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CHRYSANTHOS KANELLOPOULOS & MANOLIS PETRAKIS

Cella alignment and 4th century BC Doric peripteral temple architecture in Mainland Greece

Abstract

This article examines 4th-century BC Doric architecture, dealing with the cella position in relation to the design of the *peristasis*. Divergences from the theoretical principles are recorded and the reasons dictating the aesthetics as well the traditions are examined. A categorization of Doric peripteral temples is put forward and five peripteral temples are discussed in detail, with new drawings offered; the temple on the Leprean acropolis, the Temple of Asclepios at Gortyn, the Temple of Apollo Ismenios at Thebes, the Temple of Apollo at Mount Ptoion, and the so-called Temple of Hippolytos at Troizen. It is inferred that the previously reconstructed Ionic axial cohesion in the temples under examination has taken into account neither the principles of the Doric order, nor the correct sizes of the elements. An argued evaluation of the physical evidence is necessary for reconstructing the implemented ground-plans. By taking the above into consideration and by re-examining the existing foundations, it is possible to reconstruct features such as the lower diameter of the *pronaos* columns, the width of the *antae*, the thickness of the cella and *pronaos* walls, the cella width and the angular contraction. The aim of this paper is to demonstrate the rules to which the 4th century BC peripteral temples tend to conform and to investigate the reasons that led to their formation. It is proposed that reconstructing the roofing systems is the key to a cohesive system of correspondence.*

Keywords: 4th century architecture, Doric order, peripteral temple, temple proportions, Doric correspondence, roofing systems, Lepreon, Gortyn, Thebes, Ptoion, Troizen

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Introduction

The architectural remains of five Doric 4th-century BC peripteral temples will be discussed, in order to draw conclusions regarding their plans and on the evolution of Doric temple architecture within the 4th century BC in Mainland Greece. The temples under consideration are the temple on the Leprean acropolis, the Temple of Asclepios at Gortyn, the Temple of Apollo Ismenios at Thebes, the Temple of Apollo at Mount Ptoion, and the so-called Temple of Hippolytos at Troizen. Although all five have been excavated and published, the present paper is a restudy, based mostly on the remains of foundations, as the temples at Gortyn and Troizen do not preserve features of their entablatures.[1]

The ground-plans of Doric temples of the 4th century BC present a large variety in plan proportions, size, cella dimensions and type of *opisthodomos* (for a glossary of architectural terms, see *Appendix*). A common feature is a *pronaos* that corresponds to the third column of the flanks. Typology is not helpful in terms of relative chronology, as the variety of plans during the 4th century BC may depend on function, available space in the sanctuary, pre-established traditions and special cult and ritual characteristics. The following is a categorization of Doric peripteral temples after location and size of cella and *opisthodomos*:

A) The archaistic plan (*Fig. 1A*): these elongated temples with 14 and 15 columns along the flanks were either built

* We thank Erofili Kolia and Anna Karapanagiotou, as topographical research at Lepreon and Gortyn respectively was carried out with their permission. We also warmly thank architect Youli Anastasiadou and archaeology students at the University of Athens Lina Tsatsaroni, Anna Dalgkitsi and Dimitra Kovani, for their contributions in the development of the article; unfortunately, it is not possible to thank in person the late Dimitris Terzis, the guard of the archaeological site of Gortyn for his support in the field. Finally, special thanks to Jari Pakkanen and David Scahill, who improved our paper with their insight. An earlier version of this article was presented at the American School of Classical Studies at Athens as a lecture at the forum "Circle. Dialogues for Greek and Roman Architecture", on 16 May 2016, the participants of which we warmly thank for fruitful discussions.

[1] Data on the entablatures of the so-called Temple of Demeter at Lepreon and the Temple of Apollo at Ptoion are published, while new work on the Temple of Apollo in Thebes includes pieces of entablature, as presented by Scahill in the Circle for Dialogues on Greek and Roman Architecture at Athens in 2016 and at the Annual Meeting of the Archaeological Institute of America in San Francisco also in 2016.

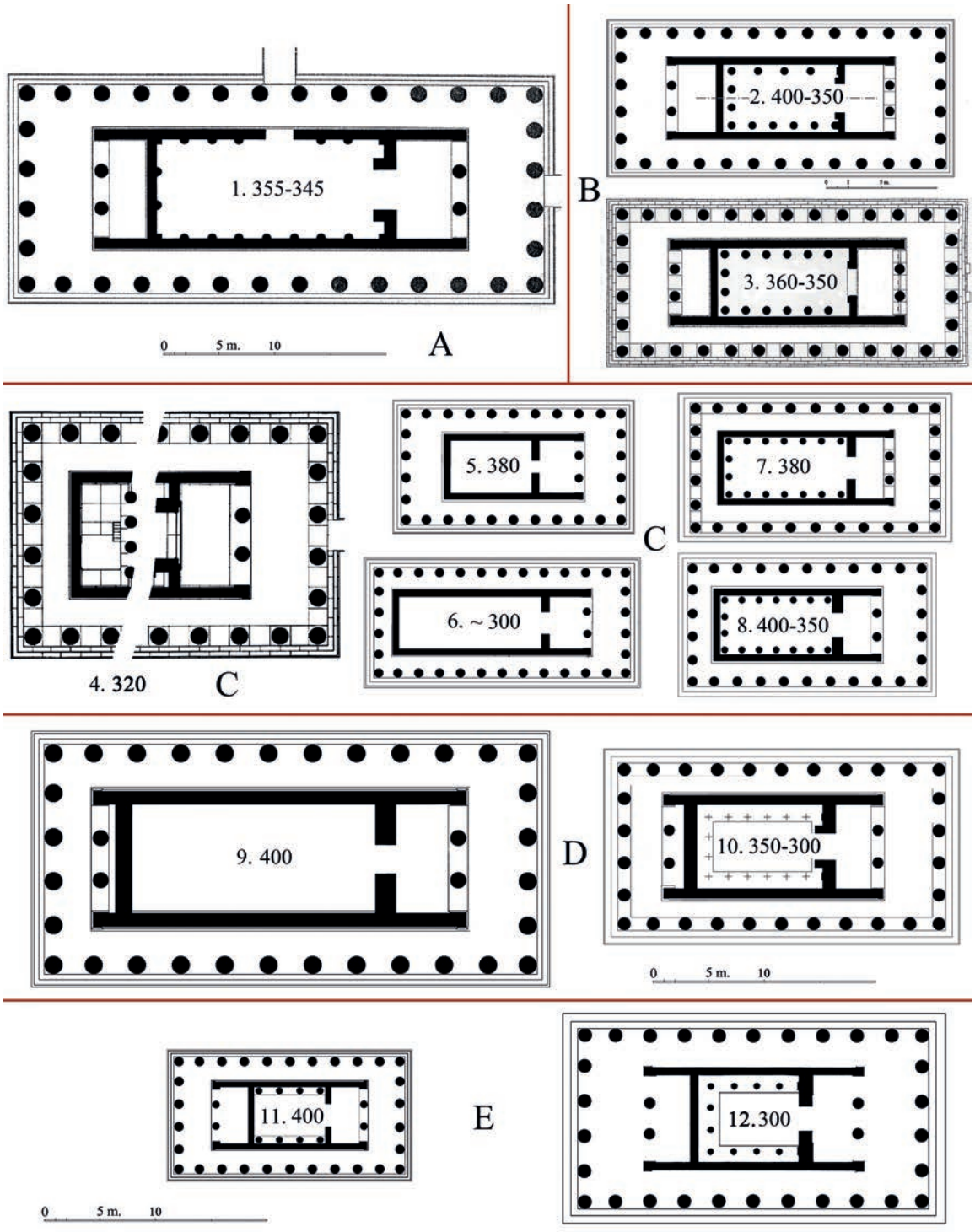

Fig. 1. Categorization of 4th-century BC temple plans after location and size of cella and opisthodomos. *1: Athena Alea, Tegea (after Dugas* et al. *1924, pls. 9–11; Pakkanen 2014, 358, fig. 4); 2: Poseidon, Molykreion (after Orlandos 1922–1925, 60, figs. 7–8); 3: Artemis, Kalydon (after Dyggve 1948, pls. 29, 34); 4: Zeus, Nemea (after Hill 1966, pl. 4); 5: Demeter, Lepreon (after Kanellopoulos); 6: Apollo, Ptoion (after Kanellopoulos); 7: Asclepios, Epidauros (after Kavvadias 1884, pl. 2; Roux 1961, pl. 28); 8: Asclepios, Gortyn (after Petrakis & Kanellopoulos); 9: Apollo, Thebes (after Kanellopoulos); 10: "Hippolytos", Troizen (after Kanellopoulos); 11: Metroon, Olympia (after Mallwitz 1972, 161, figs. 125, 162); 12: Zeus, Stratos (after Orlandos 1923, fig. 14).*

around a replacement of an older oblong cella (as in Bassae) or on foundations of destroyed Archaic temples (in Delphi, first quarter of the 4th century BC and in the Sanctuary of Athena Alea in Tegea, middle of the 5th century BC, see *Fig. 1A.1*). The oblong proportions of these plans were dictated by the dimensions of the pre-existing foundations upon which the new temples were built. The result would be acceptable within the context of contemporaneous archaism in 4th-century art; the appearance of those temples would be surrounded by an aura of sacred past.[2]

B) The canonical plan (*Fig. 1B*): these temples have 13 columns on the flanks, with a symmetrical *opisthodomos* and *pronaos*, each placed in correspondence with the third columns from the corners; this plan carries the 5th-century BC orthodoxy. It occurs in the Greek Mainland (the Temples of Poseidon at Molykreion and Artemis at Kalydon) and it does not survive into the second half of the 4th century (*Figs. 1B.2* and *1B.3*).

