

# Listening to the Stones

Essays on Architecture and Function  
in Ancient Greek Sanctuaries  
in Honour of Richard Alan Tomlinson

Edited by

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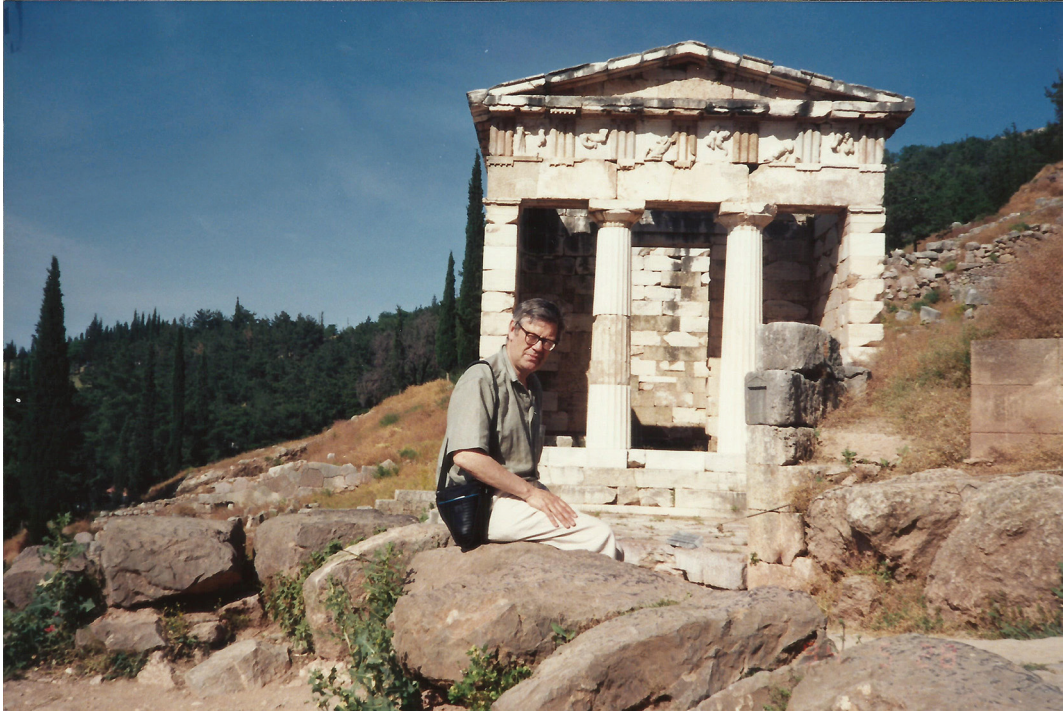
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Richard Tomlinson in Delphi. May 1994



Richard Tomlinson in Amphissa. May 1994

# Contents

<b>Preface</b> .....	iii
<b>Publications by Richard Alan Tomlinson</b> .....	v
<b>Emplekton - The Art of Weaving Stones</b> .....	1
Poul Pedersen	
<b>Ionic or Doric</b> .....	11
Barbara Schmidt-Dounas	
<b>Observations on the Interior Structure of Macedonian Tombs</b> .....	20
Stella Drougou	
<b>The Stoas of the Sanctuary at Dodona</b> .....	29
Nikolaos Th. Katsikoudis	
<b>Architectural Practice and the Distinctiveness of Sacred Sites</b> .....	38
Franziska Lang	
<b>Town and Sanctuary in Aetolia - Calydon in Context</b> .....	54
Søren Dietz	
<b>Politics Reflected on Architecture: An Evaluation of the Aetolian, the Pergamene and the Roman Input to the Religious Landscape at Delphi</b> .....	65
Elena C. Partida	
<b>From the Valley of the Muses Via the Kabeirion of Thebes to the Ptoion: The Theatres and Sanctuaries of Boeotia</b> .....	80
Marco Germani	
<b>Observations on the History and Topography of Two Major Sanctuaries of Poseidon and Zeus in Aigialeia of Achaea</b> .....	88
Dora Katsonopoulou	
<b>The Organization, Planning and Architectural Design of the Sanctuary of Zeus at Mount Lykaion, Arcadia</b> .....	98
David Gilman Romano	
<b>Reconstructing Building Height: The Early Hellenistic <i>Hestiatorion</i> Propylon at Epidauros</b> .....	109
Jari Pakkanen	
<b>Interpretation of the Current State of the Treasuries Retaining Wall at Ancient Olympia through Staged Historical Back Analysis</b> .....	121
Dimitrios Egglezos	
<b>Sacred Architecture in Roman Laconia</b> .....	139
Georgios Doulfis	
<b>More Corinthian on Samothrace</b> .....	153
Bonna D. Wescoat	
<b>The Sanctuaries on the Island of Lesbos from an Architectural and Topographical Perspective</b> .....	162
Yannis Kourtzellis	
<b>Shaping the Ancient Religious Landscape at Kato Phana, Chios</b> .....	182
Lesley A. Beaumont	

<b>Topographical Study of Ancient Cos: New Data from the Western District</b> .....	191
Giorgio Rocco	
<b>The Tufa Stoa in Cos: A Hypothesis on Its Identification</b> .....	202
Monica Livadiotti	
<b>Medicine, Urbanisation and Religion in Classical Cos</b> .....	214
Luigi M. Calì	
<b>Temple and <i>Hestiatorion</i>. The Combined Edifice on Mount Çatallar Tepe (Turkey)</b> .....	223
Frank Hulek	
<b>The Role of Carians in the Development of Greek Architecture</b> .....	233
Abdulkadir Baran	
<b>Visualising Cyrene: Three-Dimensional (3D) Laser Scanning and the Ancient Urban Environment</b> .....	245
Gareth Sears and Vince Gaffney	
<b>New Evidence for Early Greek Settlement on the Acropolis of Selinunte</b> .....	252
Clemente Marconi	
<b>Travels Around Greece</b> .....	262
Tony Spawforth, Erica Davies and Marie-Christine Keith	

## Preface

Two groups of architectural historians have benefitted from Richard Tomlinson's scholarship: the readers of his published work and –in a far more advantageous position– his students. Those of us who share the good fortune of having been taught by Professor Tomlinson, share also the feeling that his dedication to teaching stands out, emulating his professional capacities as Head of the Department of Ancient History and Archaeology at the University of Birmingham, and former Director of the British School at Athens.

