardian sphinxes and lions that pose heraldically atop their roofs shown in the frescoes.

There are other relevant frescoes from other Mycenaean sites—all from palatial contexts (Orchomenos, Tiryns, Thebes) – but they warrant no further comments, as they do not add substantive information to the use of the motif.

I. 3. Conclusions on the Evidence from the Frescoes

A tentative distinction between religious and secular buildings, or perhaps distinct occasions in which buildings play different roles, was drawn above. What is more important to realize for the purposes of this paper, however, is that the buildings of either type, or in either occasion, are clearly architecturally elitist. Likely, palaces are represented, or else abodes of the high nobility. It is interesting that the U-shaped motifs appear almost exclusively in these. Perhaps the absence of the motifs in Cycladic paintings in Thera and Kea noted above is because towns, rather than the most elite of buildings, are represented. Peculiar is the case of another representation not yet mentioned, which is also part of the Megaron Frieze at Mycenae. It depicts what seems to be an agglomeration of rooms or buildings in front of which appear two women who seem to have just stepped out. Even though it too features architectural niceties, like wide windows and columns, it lacks the mysterious U-shaped patterns. One wonders whether this part of the Frieze depicted a town rather than a palace, but perhaps there are other and still unsuspected criteria as to which buildings or parts of buildings were marked in that particular fashion.

II. The Archaeological Evidence

In this section, and for the first time, examples of a type of construction will be presented that may correspond to the enigmatic motifs seen in the frescoes. It combines ashlar blocks and wooden beams and was used to strengthen wall antae and, possibly, pillars. While antae in Classical Greece were constructed with a pilaster-like thickening, there is no evidence that this method was used in the Bronze Age Aegean. In the cases I discuss from Crete, the construction involves wooden beams built into the stone masonry.

The importance of wood in the construction under consideration has become clear from the above discussions of the frescoes. When it comes to the archaeological evidence, however, the problem is that wood is hardly ever preserved. It is important, therefore, by way of introduction, to go over some criteria used to identify the placement and shape of the missing wood. In excavations, wood is often inferred from the gaps or chases left after it decays, but the inclination and shape of the gaps are distorted due to

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19 LANG (supra n. 17) 139.
20 LANG (supra n. 17) 131, Pl. 136, 2 A 2; pl. R, 1 A 2.
21 The best preserved and restored examples are: LANG (supra n. 17) pl. 136, 2 A 2, and pl. R, 1 A 2, and 131, for a discussion of such facades. For sacred or protected entrances, see M. C. SHAW, “The Lion Gate Relief at Mycenae Reconsidered,” in *Φυλαξ της Επ Αρχαιας* (Festschrift for Prof. G. Mylonas, Archaeological Society of Athens, 1986) 108-123 *passim*.
22 For more examples, see NÖRLING (supra n. 1).
23 It is easiest to compare the two in their reproduction side by side in: E. VERMEULE, *Greece in the Bronze Age* (1964) pls. XXXI A and B.
accidents of preservation, and because of the shifting and subsidence of adjacent stone blocks and other building materials that the wood originally kept in place. Indeed, and ironically, walls that once incorporated extensive timber to strengthen them are among the most vulnerable in the long run. Even if the imperishable building materials were to stay miraculously in place, some details about the wood used are not detectable from the gaps themselves. One cannot know, for instance, whether a long vertical gap represents a continuous vertical beam, or jointed segments of wood placed variously, including transversely. When horizontal and vertical beams are combined, speculation naturally increases as to the construction method.

From the above, it becomes clear why wall antae – the main area of application of the U motifs on the evidence of the frescoes – are most vulnerable. In actual Minoan buildings, such walls likely existed in the now lost upper storeys, the logical place for the wide openings that we see in the frescoes. It is possible that some of the antae flanking openings in higher storeys continued lower down in the form of pilasters. Although I do not know of an actual Minoan example, J. Wright has recently suggested pairs of pilasters (which he restores with U-shaped motifs) on either side of an entrance set at ground floor located at the northeastern facade of the Palace at Pylos. He shows them continuing upstairs where they flank a balcony and windows set in the recessed area. Unfortunately, only the ashlar projections are preserved on the ground floor, and on them Wright has restored horizontal beams as the first course, based on the cuttings in the base. What the construction was like higher up, however, remains moot. Indeed, we cannot take it for granted that the construction implied by the U motifs was actually used in Mycenaean architecture. Mycenaean frescoes with architectural facades may have largely copied the forms of Minoan frescoes, including details of Minoan buildings, rather than local architecture.