C) The third scheme is characterized by the lack of *opisthodomos* (*Fig. 1C*): under the same category would fall the Temple of Asclepios at Gortyn, which clearly repeats the Temple of Asclepios at Epidauros in both dimensions and plan scheme (cf. *Figs. 1C.7* and *1C.8*), and the Temple of Dionysos in Eretria. The same is true for the Temple of Zeus at Nemea which encompasses a cella without an *opisthodomos* in a 12 column long flank (*Fig. 1C.4*). The so-called Temple of Demeter at Lepreon would also fall into the same category, due to the lack of *opisthodomos* and the short flank (*Fig. 1C.5*).

D) The plan illustrated in *Fig. 1D* appears with the Temple of Apollo at Thebes and is followed during the second half of the 4th century BC by the "Temple of Hippolytos" at Troizen. An excessively shallow *opisthodomos* appears almost simultaneously in the Ionic Temple of Athena at Priene.

E) The square-symmetrical plan (*Fig. 1E*): a compact symmetrical plan scheme, with an almost square cella, is in fact a version of the canonical plan, shortened by two columns in the middle of the plan; the square-symmetrical scheme does not appear as the result of chronological evolution nor is it suitable as an abbreviated plan suitable only for small sized temples; this type of plan is used for the Metroon at Olympia (*c.* 400 BC) and the Temple of Zeus at Stratos (310s BC).

In the Peloponnese (*Fig. 2)*, schemes B and C are combined with a short peristyle that is 11 columns long, whilst in Boeotia, the same plans are combined with 12- and 13-column flanks and a preference for oblong cellas (the Temples of Apollo at Thebes and at Ptoion). Similarly, the canonical cellas of type B appear only in Aetolia. The Mainland appears to be attached to the tradition, whilst the otherwise conservative Peloponnese appears progressive in trying new types and by rejecting the oblong schemes.[3] The "square-symmetrical" type D appears in Olympia—in lack of space in this section of the sanctuary—as early as the beginning of the 4th century BC. By contrast, in Kalydon, the lack of space on the plateau was solved by creating an artificial extension so that a "canonical", 13 columns-long, peripteral temple could be accommodated. Cellas of the so-called short temple type belong to categories C, D and E of *Fig. 1*.[4] These are 11 or 12 columns long, with interior columns that are almost attached to the rear wall of the cella. According to a trend spread in the 4th century BC, peripteral temples should ideally have a *pronaos* that is aligned with the third column of the flanks.[5]

From the early 300s onward the scheme with two storeyed interior Doric colonnades gives way to Ionic or Corinthian interior columns. During the 4th century BC the emergence of the Corinthian order helps resolve issues in the interiors. As

Fig. 2. Map of Mainland Greece with location of corresponding temples in Fig. 1.

[2] Knell 1983b, 226.

[3] Sioumpara 2015, 198, 202.

[4] Wurster 1973; Knell 1975.

[5] This *pronaos* layout is practically introduced in the Temple of Makistos which dates to the 500s (Nakasis 2004, 25–26, 218, 234, pl. 11).

Corinthian columns are emancipated from the Ionic theory, it is possible to reach the ceiling level with a single colonnade that has excessively slender proportions (as in the Thymele at Epidauros and the Tholos at Delphi) or with columns that stand on an elevated feature, this being a bench (Tholos at Delphi), a podium (Temple of Athena Alea in Tegea), or a moulded shelf (Philippeion in Olympia).[6] As such, the Corinthian order is the best candidate if there is a lack of evidence for the order of the cella interior.

Description of the Doric "*Einbindung*" and methodological approaches

Sekoi are supposed to passively follow the design of the *peristasis*. Hans Riemann was the first to explain the Doric (and Ionic) correspondence of the cella relative to the *peristasis* columns.[7] The rule is accurately termed in German as the Doric "*Einbindung*" and δωρική συνοχή in Greek. Its closest English translation is alignment, even though this is a passive term. According to this norm, the exterior face of the cella wall corresponds to the axis of the second column from the corners of the front and rear (*Fig. 3, left*). As a result, the width of the cella above orthostate level is equal to the sum of three interaxial column spaces. This arrangement allows partial view of the second column from the corner in the opposite part of the peristyle for a spectator that stands in front of the temple's front or rear. The Doric order is fond of rules and the "*Einbindung*" of the cella relative to the peristyle soon became yet another rule in the Doric system; it appears as early as the middle of the 6th century, together with the appearance of curvature in the *krepis*. Indeed, in the Temple of Apollo at Corinth, the first known canonical Doric temple, the cella has a width of three interaxial spacings.[8]

Considerable departure from the Doric "*Einbindung*" is rare, yet it is recorded in prominent temples. The following are cellas that depart from the canon of the Axial "*Einbindung*" before the 4th century BC. During the late 6th century a number of temples in the Peloponnese have cellas that are considerably narrower than three normal interaxial spaces. These are the Temple of Poseidon at Isthmia, the Temple of Athena at Alipheira, the Temples C and D at Pallantion of Arcadia, the temple at Mamousia/Keryneia, the temple at Gremoulias, near Kalavryta and, most probably, the temple on the summit of Papailias/Ano Melpeia of Trifylia. These belong to the Arcadian-type temple.[9] Quite surprisingly, the famous Temple of Hera in the Argive Heraion, built around the year 400, also conforms to the Archaic Peloponnesian tradition with a *sekos* that is notably narrower than the Doric "*Einbindung*".[10]

A small number of Doric temples are designed according to the Ionic correspondence. Following this rule, the axis of the cella's lateral wall is aligned behind the second column from the corner (*Fig. 3, right*). During the 6th and 5th centuries cellas wider than the Doric "*Einbindung*" appear only in temples of the Athenian School.[11] After Courby's reconstructed plan and elevation, the cella of the Temple of the Alcmaeonids at Delphi would have been 1.10 m larger than the sum of three spaces and, following Riemann's reconstruction, the cella of Athena Polias in Athens would have been 0.20 m short of Ionic correspondence. Giorgio Rocco argues that both the Temple of Athena Polias and the Archaic Temple of Apollo at Delphi must have had Ionic correspondence of their cellas relative to the *peristases*. The latter is due to gradual or double corner contraction of the interaxial column spacings in these two temples.[12] Ionic correspondence is found with certainty in the Archaic Temple of Poseidon at Cape Sounion.[13] The layout of the Classical Temple of Poseidon, which was built on top of the foundations of the Archaic construction, was largely dictated by the configuration of this earlier predecessor; as a result, the width of the Classical cella is 8.13 m, whilst the sum of three interaxial column spacings is 7.575 m. The departure is 0.2775 m on either side for a cella that is 0.555 m wider than the sum of three interaxial spaces. According to Heiner Knell this temple also has Ionic correspondence.[14]

During the 5th century, perfect Ionic correnspondence appears once more, again in Attica, in the Temple of Nemesis at

[6] Pakkanen 1996, 147, fig. 5, 148–149; 2014, 256, fig. 3; Seiler 1986, 95, fig. 40; Schultz 2009, 128, fig. 6.
[7] Riemann 1935, 134.
[8] Pfaff 2003a, 113.
[9] Orlandos 1968, 47, fig. 28, 53, 59, pl. 3; Kanellopoulos & Kolia 2011, 146, 149; pers. comm. with Georg Ladstätter; Arapoyanni 2010; Østby 1991, 45, fig. 1; 2005. During the same period, the Temple of Athena at Hermione (late 6th century) also has a cella that is 0.20 m narrower than the sum of three interaxial column spaces (McAllister & Jameson 1969, 173, fig. 3).
[10] Pfaff 2003b, 170, 152, fig. 84.
[11] The *sekos* of the Late Archaic Temple of Aphaia on Aegina is only slightly wider than the added lengths of the three interaxial spaces (8.01 m and 7.89 m respectively; Bankel 1993, 8, pl. 55, 122); the *sekos* of the Peripteral Temple on Delos is 30 cm wider than the added lengths of 3 spaces (Courby 1931, pl. 4). The cella of the Metroon in Olympia is 6.12 m (Hitzl 1991, 5, 34) or 6.17 m wide (Mallwitz 1972, 162) whilst the sum of 3 interaxial spaces is 6.03 m. The width of 6.17 m would be equal to the added lengths of 7 triglyphs and 6 metopes that are each 0.363 m and 0.605 m long, accordingly. Quite possibly not all metopes had identical lengths.
[12] Rocco 2016. Quite possibly, the cella width in each of these two temples was approximately 0.20 m narrower due to the presence of *toichobate* courses.
[13] Paga & Miles 2016, 659, fig. 2 (after Dörpfeld 1884, pl. 15).
[14] Knell 1973b, 104–105, 114.