The multinational provenance (Great Britain, Germany, Denmark, Finland, Italy, Turkey, the USA, Australia and Greece) of the contributors to the present volume, who immediately responded to our invitation, reflect precisely the radius of R.T.'s reputation. Nearly all of the geographical regions represented here coincide with areas of his investigation. More important, the range of topics discussed relate to the broad scope of the dedicatee's own archaeological quests. Since its 24 chapters seem to provide answers to enquiries which R.T. himself has motivated and inspired us to look into, this book echoes his own methodology in research.

Innovative masonry modes, matters of style and orders, proportions and design principles, as well as the inter-regional connections which fostered the transmission of architectural traditions and technical know-how have been cardinal points in R.T.'s writings and lectures, as much as the Greek foundations on foreign soil, the forethought in planning, achievements in the field of engineering and the interaction between the secular, the sepulchral and the sacred premises in an ancient city. Among R.T.'s essential instructions is high attention to detail, evaluated as a key to unlocking the past. The conservative or progressive attitudes of a society are bound to leave an imprint on architectural creations, as argued in the present volume. Salient in R.T.'s methodology is the spherical, interdisciplinary, holistic approach of every subject, an approach that broadens our perspective. He urged his students to glean evidence from art and archaeology, seeking the builders' original intentions. Thereby a monument could be properly contextualized and embedded not only in its structural setting and natural landscape but also in contemporary mentality.

Of particular gravity is the human factor, be it stone-cutters, architects, revelers, a town's population, pilgrims or commissioners. The people's spirit, genius, needs and demands underlay every architectural synthesis. So his students grew to realize that architecture is subject to evolution along with the developing societies. Its constant transformation, as if triggered by some intrinsic motion, makes architecture look almost alive. No less alive than the human beings who forged it into shape. No less adjustable than the people whom it represented. The appearance of an ancient sanctuary was continuously evolving and it should not be conceived as scenery frozen in time. Its gradual changing signifies precisely the unceasing building programs taken up by ancient communities. Recurring details in style, construction or carving techniques may verify the mobility of artists and the hypothesis for itinerant masons. Within this frame we better comprehend the adaptability and occasionally composite function of public edifices, the remodeling of cult sites in accordance with historic circumstances, the role of politics in architecture.

R.T. has the insightful ability to reconstruct from humble vestiges. His keen interest in auxiliary components, to elucidate neglected or seemingly secondary aspects of religious architecture, resulted in his pioneer interpretation of specific buildings as ceremonial dining-halls, which met with diachronic applause. His passion for restoring settings of the past reveals his love not only of ancient but also of modern Greeks, since he always wishes to share his discoveries with them. His love of Greece radiates every time he would refer to this country with enthusiasm. R.T. studied Hellenism to its frontiers. Fascinated by Ptolemaic Egypt, Alexander's campaigns and the Orient, he traced the transition from the Hellenistic to the Roman architectural setting in Palmyra, as if fatally foreseeing this place's tragic destiny.

All of his Greek students were amazed at the respectful manner R.T. would rely on ancient authors. To arrogantly attack what earlier archaeologists had propounded was never among his targets. Apparently his respect of his predecessors and of the *Glory that was Greece* (if we may borrow Patrick Cronin's apt phrasing) stemmed spontaneously from his genuine philhellenic sentiments and his indulge into history and literary sources, first-hand testimonies to the ancient past.

R.T. systematically advises close inspection and acute observation. Researchers must structure their arguments succinctly and with clarity, thus allowing their audience and/or readers to visualise. Still resonant are his words '*if you observe and study patiently and persistently, the remains will reward you; all you have to do is listen for their whispers*'.

Indeed, the three-dimensional rendering of the Delphi sanctuary by John Goodinson, which epitomizes our current state of knowledge regarding the probable appearance of this majestic, bustling site in the last decades of the 4th century BC, vividly confirms the wisdom of R.T.'s words. We should always listen to the stones.

This book is a token of appreciation of a British Professor of Greek Archaeology, whose scholarship, authorship and teaching methodology spread knowledge of the oecumenical character and impact of Greek civilization, manifesting the brilliant spirit of the versatile ancient Greek builders. For their role in the accomplishment of the present volume, we heartily thank all contributors. Editing has been confined to the extent necessary for the precision, accuracy and comprehensibility of the text, without affecting each author's personal writing style. Sincere thanks are due to *Archaeopress*, in particular to Danko Josic for his efficiency and patience throughout the laying out and editing process, and especially to Professor David Davison, for willingly embracing this publication and for our impeccable co-operation.

The Editors  
Elena Partida and Barbara Schmidt-Dounas



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### **Forthcoming**

The Menelaion - the Architectural Remains (*Menelaion* 2)



# Emplekton - The Art of Weaving Stones

Poul Pedersen

## Summary

Vitruvius (2.8.7) and Pliny (NH 36.51.171-172) write of a type of Greek masonry called *emplekton* masonry. Unfortunately it is not very clear exactly which kind of masonry they are talking about, among the various types of masonry known archaeologically. The word is generally believed to have to do with the Greek word for weaving, although a few find this impossible and think it has to do with filling, referring to the rubble fill generally used for the interior of Greek fortification walls. Many scholars have tried to explain the expression and among these there is a different and original proposition by Prof. Richard Tomlinson. In the contribution presented here, it is suggested that *emplekton* masonry is referring to Greek masonry of a technique not previously discussed in this connection, as far as the present writer is aware.