Turning now to the ground floor of Minoan buildings, our best chance of locating antae is in the lateral walls of stoas or other spaces with wide openings. My archaeological evidence involves two stoas in southern Crete, the colonnaded North Stoa of the LM I palatial Building T at the Minoan harbor at Kommos, (Pl. CLXXIIc-f), and one in the so-called Mercato at Hagia Triada. The latter stoa has alternating columns and pillars that front a series of rooms opening west (PL CLXXIIIa-c), and has been dated by V. La Rosa to LM IIIA2. The construction methods employed at both sites show a remarkable consistency, despite their differences in date. The stoa at Hagia Triada, likely continues earlier traditions in its plan. A close parallel is the LM I East Portico facing the Central Court of the Palace of Mallia, which also features an alternation of pillars and columns with a series of small rooms in back. Unfortunately, only the bases are preserved at Mallia, leaving us ignorant about how the higher courses were constructed. In all three stoas, the columns or pillars were set in antis.

At Kommos, the stoa was located in the north wing of Building T, the north facade of which served as its back wall (Pl. CLXXIId). Of the lateral walls of the stoa, the west one was so heavily remodelled that it is now impossible to know the original construction. One could restore a pillar (shown in dotted lines in Pl. CLXXIId), or a column there, but one cannot tell what was replaced by a transverse wall that is a later addition (not shown in PL CLXXIId). The situation with the east wall of the stoa is different. This wall was marked by two large openings: a double-window, and, directly south of it, a door

27 V. LA ROSA (with A.L. D’AGATA), Hagia-Triada in Ancient Crete. a Hundred Years of Italian Archaeology (1884-1984) (1985) 108-142. See period plan, 135, fig. 224.
28 MARINATOS-HIRMER (supra n. 6) pl. 59.
that led into a little room to the east (PL. CLXXIIc-d). The segments of wall adjacent to these openings were evidently vulnerable structurally. Besides serving to secure the frame of the door, the south segment was in effect the *anta* of a long east-west wall of a corridor provided at intervals with doors leading into rooms of the north wing of the palace.

Both of the wall segments in the eastern part of the Stoa at Kommos display a rather unusual and interesting type of masonry construction. I shall refer to the northern one as Pier A, and the southern one as Pier B (PL. CLXXIIc-d at A and B). My choice of the term “Pier” refers to the meaning of “an auxiliary mass of masonry used to stiffen a wall.”\(^{29}\) Eventually, but still during LM IA, both openings were filled in (PL. CLXXIIc). In the case of the window, the blocking wall was constructed over the original two-course-high sill. The blocking wall of the doorway partially collapsed already in antiquity (PL. CLXXIIc, left of B). Its construction, nevertheless, had earlier helped keep the masonry in place, but there was more subsidence here than in Pier A.\(^{30}\) Preservation in both cases was further aided by the fact that the Stoa along with most of the north wing of the palace went out of use in LM I. It was filled in and later covered by a terrace.