Rhamnous;[15] the Ionic plan increases the cella width of an objectively small peripteral temple. Had the cella been equal to the added lengths of 3 interaxial column spacings, according to the Doric canon, the outer width would have been equal to 5.714 m. This dimension is smaller than the narrowest known cellas, the ones at Ptoion (5.80 m) and in Lepreon (*c.* 5.88 m, see below, sections A and D); in fact, the cella width of 5.71 m is comparable with the width of the small Temple of Athena Nike in Athens. Nevertheless, the cella layout is the only Ionic feature in the temple at Rhamnous, which lacks a moulded *toichobate* and Ionic friezes, seen in the works by the "Theseion Architect".[16]

Knell reconstructs a total of five Doric temples of the 4th century BC with Ionic correspondence of the cella relative to the *peristasis* (see below, Temple of Apollo at Ptoion, so-called Temple of Demeter at Lepreon, Temple of Asclepios at Gortyn, Temple of Apollo at Thebes and the "Hippolytos" Temple at Troizen). It appears that the Rhamnous Temple becomes the model for Knell's reconstructed plans (whilst, for some of them, the model should be the Classical Temple of Poseidon at Cape Sounion). The phenomenon, within the context of 4th-century temple architecture, is explored by Sioumpara.[17]

A useful rule taken into consideration during the present analysis dictates that the diameter of the *pronaos* columns is about 15% smaller than the diameter of the *peristasis* columns.[18] In *Table 1*, it is displayed systematically that during the 4th century the ratio of the lower diameter of *pronaos* column to the lower diameter of *peristasis* column varies between 0.85:1 and 0.92:1.[19]

Generally speaking, and for reasons of uniformity, the front of the *anta* jamb should have a width *almost* equal to the lower diameter of the *pronaos* column. In fact, the *antae* of distyle *in antis* façades are designed slightly narrower than the lower diameter in order to increase the corner intercolumnar openings; in small Doric façades the latter tends to become inconveniently narrow due to the contraction of the intercolumniations in the corners of the Doric order. In other words, in a tetrastyle elevation, the contraction in the corners would create two narrow schemes in the corners flanking a wider central opening; the rhythm would then be demolished. The phenomenon appears commonly in both freestanding Doric distyle *in antis* elevations[20] and in *pronaoi* of the same type. During the 4th century the lower diameter of the *pronaos* columns is between 1.14 and 1.23 times the width of the *anta*. In *Table 1*, it is clearly demonstrated that Doric temples (at Lepreon, Thebes, Troizen, Ptoion and Gortys) that have been reconstructed with Ionic correspondence yield ratios that are above or below these numbers and as such they present anomalies.

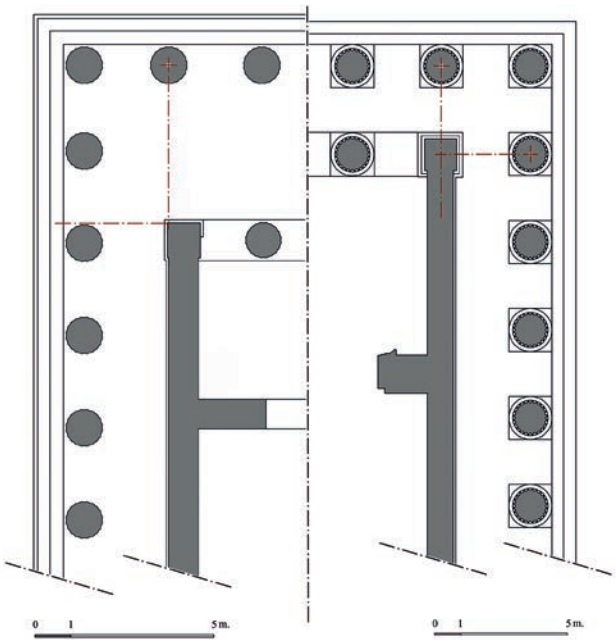

Fig. 3. Cella alignment in the Temple of Hephaistos in Athens (left of the longitudinal axis) and in the Temple of Athena at Priene (right of the axis). Not to same scale. The two temples are presented with common stylobate *width.*

[15] Knell 1973b, 104–112; Miles 1989, 143, fig. 3.

[16] For a discussion on the "Theseion Architect" see Knell 1973b, 94–114.

[17] Sioumpara is cautious on the Ionic correspondence of the temple at Gortyn. She also avoids quoting the cella width of the temples at Ptoion and Lepreon as reconstructed by Orlandos and Knell; for the Temple of "Hippolytos" she notes that the cella width noted is at foundation level (Sioumpara 2011, 205–206, 250, 276–277, table 24).

[18] After Vitruvius (4.4.2) the columns of the *pronaos* should be 5/6ths the size of the *peristasis* columns, or 83% the width of the latter. See also Orlandos 1977, 300.

[19] In the Temple of Asclepios at Epidauros, the lower diameter of the *pronaos* column is awkwardly reconstructed 0.80 times the lower diameter of the *peristasis* column (Roux 1961, Pl. 28); however in Kavvadias 1884, pl. 2 by Dörpfeld, the columns of the *pronaos* are a reasonable 90% the size of those columns in the column cage. Thanks are due to Youli Anastasiadou for drawing Dörpfeld's ground-plan to our attention and who kindly pointed out that during Dörpfeld's time the freshly excavated remains of foundations must have been in a better state of preservation than they were in Roux's time. The Temple of Dionysos in Eretria is also reconstructed with proportionally thin *pronaos* columns; in Auberson 1976 (pls. 2, 5) the ratio lower diameter of the pronaos column: lower diameter of the *peristasis* column is approximately 0.73:1.

[20] To mention a few examples, the Megarian Treasury at Olympia (*c.* 510 BC, Dörpfeld 1892, 51, pl. 28) has a lower diameter of 0.708 m and an *anta* width of 0.54 m, the Treasury of Sicyonians at Olympia (shortly after 480 BC, Dörpfeld 1892, 51, pl. 28) has corresponding dimensions 0.75 m and 0.55 m, the Treasury of Athenians at Delphi (*c.* 501 BC, Audiat 1933, 17) 0.754 m and 0.546 m, and the Doric Treasury at the Pronaia Sanctuary (before 480 BC, Daux 1923–1926, 94, 95, pl. 38) 0.75 m and 0.60 m respectively. The same difference between the lower diameter of the column and the width of the *anta* is apparent in the Temple of Apollo at Kardamaina on the island of Kos (3rd century BC, Kokkorou-Alevra *et al.* 2006, fig. 13).