## Περίληψη

Ο Βιτρούβιος (2.8.7) και ο Πλίνιος (Φυσ. Ιστ. 36.51.171-172) αναφέρουν έναν τύπο τοιχοποιίας που ονομάζεται 'έμπλεκτον'. Δυστυχώς δεν είναι σαφές ποιον από τους γνωστούς σε εμάς από αρχαιολογικά ευρήματα τύπους εννοούν. Διατυπώθηκε η υπόθεση ότι η λέξη έχει σχέση με την ελληνική λέξη 'πλέκω'. Άλλοι υποστήριξαν ότι πρόκειται για το γέμισμα (υλικό πλήρωσης) στο εσωτερικό οχυρωματικών τειχών. Πολλοί ερευνητές προσπάθησαν να εξηγήσουν τη λέξη, ανάμεσα σε αυτούς και ο καθηγητής Richard Tomlinson, που έκανε μια διαφορετική και πρωτότυπη πρόταση. Στο άρθρο που προσφέρεται προς τιμήν του, το 'έμπλεκτον' θεωρείται μια ελληνική τοιχοποιία, της οποίας η τεχνική ως τώρα - όσο τουλάχιστον γνωρίζει ο συγγραφέας - δεν έχει συζητηθεί σε συνάρτηση με το παραπάνω ζήτημα.

## Key Words

*Emplekton*; ashlar masonry; headers; stretchers; fortification walls.

## Vitruvius on Greek walling

Vitruvius' chapter 8 in book 2 on walling poses enough difficulties to turn the hair grey on its readers but nevertheless a number of devoted architectural historians have responded to the challenge and tried to make sense of his description. Among these I would in particular like to draw attention to the works of G. Dennis (1848), R.A. Tomlinson (1961) and L. Karlsson (1992) while exploring if there are still any new angles from which the subject can be viewed.<sup>1</sup>

The text by Vitruvius seems inconsistent and self-contradictory and in order to make sense of some parts of the text it seems simply necessary to ignore what Vitruvius has just written in another part of the text.<sup>2</sup> Before describing the masonry types of *isodomum*, *pseudisodomum* and *emplekton* Vitruvius seems to say

that these types concern masonry which is *not* ashlar masonry. This statement is, however, generally ignored by architectural historians, who apply these terms precisely on ashlar work and not without reason. Because all the concerns expressed by Vitruvius about the careful levelling of courses and avoiding placing joints congruently above one another, make far less sense in rough work of unhewn stones than in ashlar work. In a similar way, most readers ignore that Vitruvius seems to presuppose that the Greeks used mortar in building their walls. Only Tomlinson would not readily discard this notion in his important article on *emplekton* from 1961, in which he insists that Vitruvius is talking about '... rough stone and mortar, not solid squared masonry (*quadratum*)'.<sup>3</sup> Tomlinson did, however, I think, have considerable difficulties in identifying Greek mortar masonry archaeologically.<sup>4</sup>

Vitruvius admires and praises Greek masonry in this part of his text whilst at the same time expresses some mistrust in Roman mortar walls which tend to break down and begin to dissolve when the mortar has dried out. Speaking of *isodomum* and *pseudisodomum* he is of the opinion that as the building stones of the Greek

<sup>1</sup> Dennis 1848: 106-108 Appendix. Emplekton masonry; Karlsson 1992: 67-85 Emplekton Masonry and the Chain Technique; Tomlinson 1961.

<sup>2</sup> I have made use of the Loeb edition edited and translated by F. Granger (Granger 1970) and I have accepted, in general, the interpretation of the Latin text which Granger expresses in his translation. I am very grateful to Jacob Isager from the University of Southern Denmark for sharing his expertise on Vitruvius with me and I am also most grateful to Lars Karlsson for his advice and comments although unfortunately he does not share my view on the meaning of 'emplekton masonry'.

<sup>3</sup> Tomlinson 1961: 133.

<sup>4</sup> Tomlinson 1961: 136-140.

walls are of a dense and strong nature, they will not dry out the moisture of the mortar, and, because they are placed carefully in levelled courses and bonded in headers and stretchers, they will stay in place for very long time.

### **Emplekton**

In addition to the *isodomum* and *pseudisodomum* masonry, the Greeks had another type called *emplekton*. What is *emplekton* masonry?

The word is definitely Greek and it is generally believed that it has to do with the Greek word πλέκω for weaving cloth or plaiting baskets. *Emplekton* masonry can therefore, in some respect, be characterised as 'interwoven'. This has caused much trouble and some unsuccessful attempts have been made to interpret 'emplekton' differently as meaning 'filling up', mainly in order to bring sense into Vitruvius' description.<sup>5</sup>

Vitruvius begins his description of *emplekton* by introducing a kind of Roman walling which is supposed to form an analogy to this Greek type of masonry. This technique was still in use in the countryside at the time of Vitruvius and the characteristic feature was that only the face of the stones in the wall face was dressed, while the stones in the interior of the wall were left in their natural state although placed in mortar and with alternating joints. In more recent times - if I understand correctly - this technique had degenerated in the opinion of Vitruvius. People now were eager to build fast and therefore constructed two facing walls separately sometimes setting stones on end for speeding up the building process. Then they filled up or 'stuffed' the space between the walls with broken rubble and mortar. The Roman wall accordingly consists of three separate, vertical sections or 'slices', which are not connected.