In the case of Hagia Triadha, of the two lateral walls of the stoa (PL. CLXXIIIa), the *anta* of the northern one flanked a doorway, which was used till the abandonment of the site, and which, naturally, was never blocked. All that is preserved of the *anta* there is abase, a large ashlar block of the same size as the *anta* of the south wall and of the bases of the pillars in between the two *antaes*. Circumstances were different in the case of the south wall of the stoa (PL. CLXXIIIb), the *anta* of which I shall refer to as Pier C. The *anta* was miraculously preserved when a staircase leading up to a higher terrace south of the Stoa was built against it during LM IIIB. As a result, we can see that this was built of a combination of wooden beams and stone blocks – the latter to be referred to as Pier Blocks. Finally we must note Pillar D (PL. CLXXIIIa and c) directly north of Pier C, the construction of which is pertinent to our concerns. Still *in situ* upon D’s base are two slim rectangular blocks (similar in size with the Pier Blocks of Pier C) set opposite each other, one along the north, the other along the south side. They are neatly squared on three sides, the exception being the interior side which is roughly triangular in keeping with the Minoan manner of shaping wall blocks. Pier blocks are used also in the two Piers at Kommos and in all cases they are similar in size, their width averaging 60-62 cm, their height 20-22 (cf. Table 1). Interestingly, mortice sockets can be seen in Pillar D (and in the bases of the rest of the pillars), placed along the centre of the sides, rather than at the corners. The cuttings were clearly used for the attachment of two squared beams set horizontally across from each other. In other words, the construction in Pillar D used a wooden beam and a pier block alternately around the base. The part where there may have been cuttings in the base of Pier C is not visible, but mortice cuttings are visible on the base of the north *antes* of the Hagia Triadha Stoa.

Further information about the construction of Piers can be gleaned from Kommos, where modern consolidation has not concealed the crucial details. The similarity in the construction between the two is most visible in the photos provided here of the west face of Pier A at Kommos (PL. CLXXIIe) and the north face of Pier C at Hagia Triadha (PL. CLXXIIIb). One notes stacked horizontal gaps (the beams) alternating with Pier Blocks. Two vertical gaps flank the stacking just described. The problem is how to interpret the gaps. Do we have two vertical beams with cross beams at intervals, or does the evidence suggest something else?

Let us start with Pier A at Kommos (PL. CLXXIIe). Examination of how this segment of masonry was bonded with the rear wall of the stoa revealed evidence that the horizontal wooden beams had extended north (left in the illustration) into the back wall of the Stoa. This wall was built of small rectangular blocks set in neat courses. At exactly the junction with Pier A, there is a vertical gap in the wall’s masonry, created by lining up the ends of the wall blocks in the successive courses. The gap is

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30 The gaps left by the disintegrated wooden beams as a result are irregular in shape and compressed. It must be noted that the small stones one sees in the photo just above the base (fig. 4, B) were placed at the time of the excavation under the upper block to prevent its collapse.
intercepted at regular intervals by a wall block projecting east, its top surface acting as a ledge on which to rest the end of the respective beam (the horizontal gaps in Pl. CLXXIIe). Needless to say, the projection of the horizontal beams into the wall structure means that there was no vertical beam or post at that corner of the Pier. Because the Pier had to be reinforced at the south end as well, the same horizontal beams must have extended in that direction, thus crossing the vertical gap there. The ends of the beams were likely morticed into a vertical post, part of the construction of the north jamb of the window mentioned earlier.  

More information about the vertical gaps derives from Pier B, since we can see its west and south sides (Pl. CLXXIII). The west face shows the same sequence of alternation as in Pier A; construction starts with a longitudinal horizontal gap, above which rests a Pier Block and so on (Pl. CLXXIII, B1). Turning to the south side, we find that the order changes. Right above the Pier Base (Pl. CLXXIII, B) is a Pier Block (Pl. CLXXIII, B2), succeeded by a horizontal gap (“transverse” when facing the east face of the wall), above which comes another Pier Block (PL CLXXIII, B3). I suspect that the north face of Pier B was constructed in a manner similar to the south one and that the beams on that side helped hold in place the wooden frame of the doorway (Pl. CLXXIIIId). Looking at the original west face of Pier B – indeed, of Pier A too – one would see the ends of the horizontal beams of the south and north sides projecting below the two ends of the longitudinal beams on the west side. In the case of Pier B, the south face would present another pattern. Because of the staggered placement of the materials, the south side would show the ends of transverse beams projecting above the longitudinal beams – the latter presumably projecting into the wall by analogy with the beams of Pier A (PL CLXXIIIId). The pictorial configuration of the south side of Pier B recalling the stacked U-shaped motifs in the frescoes is what prompted me to explore a possible connection, but there is still much that needs to be explained.