Date	*Temple*	Pteroma *L.D.*	Pronaos *L.D.:* pteroma *L.D. 0.85–0.93*	Pronaos *L.D.*	Anta *width*	Pronaos *L.D.:* anta *width 1.10–1.25*	*Cella wall width*	Pteroma *L.D.: cella wall width 1.40–1.76*
400	Hera, Argos	1.308	0.88?	1.15?	0.85–1.01	1.14–1.32	0.81	1.61
400	Metroon, Olympia	0.85					0.51	1.66
380–370	"Demeter", Lepreon (Knell 1983a)	0.83	0.93	0.77	0.52?	**1.48**	~0.45	**1.84**
380–370	**"Demeter", Lepreon**	**0.83**	**0.93**	**0.77**	**[~0.65]**	**1.18**	**[0.58]**	**1.43**
400–350	Poseidon, Molykreion	1.02					0.68	1.50
373	Apollo, Delphi	1.718	0.87	1.496	1.25	1.20	1.14	1.50
370	Apollo, Thebes (Knell 1983b)	1.60	**1.00**	1.60	~1.15	**1.50**	~1.05	1.52
370	**Apollo, Thebes**	**1.60**	**[0.87]**	**[1.40]**	**[<1.30]**	**[>1.08]**	**[1.10– ...]**	**1.45**
360–350	Artemis, Kalydon	1.03	0.85	0.88			0.625	1.648
	"Hippolytos", Troizen (Knell 1978)	1.18	**1.00**	1.18	1.18	**1.00**	~1.08?	**1.07**
	"Hippolytos", Troizen	**1.18**	**0.87**	**[0.94–1.02]**	**[~0.90]**	**[1.10]**	**[~0.86]**	**1.40**
345–335	Athena Alea, Tegea	1.456	~0.93	~1.35	1.105	1.22	0.89	1.74
330–320	Zeus, Nemea	1.63	0.86	1.404	1.155	1.21	0.935	1.74
End of 4th century	Zeus, Stratos	1.29	0.92	1.191	0.963	1.25	0.73	1.76
End of 4th century	Apollo, Ptoion (Orlandos 1915)	≥0.754	0.93	~0.70	~0.70	**1.00**	0.65	1.16
	Apollo, Ptoion	0.78–0.80	0.90	~0.72	~0.61	1.18	~0.55	~1.45
	Asclepios, Gortyn (Knell 1983b)	0.84	**1.00**	0.83	0.70	1.24	~0.65	**1.34?**
	Asclepios, Gortyn	~0.90	0.90	~0.81	~0.68	1.21	~0.63	1.42

Table 1. 4th century BC temple proportions, relative to lower diameter of columns, antae *width and width of cella wall. L.D. = lower diameter of column. Temple of Hera at Argos (Pfaff 2003b, 153, 160); Metroon at Olympia (Mallwitz 1972, 161, figs. 125, 162); so-called Temple of Demeter at Lepreon (Knell 1983a, 136); Temple of Poseidon at Molykreion (Orlandos 1922–1925, 62); Temple of Apollo at Delphi (Amandry & Hansen 2010, 404, 433, 265, fig. 8.5); Temple of Apollo at Thebes (Keramopoullos 1917, 162, fig. 37; Knell 1983b, 224, fig. 8); Temple of Artemis at Kalydon (Dyggve 1948, 41, 92, 51, 247); Temple of Hippolytos at Troizen (Knell 1978, 676, fig. 2); Temple of Athena Alea at Tegea (Dugas* et al. *1924, pls. 9–11; Østby 2014, 333); Temple of Zeus at Nemea (Hill 1966, 10, 21); Temple of Zeus at Stratos (Østby 2014, 333); Temple of Apollo at Ptoion (Orlandos 1915, 106–107); Temple of Asclepios at Gortyn (Knell 1983b, 216, fig. 5).*

A. The Lepreon Temple

Very little is known about the so-called Sanctuary of Demeter at Lepreon. Lepreon was one of the most important cities in Trifylia, Arcadia.[21] The sanctuary is situated on the fortified acropolis used during the historical period to the north of the city. Pausanias reports that he was told by the Lepreans that there was once in the city a temple of Zeus Leucaeus, the grave of Lykurgos, son of Aleus, and the grave of Caucon. During his time, however, when the city was in demise, the only monument he could actually see and visit was the Temple of Demeter.[22]

Wilhelm Dörpfeld was the first to briefly discuss the site in 1891.[23] He visited the site, where he found freshly dug trenches, with column drums and stone blocks visible. Dörpfeld opened new trenches, described the remains of the ancient temple, made some measurements and calculated its axial spacing (*Fig. 4*). Following the temple's discovery, extensive excavations took place, which were carried out by the Greek Antiquities Service under the direction of Freiderikos Versakis, but no published reports are known. Wolfgang Wurster reconstructed the temple as a peripteral with a *peristasis* of

[21] See extensive bibliography about Lepreon in Pritchet 1989, 59–60.
[22] Paus. 5.5.6.
[23] Dörpfeld 1892, 259–260.

Fig. 4. Preserved foundations of the Temple at Lepreon seen from NE. Photo by M.E. Wassenhoven.

eleven columns in length.[24] Nikolaos Yalouris also excavated in the area of the temple in 1970 and his excavations unearthed the foundations of the temple's altar to the east of the temple's entrance. He also published the pottery discovered at the site.[25] Knell has produced an extensive architectural analysis of the temple, after fieldwork in 1978.[26]

The only known literary source about the Demeter Sanctuary at Lepreon is Pausanias; in his days Lepreon was in poor shape, the temple was built of mudbrick and it contained no statue.[27] This information is not compatible with the archaeological data, as stone fragments of the superstructure, such as Doric column drums and capitals, architrave blocks and frieze fragments were found around the peripteral temple in the city.[28] Unfortunately, although previous scholarship has identified the Lepreon Temple as the Temple of Demeter based solely on Pausanias' description, this cannot be conclusive; no epigraphical or other testimonia have been found and no finds from the sanctuary are known.[29] Konstantinos Zachos has, rather convincingly, argued that the peripteral temple on the acropolis of the city belongs to Zeus Lykaios.[30] Moreover, it is possible that the actual Temple of Demeter, seen by Pausanias, was situated at a recently excavated site at Lepreon, as

[24] Wurster 1973, 209.
[25] Yalouris 1971, 11–18; 1973, 151–153.
[26] Results of this fieldwork were published in Knell 1979 and 1983a.
[27] Paus. 5.5.6. It should be noted that Pausanias (5.20.9) was misled in describing the red colour with painted joints on the interior surface of the Philippeion's cella as mudbrick construction.
[28] See Knell 1983a, 120–129. Croncite (1997, 426) points out that no remains of cella walls have been found; he interprets their absence either due to their reuse or due to the fact that the walls were, indeed, built with mudbricks; this would be in accordance with Pausanias' description. Though unusual this would not be unparalleled. Most probably, the Temple at Kardaki (Johnson 1936, 46) and the Temple of Apollo Zoster at Vouliagmeni also combined cella walls built of mudbricks with peristases constructed of stone (*contra* Kourouniotis 1930, 35–36). Quite surprisingly, the 4th-century temple at Oropos combined both a Doric *prostasis* constructed of limestone and cella walls built of mudbricks (Petrakos 1968, 101–105). The cella of the 4th–3rd century peripteral temple at Kallion was also of mudbrick construction (Themelis 1983, 237–238).
[29] Doubts about this identification have also been raised by Panagiotis Pyriovolis (1998, 114). Dörpfeld himself admitted that he couldn't determine to which god the temple was dedicated: Dörpfeld 1892, 259–260.
[30] Zachos 2011.