The Greeks did not do like this, Vitruvius says. They place the stones level, stretchers alternating with headers going into the wall. The Greeks therefore do not fill up or 'stuff' the middle of the wall ('...*non media farciunt...*') but instead with blocks going from the face of the wall they make it into one solid and permanent unity. Furthermore, they insert very long binders, which they call *diatonoi* that reach from one wall face to the other and thus hold the wall together.

I understand the text in the way that in Roman architecture the *emplekton*-system has developed into a system of three more or less separate bodies, consisting of the two facings and an interior stuffing of broken rubble and mortar. This is in fact a simple description of the general system applied to most Roman concrete

walls, whether they are faced with natural stones in *opus incertum* and *opus reticulatum* or with bricks (*opus testaceum*) or with more or less regular ashlar work.

It seems clear to me, though, that Vitruvius is of the opinion that in Greek masonry *emplekton* refers to walls built solidly of headers and stretchers through the entire thickness of the wall.

This reading finds some support in Pliny, I think. In his account of Greek walls Pliny seems to be paraphrasing Vitruvius although he has obviously mixed up his descriptions of the Roman *emplekton* with that of the Greek *emplekton*.<sup>6</sup> In Karlsson's translation the text by Pliny runs like this: 'A third style is the *emplekton*, in which the wall faces are dressed and the rest of the material being laid at random. It is essential that the joints should be made to alternate in such a way that the middle of the stones covers the vertical joints in the course last laid. This should be done even in the core of the wall if circumstances permit, and failing this, at least on the sides. When the core of the wall is packed with rubble, the style is *diatonikon*'.<sup>7</sup> The first part of the text must refer to Roman walling, but the central part of the text surely must refer to a wall solidly built up by headers and stretchers. The great concern for avoiding vertical congruence of joints in both the faces of the wall and in its interior would make little sense for a wall built of rubble. In my opinion it must therefore be assumed that Greek *emplekton* walls are normally constructed of worked ashlar throughout the thickness of the wall.<sup>8</sup>

This is precisely what Dennis concluded in 1848 in his discussion which I find convincing.<sup>9</sup> He rejected the attempts that were made in his time by Italian scholars to derive the word *emplekton* from ἐμπίπλημι or ἐμπλήθω, 'to fill up'. Dennis had seen solid Greek ashlar masonry in Sicily and southern Italy and especially in Etruria. He had observed, that masonry solidly built of standard ashlar block was typical of southern Etruria, where the natural rock consists of easily workable volcanic tuff, while the harder types of natural rock like e.g. limestone typical for northern Etruria was the reason that other types of wall techniques were prevailing there.<sup>10</sup>

To this day, however, the term *emplekton* masonry is almost universally used as designating the technique

<sup>6</sup> Pliny *NH* 36.51.

<sup>7</sup> Karlsson 1992: 68.

<sup>8</sup> The *diatonikon* of Pliny looks like a description of normal Greek fortification masonry with a fill of rubble and earth, but is generally regarded as a misunderstanding of Vitruvius' *diatonous*-system (Karlsson 1992: 69). Could *diatonikon* simply mean 'masonry tied together with *diatonoi*'? If so, there would be no discrepancy between Vitruvius and Pliny.

<sup>9</sup> Dennis 1848: 106-108.

<sup>10</sup> Dennis 1848: lxiii.

<sup>5</sup> Dennis 1848: 106.



of Greek fortification walls, which most often consists of two facings constructed of large stones of ashlar, trapezoid or polygonal type and a filling of earth and rubble.<sup>11</sup> Headers are occasionally inserted from the front of the wall into its inner in order to bind the three layers together. The insertion of these headers into the fill of the wall is what has been seen as 'weaving' or 'plaiting' and as having given the masonry its name of '*empektion*'.<sup>12</sup>

Karlsson has observed that at a certain time and place - maybe in Sicily - the builders began to place the headers vertically above one another up through the wall face in 'chains'.<sup>13</sup> In this way compartments were created inside the wall both making the wall stronger and limiting the size of a breach, if an attacking enemy managed to make part of the wall collapse during a siege. This, Karlsson suggests, could perhaps be what was called *diatonikon* and could be where *diatonoi* especially came into use.

Karlsson - like most others - in general takes it for granted, that Vitruvius is talking about fortification walls when describing Greek *empektion* masonry.<sup>14</sup> This is, in my opinion, far from certain and I think that it could be precisely here that the search for Greek *empektion* masonry ran off the track. Karlsson, however, saw the problem when trying to make the text of Vitruvius fit the fortification wall-technique and he rhetorically asked: 'The text is a little difficult to understand and it seems as if Vitruvius would be describing a wall built solid with ashlar blocks. Did Vitruvius not know that the most common Greek wall type of the Hellenistic period was the header and stretcher wall with two separate faces and a filling of rubble or mudbrick? Or is this the wall he is describing? He wrote that the Greeks *non media faciunt*. If the Greeks did not fill in the middle, then the headers and stretchers must have been placed so that they filled even the interior, thus making the wall solid'.<sup>15</sup>

Like Karlsson and most other scholars, Tomlinson seems to regard Greek *empektion* walls as more or less identical with Greek fortification walls and to consist of three sections, two outer faces and a central core.<sup>16</sup> Tomlinson did not agree, however, in his 1961 article, that the designation *empektion* is derived from the

structural method by which headers are occasionally and sometimes systematically inserted from the face of the wall into its core, especially as this is specifically said by Vitruvius not to be the case for Roman *empektion*. Instead Tomlinson offered an entirely new and original explanation: The word *empektion* does not refer to the structure of the wall but to its appearance. When headers are placed at regular intervals among the stretchers, they form a pattern on the façade of the wall, which may remind one of the pattern made by warp threads and weft threads in woven cloth or basketry. *Empektion* thus constitutes a parallel to the other designations for walling that Vitruvius applies. *Opus incertum*, *opus reticulatum*, *isodomum*, *pseudisodomum* can all be said to refer to the surface patterns resulting from the different construction techniques applied.