Corroborative information derives from Pier C at Hagia Triadha, of which we can only see the north face (Pl. CLXXIIIb). Here again the construction consists of horizontal beams and Pier Blocks, the order of alternation matching that of the south, rather than the west, face of Pier B at Kommos. Above the base is placed a Pier Block (Pl. CLXXIIIb, C1), above which comes a beam and so on. The west side of Pier C is now concealed by the added staircase (Pl. CLXXIIIa), but on the principle of the staggered use of the materials, as explained above, the alternating order would be followed. There, a horizontal beam would be placed above the Pier Base, followed by a Pier Block the side of which can just be made out in the photo, directly right of the gap between Pier Blocks C1 and C2 (PL CLXXIIIb). The principle of staggering was likely used in Pillar D as well.

To illustrate the points made above and the practicable character of this mode of Minoan engineering, I present two restorations. One, the drawing already mentioned above (PL CLXXIIIId), shows the junction of the eastern end of the North Stoa at Kommos and the west end of the east-west corridor, both opening onto the northeastern corner of the Central Court of the Kommos Palace. The other is a model I made out of plasticine which provides a three-dimensional perspective (Pl. CLXXIII-e-f). In the model the end part of a hypothetical wall is restored; its anta is braced in the manner suggested by the archaeological evidence at Kommos and Hagia Triadha. Both the drawing and the model are based on the

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31 Cf. Similar bonding, but between wall and door opening, is attested in Old Kingdom architecture in Egypt: A.J. SPENCER, Brick Architecture in Ancient Egypt (1979) 59-61, fig. 36.
32 The relatively small width of the bottom pier block in Pier B at Kommos (here, Fig. 6, B2) stands out as an exception to the regular sizes of the building material, but we need to remember that it is on the south side, where pier and wall construction merge, and the wall's own rectangular blocks make up the difference.
33 Modern conservation has unfortunately covered the wall areas on the north and south sides concealing any gaps that may exist in the masonry from the extensions of the horizontal beams in the pier into the wall, in the fashion attested on the south side of Pier B at Kommos.
34 Pier A at Kommos was not yet fully published when the Italian architect and scholar, F. TOMASELLO produced his new restoration of the pillars of the Hagia Triadha Stoa. (In “Edilizia antica e sismi. Struttura muraria del tipo a telai in Sicilia,” in G. GIARRIZZO (ed.), La Sicilia dei terremoti. Lunga durata e minamiche sociali [1996] 21-25; fig. 1). In the case of the pillars, he opts for vertical posts at the corners, linked by cross beams on two opposite sides only. I thank Dr. V. LA ROSA for bringing this publication to my attention (letter, November 20 1997).
relative sizes of timber and stone blocks at Kommos. Naturally, the wooden beams are no longer directly measurable, unlike the preserved stone elements of the construction. Beam size can, nevertheless, be estimated mathematically. The width of the two transverse beams just above the bases of both Pier A and Pier B can be obtained by subtracting the width of the bottom Pier Block (A1 and B1, in PL CLXXIIe-f, respectively) from the width of the Pier Base (ca. 93 cm) and then dividing by two. The resulting width falls within the range of 16.5-17 cm. As for the height of the beams, Pier A provides a clue. Here, I measured the distance between the top of the first “ledge” supporting a beam end and the top of the Pier Base (Pl. CLXXIIe, A), which was 39.5 cm. Subtracting from this number the measurable height of Pier Block A1 (22.5 cm.), I obtained the number of 17 cm, which is equal to the remaining gap once occupied by the now missing beam. These calculations suggest that the beams had a square, rather than a rectangular section, and their height was less than that of the Pier Blocks. The ratio between beam end and Pier Block seems to be ca. 3:4, a ratio probably maintained throughout the construction, given the consistency in the lower courses. Needless to say, the separation of sets of beams would produce a pattern that comes much closer to that seen in the frescoes, in which we witness some variation in the height of the intervals (cf. PL CLXXIIa-b).