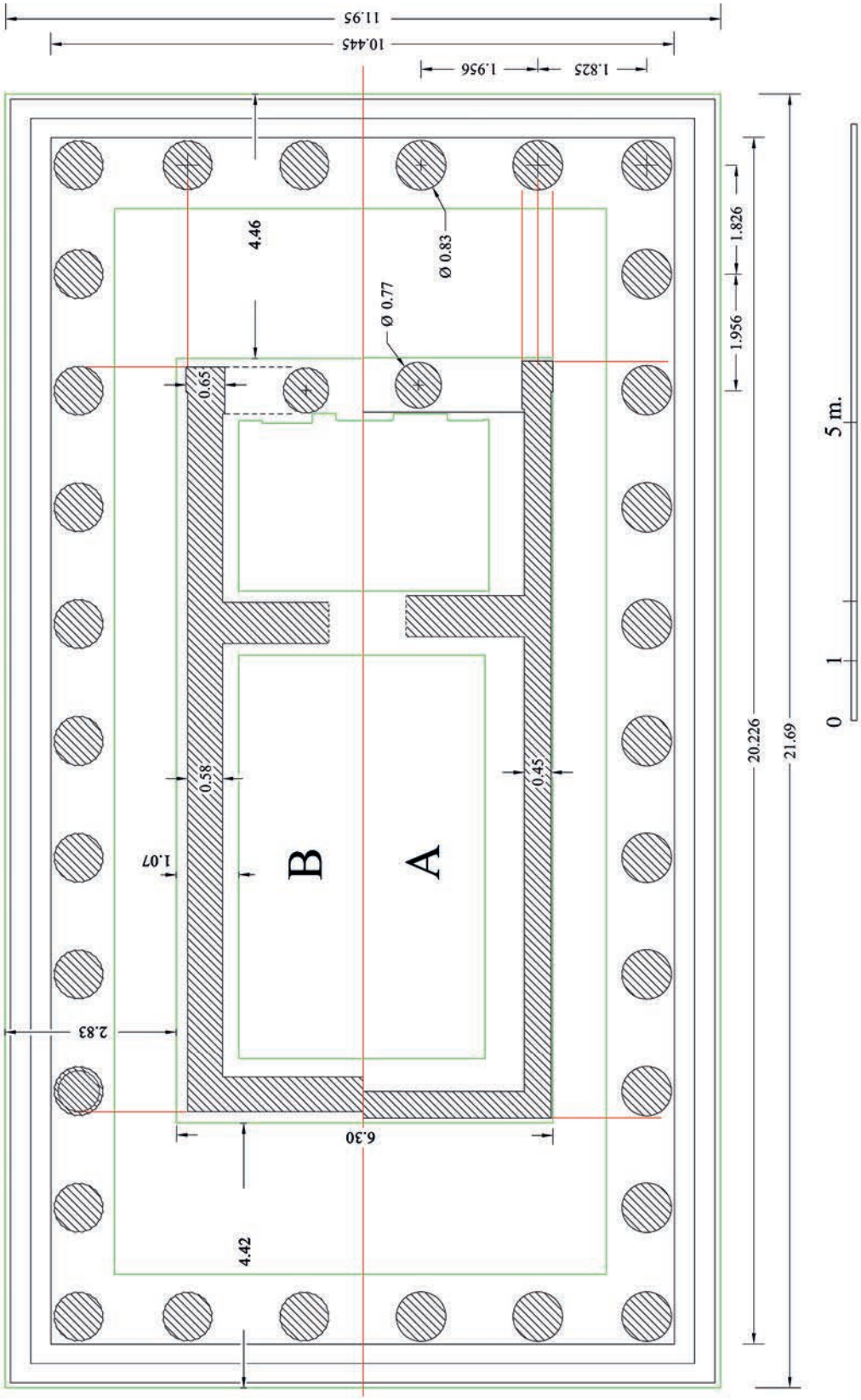

Fig. 5. Plan of the so-called Temple of Demeter at Lepreon. A: after Knell 1983a, 131; B: after Kanellopoulos. Red is for axes; green stands for outline of foundations.

presented recently by Xeni Arapoyianni.[31] We address conventionally the Leprean acropolis peripteral temple as the Lepreon Temple.

The Lepreon Temple is dated based on the architectural material to the 4th century BC; no earlier temple seems to have existed on the site.[32] It is poorly preserved at the level of foundations and part of the *krepis*. A peripteral temple with 11 by 6 columns stood on these foundations.

The remaining foundations and the few members of the temple's superstructure laying on the site of the sanctuary provide some information about its form. The lower diameter of the *peristasis* column is 0.83 m, and of the *pronaos* columns 0.77 m (*Fig. 5*). The interaxial column spacings are known based on the dimensions of the triglyph frieze, while Z-type clamps have been used.[33] No features from the frieze of the *pronaos* are known, and as such the distances between the columns and *antae* of the *pronaos* can only be hypothesized. Knell reconstructs excessively thin cella walls (0.45 m) which result in Ionic correspondence of the cella relative to the *peristasis*. In his text it is stated that the foundations of the cella wall are 1.00–1.04 m thick.[34] Knell assumes that the axis of the cella's lateral wall corresponded to the axis of the second column—in the Ionic manner—and that, consequently, there would be space for a cella wall that would be only 0.45 m thick.[35] In short, Knell argues that the thickness of the—very thin—cella wall is dictated from its assumed axis (*Fig. 5A*). The latter would then stand on the edge of the extant, 1.00 m-thick foundation. No explanation is offered for the Ionic correspondence of the cella relative to the *peristasis*.[36] In order to support his reconstruction, Knell draws analogies with corresponding proportions in the Temple of Athena Alea in Tegea. In this temple the ratio of the lower diameter of the *peristasis* columns: thickness of cella wall is 1.55 m: 0.89 m, or 1.74:1.[37] The corresponding proportion at Lepreon would result in a ratio of 1.844:1, which, as Knell argues, is close to the one found in Tegea. In most temples the corresponding ratio varies between 1.30:1 and 1.60:1, with a maximum ratio of 1.63:1, 1.74:1, 1.76:1 found in the Temple of Athena Alea in Tegea, and the Temples of Zeus in Nemea and Stratos (*Table 1*, proportion *peristasis* L.D.: wall thickness). In fact, Knell's ratio of 1.84:1 in Lepreon is considerably larger than the maximum corresponding ratio of 1.74:1, found at Tegea.

Furthermore, the hypothetical wall thickness of 0.45 m would have resulted in *antae* that would each be approximately 0.52 m wide on the front. The lower diameter of the *pronaos* column would then be approximately 1.5 times the width of the *anta*. This ratio is, as in Knell's reconstructed plan of the Temple of Apollo at Thebes (see below), unprecedentedly large. In fact, it is an excessive 25% larger than the largest known proportion of its kind. It is displayed systematically that during the 4th century the ratio lower diameter of *pronaos* column: *anta* width is a maximum 1.22:1 (In *Table 1*, proportion *Pronaos* L.D.: *anta* width).

In our opinion, the lateral walls would be approximately 0.58 m thick. The *anta* would then be approximately 0.65 m wide on the front. They would be combined with the *pronaos* columns that have a lower diameter of 0.77 m. Thus, the corner contraction of the spacings in the Doric *pronaos* would be reduced with *antae* that are narrower than the columns, as demonstrated above. Ratio lower diameter of *pronaos* column: *anta* width would then be a reasonable 1.18:1.

The scheme offered in our plan (*Fig. 5B*) is overall more logical. The thickness of the cella's foundations can accommodate both the wall and a *toichobate* course. Moreover, the wall with a thickness of 0.58 m and almost axially positioned relative to its foundations, results in a cella that conforms perfectly to the Doric "*Einbindung*". Had the *toichobate* course been smaller, the cella could be only slightly wider than three interaxial column spacings (6–7 cms on either side), as in the Temple of Aphaia on Aegina, the Metroon in Olympia (above), and the Temples at Gortyn, Ptoion and Thebes (below), which practically conform to the Doric canon with negligent declination from the latter. The outer width of the cella is reconstructed as ± 5.88–± 6.00 m (6.32 m according to Knell), thus being the narrowest known cella after the Temple of Apollo at Ptoion (see below). The same cella width of 6.00 m is reconstructed in the Temple of Dionysos in Eretria, which also presented perfect Doric correspondence.[38]

B. The Temple of Asclepios at Gortyn

This is yet another peripteral temple in the Peloponnese that lacks the *opisthodomos*. In addition to the *in situ* remains of the foundations, only a few *krepis* blocks and fragments of

[31] Arapoyianni 2018.
[32] *Contra* Rohn & Heiden 2009, 351.
[33] Knell 1983a, 117–119, 128, fig. 10.
[34] Knell 1983a, 120. In October 2015 we measured the remains of the so-called Temple of Demeter, by simple means, namely measuring tapes and plumb. The dimensions 2.83 m, 4.42 m and 4.46 m in our *Fig. 5* are the average distances in these areas of the construction, with a discrepancy of + 0.03 m. All other figures in the same image are by Knell 1983a, 131, fig. 12.
[35] Knell 1983a, 136.
[36] Boussios (2009, 146) also questions Knell's reconstruction with Ionic correspondence.
[37] This proportion is not compared with the corresponding ratio in other temples.
[38] Auberson 1976, pls. 2 & 5.

Fig. 6. The construction of the foundation of the Temple of Asclepios as seen from SE, in November 2015. Photo by C. Kanellopoulos.

the fluted column shafts have been discovered.[39] Plan dimensions of the foundation are 13.12 m and 23.49 m for width and length accordingly.[40] The foundations in the west part of the temple stand at a level of 3.60 m above the remains of the foundations in the east part of the construction (*Fig. 6*). Foundations in the east are deeper and consistently thicker in order to resist the pressure of the slope along the west bank of the Loussios/Gortynios river, in the fashion of a subterranean retaining wall. According to Pausanias, the Temple of Asclepios, which was supposed to have been built in Pentelic marble, housed a statue of Hygeia by Scopas and Alexander the Great's cuirass and spear.[41]

The letter shapes on the blocks in the foundations, the *toichobate* moulding and a clay *antefix* attribute the construction of this building to the first half of the 4th century BC.[42]

The Temple of Asclepios at Gortyn almost repeats the Temple of Asclepios at Epidauros (380 BC) in terms of size and plan scheme.[43] The overall plan is 2 columns shorter than

[39] The plan offered by Martin and Metzger (1942/1943, pl. 26) is in very small scale. The published axonometric view of the foundations (Ginouvès 1956, 104, fig. 1) is in fact 80% smaller than the scale in the same image. Knell's (1983b, fig. 5) ground-plan is printed 3% compressed along the longitudinal axis. As a result, the overall length of the construction appears 0.75 m shorter than the corresponding dimension provided by Knell in the same figure. In November 2015 the extant remains of the temple's foundations were surveyed by the authors with a TOPCON GR-3 GPS receiver.