Tomlinson's ingenious explanation of the origin of the designation '*empektion*' has been widely accepted<sup>17</sup> and may appear to have solved the enigma of this technical term. But even if one accepts for a while that '*empektion*' refers to the pattern created by the appearance of the headers and stretchers on the wall face, there are still some related problems, that are not solved, I think.

Is it likely that we should look for Greek *empektion* masonry only among Greek fortification walls? Why would Vitruvius now suddenly have turned to Greek fortification masonry?

And perhaps even more important: can we disregard that both Vitruvius and Pliny seems to be describing Greek *empektion*-walls as walls that are solidly constructed of ashlar masonry?

### Greek walls solidly built of ashlar

Perhaps it would be useful to follow up on the opinion expressed by Dennis in 1848 and look for an entirely different kind of Greek masonry, when trying to understand the original Greek *empektion* as described by Vitruvius and Pliny above. We should then look for examples of Greek walls solidly built entirely of ashlar, with no stuffing in the middle - masonry in which great care has been devoted to avoid joint congruence from one course to the courses above and below and masonry which somehow forms a more direct analogy to weaving.

Dennis had noticed that walls solidly built of ashlar are common in southern Etruria, where the natural rock is generally of volcanic tuff. Tuff is comparatively soft and easy to quarry and to cut into regular ashlar. When many stones are needed for a specific building purpose, it is therefore most logical to quarry the needed number of stones systematically and in standard sizes that are

<sup>11</sup> E.g. Hellman 2002: 115, 348.

<sup>12</sup> Critically discussed in Tomlinson 1961: 134. Karlsson thinks that *empektion* specifically designates masonry in which headers and stretchers alternate systematically in the same course (Karlsson 1992: 68).

<sup>13</sup> Karlsson 1992: 69.

<sup>14</sup> Karlsson does mention an example from a stoa at Morgantina (Karlsson 1992: 86) and has informed me by email that the chain technique/*empektion* is known also from houses in Sicily and North Africa.

<sup>15</sup> Karlsson 1992: 68.

<sup>16</sup> Tomlinson 1961: 136.

<sup>17</sup> E.g. Karlsson 1992: 86 n. 361; Lawrence 1979: 214-215 n. 12.



Figure 1: Foundations of the great temple at Gortys, Arcadia (photo: P. Pedersen).

convenient for both quarrying, transportation and building. Such solidly built structures of prefabricated blocks of standard dimensions are also seen very early in Rome for instance, in such important constructions as the Servian wall of the early 4th century BC, the podium of the Capitoline temple of Jupiter from c. 500 BC and the foundation for the early 5th century BC temple of Castor and Pollux.<sup>18</sup>

Although Dennis first identified *emplekton* masonry in Etruria, he rightly saw it as a Greek type of masonry, as is also indicated by its name.

Masonry solidly built of ashlar comparable to the type seen by Dennis in northern Italy is very common in the Aegean region wherever softer types of rock are found in large and homogenous deposits that can systematically be quarried into ashlar of standard sizes.

<sup>18</sup> Servian Wall: Boëthius 1978: 121-122; Capitoline temple: Boëthius 1978: 46-48; Temple of Castor and Pollux: Nielsen and Poulsen 1992: 61-79. The last-mentioned had ashlar of 30 x 60 x 90 cm, probably equaling 1, 2 and 3 feet. G. Lugli treated this kind of masonry in detail (Lugli 1957, *Capitolo II. Opus Quadratum*). His typology consisting of *maniera etrusca*, *maniera graeca* and *maniera romana*, appears impossible to me, as *maniera graeca* and *maniera romana* in my view are merely two versions among a number of variations found in both Greek and Roman architecture. Lugli has very few references to mainland Greek architecture and appears not to be familiar with this material, much of which was not known when he wrote his book.

This is the case for both *poros* and some types of conglomerate in Attica and on the Greek Mainland and for different types of volcanic tuff typical for large parts of Western Asia Minor.

These types of soft stone are not well-suited for the superstructure of temples and other prestigious buildings, which would normally be of harder stone constructed in *isodomum* and *pseudisodomum*. The character of the softer stones is normally better suited for utilitarian types of masonry. Furthermore the concern expressed by Vitruvius and Pliny for avoiding congruency of joints in the internal part of the masonry shows that we are dealing with utilitarian masonry of greater thickness than the fine walls of marble temples. *Emplekton* masonry thus constitutes a third type of Greek masonry different from the fine walls in isodomic and pseudo-isodomic techniques. We should look for it where more substantial masonry is required, as in the foundations of temples, in terrace walls, in retaining walls and in fortifications.

In fact, this is an extremely well-known type of masonry in Greek architecture, beginning already in the Archaic period and seen for example in the foundation-podium of the Parthenon.<sup>19</sup> Taking issue in the temple at Gortys in Arcadia (FIGURES 1 and 2)

<sup>19</sup> Travlos 1971: fig. 567.