The use of squared beams makes sense. There is less waste of wood, for one can use tree trunks or limbs of a smaller diameter; it is also simpler to maintain one size for all sides when squaring a beam. The difference between beams with a rectangular and beams with a square section is crucial, for it results in different constructions and applications. The height of the former beams would be equal to the height of the Pier Blocks, resulting into a continuous stacking of the ends of beams up and down the outer corners of the Pier. Alternatively, and as can be seen in both my reconstructions, the use of square beams would mean that sets of three horizontal beams, one longitudinal and two transverse, would meet at intervals at the corners of the anta or the Pier, and would be secured to each other by means of vertical dowels. This last system may be seen at first as a disadvantage since little gaps would be created in the corners between each set of beams. Such gaps, however, would not compromise the strength of the construction, for gravity held the structure together. The separation between sets of jointed beams may itself have offered an advantage; it probably contributed to a structural resilience that would be most suitable for coping with earthquakes, an advantage not likely offered by single vertical beams set at the corners of the Pier. Further, the independence between sets of beams would allow them to be placed at larger intervals, when this was deemed necessary or suitable. One scenario is that the beautifully cut Pier Blocks could have been replaced by cheaper materials in some cases, such as of mud bricks, which were used extensively in Crete, outside the Messara. Intervals could thus be greater between sets of beams when using lighter materials, as perhaps in higher stories. The little gaps at the corners at Kommos and Hagia Triadha could easily be filled by stone slabs or rubble and earth mortar, the surface then plastered over. Plaster, as we know from evidence at Kommos, was used to fill the interstices between adjacent beams in ceilings. Finer plaster was used to cover the surfaces of interior walls. In my restored drawing, and in the model (Pl. CLXXIIIId-f), I deliberately show the masonry without the plaster coating to clarify the details of the materials used and their organization. A packing of rubble and earth must have filled the interior of each pier.

Because the focus of my investigation is to explain the U-shaped motifs seen in the frescoes, in the plasticine model I have opted to show a staggering that starts with a pier block (rather than a beam) as the first course on the face of the anta. In such staggering the end of each longitudinal beam is tied to the

35 In “Engineering Mystery. Why pagodas don't fall down,” in The Economist (December 20th 1997-January 2nd 1998) 121-122, one of the anti-seismic devices used in Japanese pagodas is said to be the structural independence between successive storeys. I thank L. McKeon, student in architecture at the University of Toronto, for bringing this article to my attention. See also J.W. SHAW, “Minoan Architecture: Materials and Techniques,” in Annuario vol. XLX, N.S. XXXIII (1973) 148, n. 3, for the anti-seismic use of timber frames in Minoan architecture.

36 I owe the above information about the the use of bricks in Crete to J.W. Shaw. Extensive use of timber in combination with mudbrick is also attested in Egypt, in architecture of the 1" century B.C. See SPENCER (supra n. 31) 90, fig. 51.
ends of the transverse beams of the immediately superior course. The set, one longitudinal beam with the ends of two transverse beams above, seems to me to approximate visually the enigmatic U-shaped motif seen in the frescoes. Similarly, in the construction the set of beams was repeated vertically, at regular intervals. Quite possibly, the wooden surfaces were painted black, if we judge by the frescoes. In the hypothetical cases where the sets of beams may have occurred further apart than in the instances at Kommos and Hagia Triadha, regularly sized stones or bricks would have been used as part of the masonry.

Do we still need to hypothesize vertical posts set at the corners of the piers? Vertical posts are used extensively in Aegean architecture, but mostly for secondary construction, such as the framework of windows and doors. The technique we see at Kommos and at Hagia Triadha, by contrast, represents primary construction. Its function was structural re-inforcement. Vertical posts would need to be fixed in place before using the stone, and, even then, neither the posts nor the horizontal cross beams assumed to hold them together would have been integrated structurally with the rest of the building materials.

The construction proposed here was built from the bottom up, incrementally, by assembling the already appropriately sized and shaped timber and cut stone. It was sturdy, and easy to modify and adapt to varying applications, as the concrete examples and one I suggest in the model (PL CLXXIIIe-f) can illustrate. Above all, the method performed the crucial function of holding the masonry together by means that were both simple and efficient. The ultimate irony is that, the timber, the very material that played the major role in the re-inforcement, was good as long as it lasted. It served its purpose in Minoan times, but its very disintegration led to the ultimate loss to posterity of the very type of masonry it was designed to support. Special circumstances preserved what must be rare, if not unique, examples at Kommos and Hagia Triadha.