[40] Cf. overall 13.44 m x 23.99 m (Ginouvès 1956, 105), 13.55 m x 27.09 m (Martin & Metzger 1940/1941, 280) and 13.23 m x 23.45 m (Knell 1983b, 215, 216, fig. 5) for the width and length respectively.

[41] Paus. 8.28.1. No marble members of the temple have been discovered. Martin and Metzger (1942/1943, 336) are cautious about the temple being constructed of marble.

[42] Martin & Metzger 1942/1943, 338.

[43] *Stylobate* dimensions in the temple at Epidauros are reconstructed as 12.03 m x 23.28 m (Roux 1961, 92). The Temple of Dionysos in Eretria, only slightly smaller than the temple of Asclepios at Gortyn,

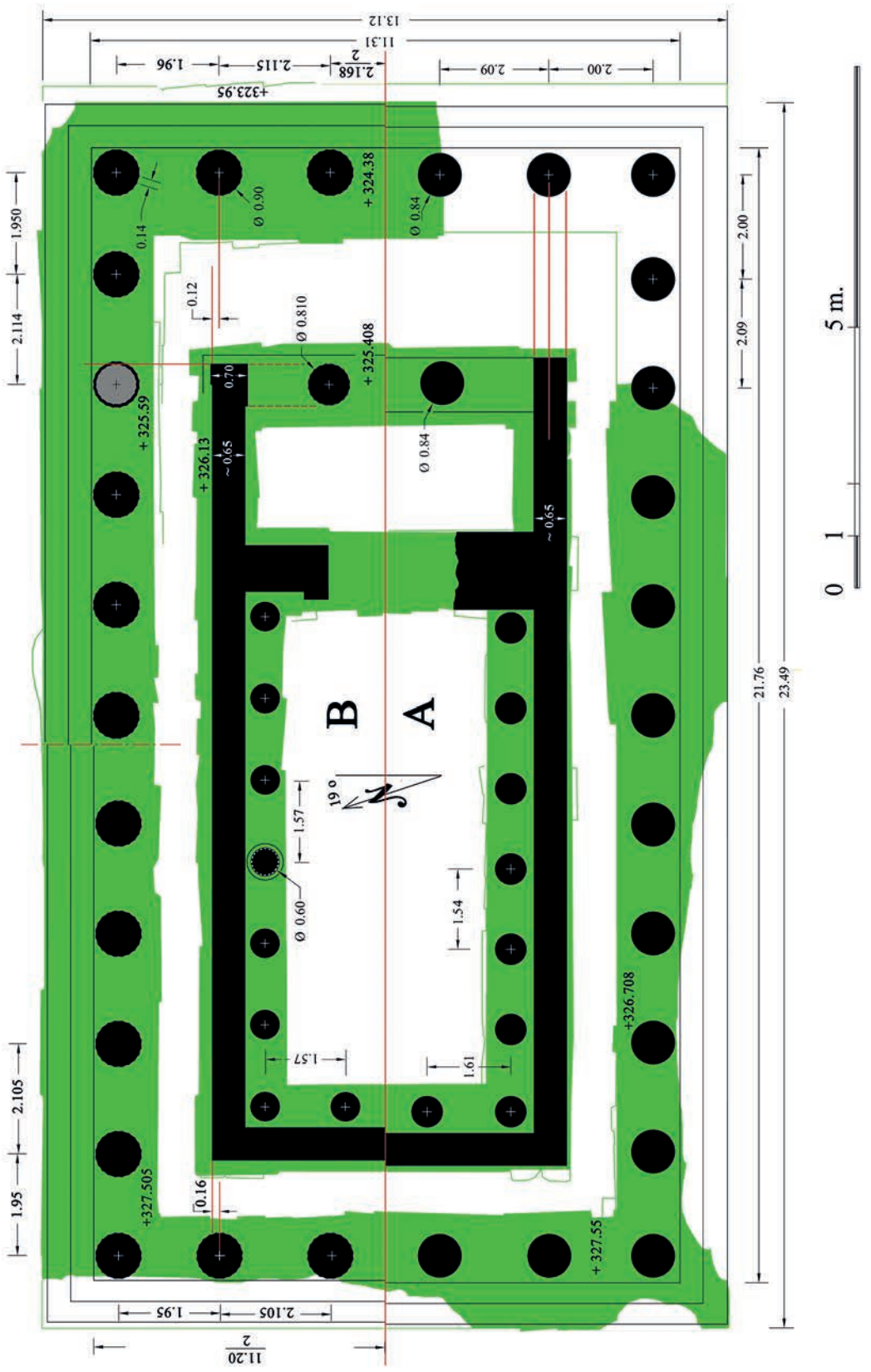

Fig. 7. Reconstructed plan of the Temple of Asclepios at Gortyn. A: After Knell 1983b, 216, fig. 5; B: after Kanellopoulos & Petrakis. Green is for the extant foundation; red stands for axes.

the canonical, 13 column-long, *pteroma*. The size of the cella is not reduced accordingly. As a result, the *opisthodomos* is entirely omitted due to the lack of space and the west flank of the peristyle becomes excessively shallow. Eventually, the cella proper in the temples of Epidauros and Gortyn is of the same size with those cellas of the "canonical", symmetrical plan attested during the 4th century at Kalydon and Molykreion; (cf. *Figs. 1B.2, 1B.3 with 1C.7 and 1C.8).*

As in other temple plans by Knell, the columns of the *pronaos* have, due to oversight, the same lower diameter with these columns of the *peristasis*, the latter stand away from the edge of the *stylobate*, while the cella wall stands on the outer edge of its foundation. Though Knell, in his text, calculates the angular contraction to be approximately 0.15 m, his reconstructed plan of the temple demonstrates a corresponding contraction of only 0.09 m. The ratio of the reconstructed interaxial spacings flanking the centre to the corner interaxial spacing is 2.09 m: 2.00 m or an average 1.043:1. This is well below the range of the known corner contractions.[44] Following the data above and the reconstructed position of the features, the axis of the cella wall would be awkwardly aligned with the axis of the second column in the Ionic manner.[45] In Knell's plan, the cross wall of the doorway appears to occupy the full width of its 1.50 m thick foundation (*Fig. 7A*). The hypothetical interior colonnade is reconstructed behind this thick cross wall. Indeed, the foundations of the cella proper are an average of 1.65 m thick whilst the foundations of the *antae* in the *pronaos* are around 1.10 m thick. This allows for the reconstruction of interior columns that would be almost attached against the cella walls.

In our opinion, the columns of the *peristasis* would have had a lower diameter of approximately 0.90 m and—contrary to Knell's reconstruction—they should stand closer to the edge of the *stylobate* (*Fig. 7B*). Our suggested plan of the façade involves a central interaxial spacing of approximately 2.168 m, two interaxial spacings flanking centre that are each 2.105–2.115 m long and two corner spacings, each 1.95–1.96 m.[46] Our ratio of reconstructed interaxial spacings the centre to the corner interaxial yields a reasonable angular contraction of 1.08:1. The normal interaxial spacings of the front and flanks would then be identical (2.114 m), as they should be during the 4th century BC. Even interaxial column spacings of 2.115 m on the front and rear would be combined with a slightly narrower *stylobate*; the width of the latter could then be closer to 11.20 m.

The columns in the *pronaos* should have a lower diameter of 0.81 m, or approximately 10% smaller than those columns in the *peristasis*. The *anta* could, therefore, be 15% smaller or 0.68–0.71 m wide on the front, following the canon, as explained above and as demonstrated in *Table 1*. The lateral wall of the cella would have been 0.63–0.65 m thick. The width of the foundations can accommodate a plain or moulded *toichobate* course.[47] Departure from the Doric "*Einbindung*" is—on either side—0.12–0.16 m. Had the *pronaos* columns stood in the middle of the foundations, the front of the *anta* jamb would correspond to the tangential line of the upper diameter in the third columns of the flanks.

The order of the interior colonnade remains unknown. The reconstructed columns, behind a reasonably thick door wall, are evenly spaced on all sides. During this period interior columns could have been Ionic or, most probably, Corinthian, as noted above. Indeed, in our reconstructed plan, the thicker foundations of the cella can accommodate both a projecting *toichobate* on the exterior and Attic bases of interior columns set against the cella walls.[48]

C. The Temple of Apollo Ismenios at Thebes

The Sanctuary of Apollo Ismenios was known from Pausanias' reference but its location was unknown until Antonios Keramopoullos's excavations in 1910. Keramopoullos found traces of two successive temples, below which were six Mycenaean

with *euthynteria* dimensions 12.40 m x 23.05 m, is also modelled after the Temple of Asclepios in Epidauros (Auberson 1976, 65–67). With deeper steps in the east and west sides the interaxial column spaces on the flanks would be only slightly shorter than 2.07 m (versus 2.00 m for the interaxial column spaces in the narrow sides of the *peristasis*).