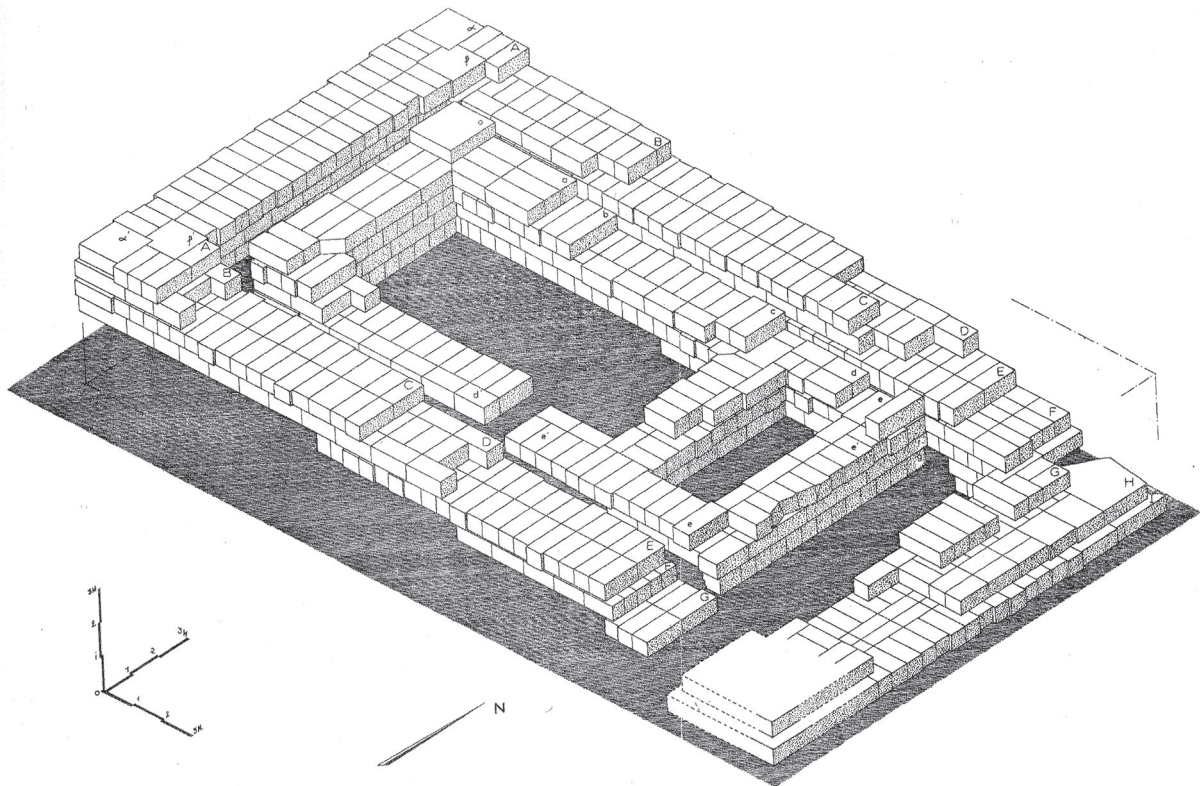


Figure 2: Foundations of the great temple at Gortys, Arcadia (after Ginouvès 1976: fig. 1).

R. Ginouvès published a number of examples in an important article in 1976 and made a basic analysis of the masonry from a number of constructions in which it has been applied for foundations mainly for temples.<sup>20</sup> He did not pretend to include all examples of such masonry and unfortunately missed important epigraphical and archaeological evidence from the 4th century BC. Ginouvès did not think of identifying this kind of masonry with Vitruvius' *empektion* type, as far as I am aware, but this is in my opinion what we should probably do.

A detailed look at one comparatively simple example of this kind of walling may be useful. I will choose the foundation wall of the *peribolos* wall of the Maussoleion at Halikarnassos (FIGURE 3).<sup>21</sup> The foundation wall reaches in some places a height of 3-4 m, it is about 1.8 m wide and only had the purpose of carrying the *peribolos* marble wall, which was approximately 2.56 m high. The foundation wall is built of blocks of soft, volcanic andesite with standard dimensions of approximately: width: 0.6 m, length: 1.2 m and height 0.45 m, no doubt equaling 2 x 4 x 1.5 units of 30 cm (feet?).

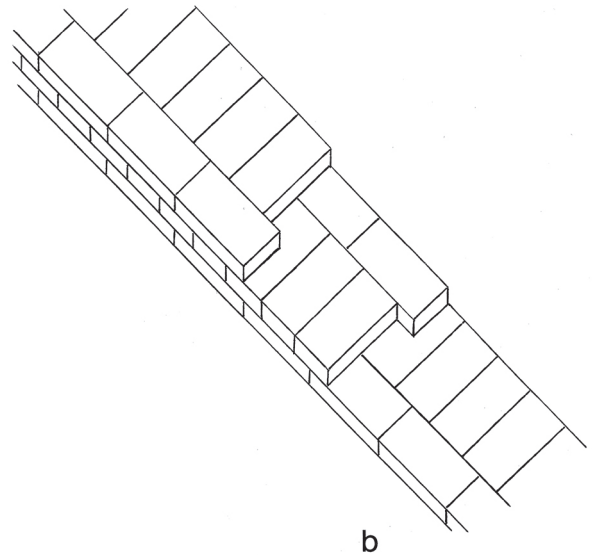


Figure 3: Foundation wall of the Maussoleion *peribolos* wall (drawing: P. Pedersen).

<sup>20</sup> Ginouvès 1976. Among examples from central Athens are the walls around the Odeon of Pericles and the great retaining walls by the theatre of Dionysos (Travlos 1971: fig. 504).

<sup>21</sup> Pedersen 1991: 12-17.

For making a simple wall like this, which is solidly built of standard ashlar, the architect or construction foreman would have to choose one out of a few possible patterns which would fit the width of 1.8 m and minimize the occurrence of congruence of vertical joints in both the face of the wall and in its interior. For the Maussoleion *peribolos* foundation the architect chose a pattern, which simply consists of a row of headers combined with a row of stretchers. In the *peribolos* foundation the two rows are placed so that there will be no transversal congruency of joints. This will, however, result in some short vertical congruencies in relation to the courses above and below in the center of the wall. In some foundations of approximately the same time as the Maussoleion, the builder has chosen to place two headers and one stretcher together forming a rectangle (FIGURE 4).<sup>22</sup> In this way, vertical congruence of joints is completely avoided, but horizontal congruence of joints occurs between each rectangular unit.