Maria C. SHAW

37 SHAW (supra n. 35) 135-185; PALYVOU (supra n. 8) 41-47, and 56-124, passim.
38 Though I have benefited from perceptions in an earlier study by J.W. SHAW (supra n. 26) fig. 11, my conclusions here vary from his proposition that vertical posts were used.
39 A peculiar experience related to my subject is worth bringing up. While visiting the Greek/Swedish excavations at Kasteli, Chania, I came across an old Venetian building nearby, the corners and window jambs of which show a construction that is eerily similar to that of the “piers” at Kommos. There, they used cemented rubble, in lieu of the blocks, and stone rather than wooden beams! The difference with Kommos is that the beams are stacked without intervals between them. The impression is that of a petrified crate.
Table 1: Measurements of Piers at Kommos and Hagia Triadha  
(All in cms; for labels see Pl. CLXXIIc-CLXXXIIIc)

A. Pier bases

<table>
<thead>
<tr>
<th>Site</th>
<th>Side</th>
<th>width</th>
<th>height</th>
<th>depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kommos/pier A</td>
<td>West</td>
<td>93</td>
<td>64.5</td>
<td>760</td>
</tr>
<tr>
<td>Kommos/ pier B</td>
<td>West</td>
<td>93.5</td>
<td>64.5</td>
<td>44</td>
</tr>
<tr>
<td>Hagia Triadha/pier C</td>
<td>North</td>
<td>99</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Hagia Triadha/pillar D</td>
<td>North/South</td>
<td>87</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td></td>
<td>West/East</td>
<td>85</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

B. Pier blocks

<table>
<thead>
<tr>
<th>Site</th>
<th>side</th>
<th>Width</th>
<th>height</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
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<td>60</td>
<td>22.5</td>
<td></td>
</tr>
<tr>
<td>block A1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>block A2</td>
<td></td>
<td>59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>block A3</td>
<td></td>
<td>59.3</td>
<td></td>
<td>26 max</td>
</tr>
<tr>
<td>Kommos/pier B</td>
<td>West</td>
<td>59.5</td>
<td>21</td>
<td>26 max</td>
</tr>
<tr>
<td>block B1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>block B2</td>
<td>South</td>
<td>44</td>
<td>20</td>
<td>26 max</td>
</tr>
<tr>
<td>block B3</td>
<td></td>
<td>58</td>
<td>19.5</td>
<td>27 max</td>
</tr>
<tr>
<td>Hagia Triadha/pier C</td>
<td>North</td>
<td>62</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>block 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>block C2</td>
<td></td>
<td>62</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>block C3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hagia Triadha/pillar D</td>
<td>North</td>
<td>60</td>
<td>25</td>
<td>24 max</td>
</tr>
<tr>
<td>block D1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>block D2</td>
<td>South</td>
<td>58.5</td>
<td>23</td>
<td>26 max</td>
</tr>
</tbody>
</table>
LIST OF ILLUSTRATIONS

Pl. CLXXIIa Tripartite Shrine, Fresco from Palace of Knossos (drawing by the author, after PM III, Col. pl. XVI).

Pl. CLXXIIb Building Facade, Fresco from Palace at Mycenae (drawing by author, after PM II, fig. 373d).

Pl. CLXXIIIC North Stoa of Building T, Kommos, from west (photo by J.W. SHAW).

Pl. CLXXIIId Plan of North Stoa, Kommos (drawing by the author, after Hesperia [1986] vol. 55, 242, Fig. 6a).

Pl. CLXXIIe Pier A, Kommos (photo by J.W. SHAW).

Pl. CLXXIIIf Pier B, Kommos (photo by J.W. SHAW).

Pl. CLXXIIla Plan of LM III Stoa at Hagia Triadha (drawing by the author, after LA ROSA (supra n. 27) 111, Fig. 167).

Pl. CLXXIIlb Pier C, Hagia Triadha (photo by J.W. SHAW, courtesy of V. LA ROSA).

Pl. CLXXIIlc Pillar D, Hagia Triadha (photo by J.W. SHAW, courtesy of V. LA ROSA).

Pl. CLXXIIId Restoration of the east end of the North Stoa at Kommos (drawing by the author).

Pl. CLXXIIle-f Model of imaginary anta using the construction of the Piers (by the author).