[44] During the 4th century the same ratio varies between 1.07:1 and 1.14:1. In the Temple of Hera at Argos, the same ratio is 1.094:1; in the Metroon at Olympia, 1.104:1; in "Demeter" at Lepreon, 1.072:1; Asclepios at Epidauros, 1.09:1–1.14:1; Apollo at Delphi, 1.116:1; Alea at Tegea, 1.07:1; Dionysos at Eretria 1.08:1; "Hippolytos" at Troizen, 1.11:1; Zeus at Nemea, 1.07:1; Nikias Monument at Athens 1.077:1; Dodekatheon at Delos, 1.16:1; Zeus at Stratos, 1.11:1 (Østby 2014, 333; Auberson 1976, pl. 2). In the Temple of Apollo at Thebes the same ratio is reconstructed 1.108:1 and in the Temple of Apollo Ptoios 1.11:1 (below).

[45] Sioumpara (2011, 250) is cautious about the temple's Ionic correspondence of the cella relative to the *pteroma*.

[46] Larger central interaxial spacings possibly occur in the Temple of Asclepios at Epidauros, the Temple of Apollo at Delphi, the Temple of Athena Alea in Tegea (cf. equal interaxial spacings across the façade in Pakkanen 2013, 103, 107), and the Temple of Zeus at Nemea (Østby 2014, 333).

[47] Martin & Metzger 1940/1941, 280; indeed, Martin and Metzger (1942/1943, 338) mention fragments of a moulded *toichobate* course discovered in the ruins of the temple. The profile of the moulding resembles the ones in the Temple of Poseidon at Cape Sounion and in the Tholos at Delphi.

[48] None of the interior columns is preserved in the Temple of Asclepios at Epidauros; the blocks of the wall maintain evidence of the interior colonnade, similar to those found in the Tholos at Delphi (Roux 1961, 112–113, fig. 25).

tombs, and he identified the sanctuary as the one of Apollo Ismenios.[49] The earliest building was built with evident disregard of these tombs.[50] The sanctuary lay on the Ismenios hill between the Helektrai gates and the St. Luke cemetery. The identification is most probable; although no direct evidence was found in the course of the excavations, a bronze inscribed *prochous*, dedicated by a certain Polykleitos to Apollo Ismenios apparently came from the vicinity of this hill.[51] The earliest reference to Apollo at Thebes is on the rim of a bronze vessel said to have come from Thebes, dated in the first quarter of the 7th century, and calling the god Pythios. The *polis* of Thebes seems to have been founded in the Late Geometric period.[52]

The site had been in use since the Mycenaean period, as indicated by Mycenaean pottery sherds found in the excavation and the tombs opened at the foot of the hill. Cult activity is attested on the site from the beginning of the Geometric period, when the cult statue could be housed in a small-sized temple, probably in the form of single small *sekos*, constructed of mudbricks.

Keramopoullos reconstructed the following sequence: a) a Geometric temple and its destruction believed to be connected with the fire mentioned by Pausanias, as indications were found of destruction dating to 700 BC,[53] b) a second one, built during the 7th or 6th century BC, c) a third temple, to which the surviving foundations belong, begun possibly in the first half of the 4th century. It would have begun during the period of the Theban Hegemony, and left unfinished when Thebes lost its power: this would be the temple Pausanias saw.[54] However this identification of the temple's building history is insecure.[55]

The fullest description of the Ismenion is given by Pausanias (9.10.2–3): it stood on a hill to the right of the Helektrai gates, beside the river Ismenios, that is, south-east of Kadmeia. At the entrance, Pausanias saw statues of Athena and Hermes Pronaioi by Skopas and Pheidias respectively. Behind them was the temple, with a cult image attributed by Pausanias to Kanachos. These statues, it may by suggested, might reflect three periods of heightened activity, late in the 6th century BC, in the second half of the 5th, and towards the middle of the 4th.[56]

According to Herodotos, it was an oracular shrine, as one could obtain an oracular response, by reading the behaviour of the burning sacrifice. During the Classical period, the collection of votive tripods mentioned by both Pindar and Herodotos was the most notable feature of the sanctuary. Herodotos notes that a golden tripod was said to have been dedicated by Kroisos. According to him Kroisos' gift to Amphiaraos was in his day at Thebes, in the Theban Temple of Ismenian Apollo, while three others bearing Kadmean characters, one of which—so the inscription claimed—had been dedicated by Amphitryon.[57] Pindar writes of the Treasure House of the Golden Tripods.[58] Pausanias noted with some surprise that he saw only a few tripods at the Ismenion. The Theban Daphnephoria procession may have ended at the sanctuary.[59]

The Ismenion was the principal sanctuary of the Archaic and later *polis*, adjoined the Herakleion, where the youth and the young men of Thebes received their military training, and Ptoion, as demonstrated below. Few things of the cult are known. The cult of Apollo Ismenios has elements imported from the Teneric Plain, between the Kabirion and Onchestos. This may have happened late in the 6th century BC.[60]

The cult complex at the Ismenion consisted of Apollo, Melia, and their son, the prophet Teneros, who are named by Pindar; to these names may be added Athena Pronaia.[61] Nikolaos Faraklas argues that only the pedimental sculptures of the Temple of Apollo have been discovered.[62]

Only the foundations at the west end and some suggestive cuttings on the bedrock at the east end of the peripteral temple at Thebes are preserved, which attest to a relatively large Doric temple. The dimensions of the *euthynteria* would be 22.83 m (N-S) and 46.25 m (E-W); the lower diameter of the *peristasis* columns is 1.60 m (unfluted). Only guesswork can be made with regards to the dimensions of the *krepis* and cella. The width of the *stylobate* can be estimated between 20.50 m and 20.54 m (or 70 Doric feet of 0.326 m each, after Knell),[63] depending on the projection of the *krepis* steps, with a 6 x 12 column *peristasis* layout. The interior width of the cella is 11 m; quite possibly this large span was divided with inner col-

[49] Keramopoullos 1917, 34–36.
[50] Schachter 1967, 3.
[51] Πολύκλετο[ς] ἀνέθεκε τὸπόλ[λ]ονι τόι Η[ι]σμενίοι. See Keramopoullos 1917, 35.
[52] Schachter 1992, 27.
[53] Paus. 9.10.5.
[54] Keramopoullos 1917, 66, 71–72.
[55] Aravantinos 2017, 223.
[56] Schachter 1981, 80.
[57] Hdt. 1.52; 5.59–61.
[58] Pind., *Pyth*. 11.6.
[59] Pind., *Pyth*. 11.4–5; Paus. 9.10.5. The Theban Daphnephoria of late in the 2nd century AD were associated not merely with Apollo, as in the past, but also with Herakles, the patron of the Theban *ephebeia*: his sanctuary with a gymnasium and a stadium adjoined the Ismenion, and the two together may have been used as the focus of the ephebic education at Thebes. Paus. 9.10.4.
[60] Shachter 1967, 4–5.
[61] According to Pausanias (9.10.6) Melia bears Apollo two sons: Teneros, to whom he gives the power of prophecy and Ismenios, who gives his name to the river, formerly called Ladon. See also Schachter 2016, 39; 1967, 4.
[62] Faraklas 1988, 270.
[63] Knell 1983b, 224, pl. 8, 225.