So, even for a very simple wall like this, it is necessary to design a basic pattern, which will give the optimal result with as few occurrences of congruence of joints as possible.

When the architect had decided on a pattern, it was then left to the foreman and his workmen to carry it out and repeat the pattern from one end of the wall to the other. When they finished one course, they would reverse the order of the stretchers and the headers and shift the rhythm with half the width of a block and then systematically place the next course. The system would be repeated until the intended height of wall had been reached.

In my opinion, this process forms a striking analogy to weaving, and thus constitutes the most probable explanation for the designation '*emplekton*' in Greek and Roman architecture. Interesting, of course, is the fact that, no matter which system is chosen for organising the ashlar of one course, it is repeated in every other course of the wall, will necessarily lead to the formation of regular patterns on the wall face. These could have some similarity to woven material, but although this may seem to support the explanation presented by Tomlinson, I agree with earlier students of Greek walls that *emplekton* refers not to the appearance of the wall face, but to the structure of walls – and in my opinion to walls, that are built solidly of ashlar of regular standard dimensions, like those discussed here.

For walls of other dimensions, suitable systems would have been applied, as demonstrated by the foundations

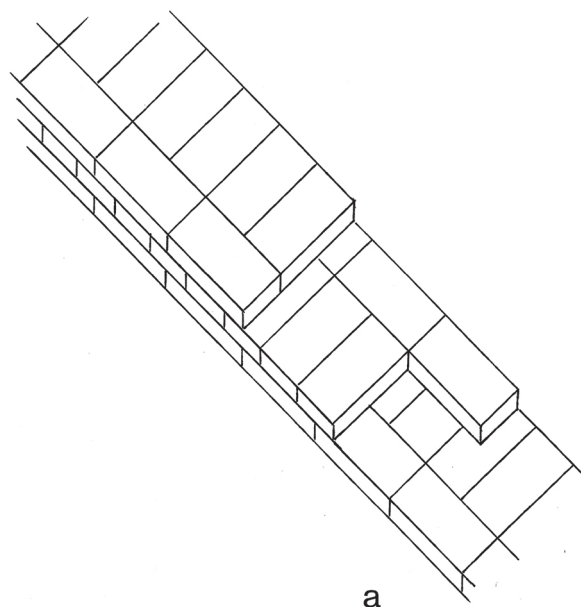


Figure 4: Alternative system for a wall with dimensions like Maussoleion *peribolos* foundation (drawing: P. Pedersen).

of the temple of Gortys and other examples presented in the article by Ginouvès.<sup>23</sup>

Almost contemporaneously with the work of the architect Pytheos and his collaborators at the Maussoleion in Halikarnassos another famous Greek architect, Philon, applied the same kind of masonry in Piraeus. During excavation in Piraeus in 1988/1989 two sections of one of the most famous buildings of Classical Greece, the Arsenal or '*Skeuothek*' of Philon, were found and, although some of the ashlar have other proportions than those of the Maussoleion *peribolos*, it seems that exactly the same system was applied by Philon as by Pytheos before him.<sup>24</sup>

The Arsenal inscription specifies that the stones of the foundation shall be placed alternately as headers and stretchers, but is not sufficiently detailed to have a description of the basic pattern for the organization of the stones. However, by an unusual piece of good luck, a system like this is described in more detail for the foundations of Philon's great project in Eleusis in the inscription *Inscriptiones Graecae* II<sup>2</sup> 1671.<sup>25</sup> K. Jeppesen and P.H. Davis do not agree on the width of the foundations but it is clear that the inscription intends to give precise instructions for the basic pattern for the organisation of the stones in each course. It is quite complicated, however, and stones of several different

<sup>22</sup> Ginouvès 1976. In the foundations for the *cella* walls of the temple at Gortys.

<sup>23</sup> Ginouvès 1976: fig. 1. Other examples may be seen in Müller-Wiener 1988: fig. 23.

<sup>24</sup> Steinhauer 1994: 44-50, figs. 23, 24, 35, 36.

<sup>25</sup> Davis 1930: 11-19; Jeppesen 1958: 139-143.

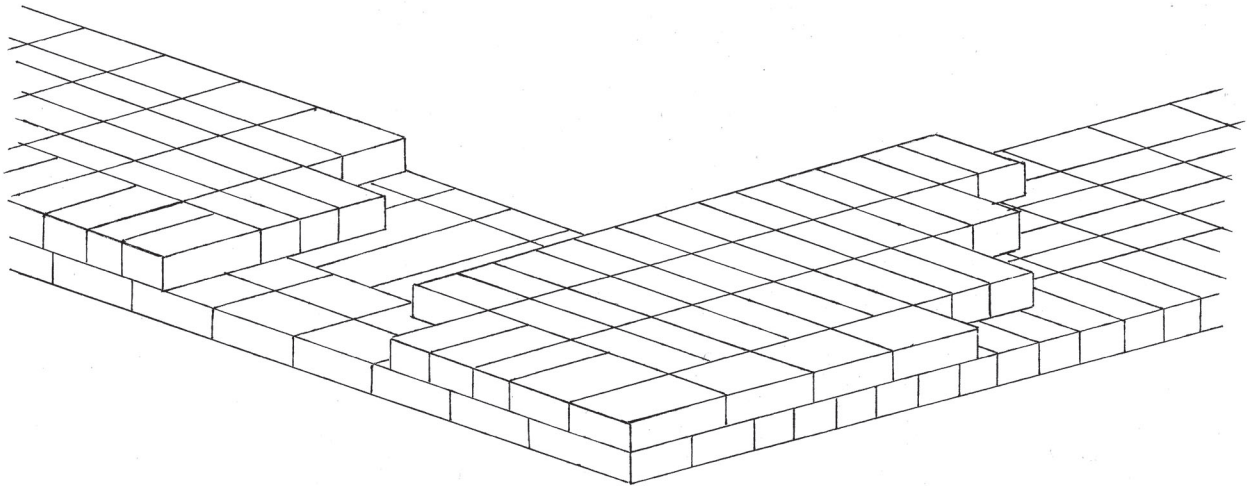


Figure 5: Foundations for the Philonian porch at Eleusis, as restored by Davis (after Davis 1930: fig. 3).

standard dimensions are needed to fill out the jigsaw puzzle. Most of the stones needed are 2 feet wide, 4 feet long and 1.5 feet high, as in the foundations of the Maussolleion *peribolos* and at many other places, as shown by Ginouvès.<sup>26</sup> In order to complete the jigsaw puzzle, a certain amount of stones are needed measuring in width to length 3 x 5 feet, 2 x 5 feet and 3 x 4 feet (FIGURE 5).

As the pattern should be reversed or changed in every other course and as it is specifically stipulated in the inscription that care must be taken to avoid congruence of joints, it is evident that very difficult and careful calculations had to be made by the architect himself or somebody close to him before stones could be ordered from the quarry.

G.R.H. Wright describes the complications involved in similar work with modern brick masonry, where congruence of joints is avoided by insertion of stones of special scantlings in the corners and the problems are exactly the same.<sup>27</sup> According to Wright, the organization of the system for placing stones is the work of trained tradesman and cannot be carried out by laymen. In modern brick work experienced, professional builders know these problems very well and have names for the stones of irregular dimensions, such as 'Queen closer', 'King closer', 'half bat' and 'three quarter bat'. These are for brick walls which have the width of 1.5 stones, and they are placed just as the ashlar in the foundations for the Maussolleion *peribolos* wall, which also had 'Queen closer' and 'three quarter bat' in the corners. Greek walls many stones wide were

even more complicated, and as the calculation would be used for ordering large stones from a distant quarry, it was extremely important that the calculation was precise. It seems quite possible that some standard patterns were generally known among experienced architects and foremen. But it may also be that great architects, such as Pytheos and Philon, developed their own systems and wrote them down both on inscriptions, such as *Inscriptiones Graecae* II<sup>2</sup> 1671 from Eleusis for building contractors and workmen, and perhaps also in their writings. As these were available to Vitruvius, this could very well be wherefrom he obtained his specific information about Greek *emplekton* technique - although he might also know it from autopsy in some, mainly older structures, in Rome and northern Italy.

Vitruvius' description of Greek *emplekton* masonry as walls solidly built of ashlar is in perfect accordance with the archaeological evidence and it constitutes a main category of Greek masonry. It was probably of Greek origin as indicated by its name, but was universally known and used east and west of the Aegean as well as in Etruria, Rome and *Magna Graecia*. It was used by some of the most famous Greek architects and may have been described in their treatises on architecture writings. If *isodomum* and *pseudisodomum* are generally about fine walls of temples and public buildings, then *emplekton* seems to be ashlar masonry of utilitarian character used for foundations, strong retaining walls (FIGURES 6 and 7) and in some rare cases for city walls (FIGURE 8).

At least one enigma remains, however. How could Vitruvius possibly compare Roman three-layer walling to Greek masonry constructed of ashlar throughout?

<sup>26</sup> Ginouvès 1976: 111-115.

<sup>27</sup> Wright 2005: fig. 156.



Figure 6: Retaining wall west of the Odeon of Pericles at Athens (photo: P. Pedersen).



Figure 7: Retaining wall west of the *auditorium* of the Theatre of Dionysos at Athens (photo: P. Pedersen).



Figure 8: North wall of the gate-yard of the Myndos Gate at Halikarnassos (photo: P. Pedersen).



Figure 9: Rough drystone wall. City wall at Halikarnassos (photo: P. Pedersen).

This is not easy to say, but one might argue that they both have the same origin in simple drystone walls (FIGURE 9). For these un-worked stones were collected around the building site and placed flat with one straight side turned outwards so that a number of these blocks form an outer facing of the wall. The two faces of the wall must be arranged quite carefully in order that the wall does not collapse, as whoever has tried to build a dry-stone garden wall, knows. The interior of the wall is also built of unhewn stones laid flat to secure some stability. Such dry-stone walls of a very rough character are found everywhere as fences around fields and they are sometimes built with great refinement for houses, as seen in villages all over the Mediterranean.<sup>28</sup>

Following what Vitruvius seems to have meant, the Romans wanted to build very fast and only cared about the facing. Therefore, they gave up the laborious process of organizing the stones carefully and neatly and, instead, built the facings separately using mortar and simply 'stuffed' the middle of the wall with un-organized rubble and mortar, and so saved time and effort.

The Greeks developed the simple drystone walls in a completely different way. They cut the rough stones to

<sup>28</sup> Extremely fine drystone housewalls can be seen in Caria, e.g. Labraunda-Milas area, in modern as well as in ancient ('Lelegian') masonry.

ashlars and developed patterns for organising these as interlocking headers and stretchers both in the façade and all through the wall. The Greek way of interweaving the stones thus may be thought to have started in simple drystone walling and culminated as the sophisticated *emplekton* ashlar masonry of Classical Greek architecture with important examples from Piraeus, Eleusis and in central Athens, as in the retaining walls of the theatre of Dionysos and the Odeon of Pericles. It spread early to Italy and is also found in the Greek East. It was used in the works of famous architects as Pytheos and Philon, who may have been the sources of Vitruvius in this respect, as they were in many others.

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