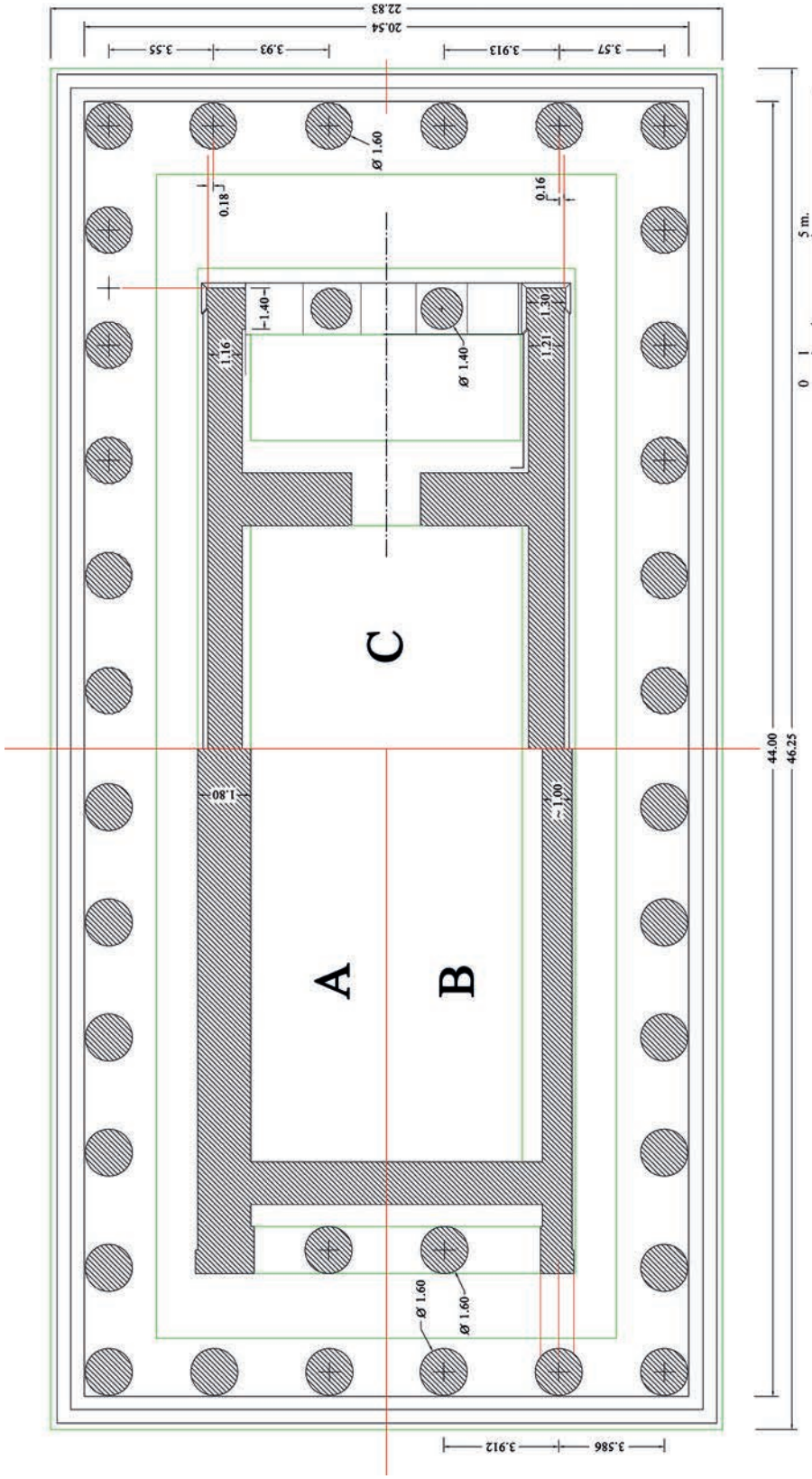

Fig. 8. Reconstructed plan of the Temple of Apollo at Thebes. A: after Keramopoullos 1917, fig. 37; B: after Knell 1983b, 224, fig. 8; C: after Kanellopoulos. Red is for axes; green stands for outline of foundations.

onnades.[64] Keramopoullos reconstructed *pronaos* columns that have a lower diameter identical to those of the *peristasis* (1.55–1.60 m) resulting in extravagantly thick walls (*Fig. 8A*). A Doric capital that matches the lower diameter of 1.60 m has the incised word ΕΞΩ on the top surface of its abacus. Keramopoullos assumed that the column shafts and capitals of the *peristasis* and the *pronaos* were of identical dimensions; as such, the column capitals of the *peristasis* must have been specifically marked with the word ΕΞΩ, so they could be placed in their proper positions on the outer column shafts and they would not be mixed with the *pronaos* colonnade. Anastasios Orlandos noted that the mark ΕΞΩ signified the corresponding, outer, side of the abacus so that the capital could be placed correctly on top of slightly tilting column shafts in the *peristasis*. Following Orlandos's hypothesis, the fronts of the column capitals of the *peristasis* were marked accordingly so they could be oriented correctly; the columns of the *pronaos* would be smaller, following the canon. Keramopoullos agrees with Orlandos's suggestion, however, in his ground-plan, he reconstructs *peristasis* and *pronaos* columns that have identical lower diameters of 1.60 m as explained above. In the same plan, the *anta* of the *pronaos* is illustrated larger than the *pronaos* columns, resulting in an excessively thick cella wall (thickness of 1.80 m).[65] Clearly, the width of 1.80 m is at extant foundation level and the cella walls above it must have been considerably thinner.

Knell agrees with Keramopoullos's suggestion which involves *pronaos* columns that should have had a lower diameter of 1.60 m and should have been perfectly aligned behind the *peristasis* columns (*Fig. 8B*). The interaxial column spacing in the *pronaos* would, therefore, have been equal to the corresponding spacing of the *peristasis* colonnade. Knell realized that the cella walls must have been considerably thinner than its 1.80 m thick foundations. He reconstructed a cella wall that is approximately 1.05 m thick and would stand on the outer edge of its foundations. This would have resulted in excessively thin *anta* jambs in the *pronaos*. After Knell, these should be approximately 1.15 m wide. The ratio lower diameter of *pronaos* column: *anta* width comes close to 1.50:1, which is unprecedentedly large (*Table 1*). In short, Knell combined thick *pronaos* columns with proportionally narrow *anta* jambs. The reconstructed position of the *antae* and, consequently, of the cella walls, is forced above the outer edge of the foundation course. The location of the *antae* relative to the second column of the front is awkwardly close to the Ionic correspondence.

In our opinion, each of the *pronaos* columns must have had a smaller diameter of approximately 1.40 m, or approximately 87% the size of those of the *peristasis*, as explained above (*Fig. 8C* and *Table 1*, ratio *Pronaos* L.D.: *Pteroma* L.D.). The *anta* of the *pronaos* must have been slightly narrower than 1.40 m, possibly 1.27–1.33 m wide, resulting in cella walls that would each be approximately 1.20 m thick. Had the lateral walls of the cella been considerably narrower than the *anta*—as in the Temple of Athena Alea in Tegea and in the Asclepios Temple at Messene—the cella walls could have been 1.10 m thick. After Knell, the interaxial column spacings flanking the centre should be 12 Doric feet long (or 3.912 m), using a foot standard of 0.326 m. In our plans, each of the reconstructed interaxial column spacings is 12 Doric feet (or 3.925 m), each foot measuring 0.327 m.[66] The corner interaxial spacings, after Knell, would be some 30 cm shorter, or 11 feet of the same unit.

Had the lateral cella walls been positioned axially relative to their foundation courses, there would be enough space for a *toichobate* course that would project approximately 0.15 m (*Fig. 8C* top).[67] In fact, the cella could be narrower, had the lateral wall stood deeper onto its foundations (*Fig. 8C*, bottom). The exterior width of the cella would, therefore, be between 0.23 m and 0.315 m larger than the added lengths of three interaxial spacings. The outer surface of the cella wall would, on either side, be less than 0.15 m (with a maximum 0.18 m) off the axis of the second column (*Fig. 8C*). The latter figures are smaller than the 0.25 m wide flute in the column shafts; departure from "*Einbindung*" is negligible.

D. The Temple of Apollo at Ptoion

The Sanctuary of Apollo Ptoios is situated east of Copais and Acraephnion, north of Lake Yliki, on the western slopes of Mount Ptoion, at the site of Perdikovrisi, at an elevation of approximately 370 m above sea level. Among the many ancient

[64] Østby 2014, 330, n. 85. Definitive results are expected by David Scahill who kindly shared his thoughts with the authors and is currently studying the architecture of the Temple of Apollo. On the shortened *opisthodomos* see Dinsmoor 1950, 218. Scahill ('New research on the Temple of Ismenion Apollo at Thebes, Boiotia: Thebes Excavation Synergasia Project', Archaeological Institute of America, Annual Meetings, San Francisco, January 2016) questions the *opisthodomos* arrangement.

[65] Keramopoullos 1917, 45; Orlandos 1958, 162.

[66] Doric foot with a length of 0.326 m (Dinsmoor 1950, 195), 0.3275 m (de Waele 1980, 399), 0.3270 m (Wilson Jones 2000) and 0.32723 m (Pakkanen 2013, 2). On more variations, see Pakkanen 2008.

[67] In the temple at Bassae, which has an *anta* width of 0.93 m, the projection of the *toichobate* course is 0.092 m (Cooper 1996, 178, 188). In the Temple of Apollo at Delphi, which has an *anta* jamb that is 1.25 m wide, the projection of the moulded *toichobate* is overall 0.165–0.171 m (Amandry & Hansen 2010, 199, fig. 4.6). In the Temple of Athena Alea in Tegea the projection of the *toichobate* is estimated 0.103 m (Pakkanen 2013, 104) and 0.15 m (Østby 2014, 327).

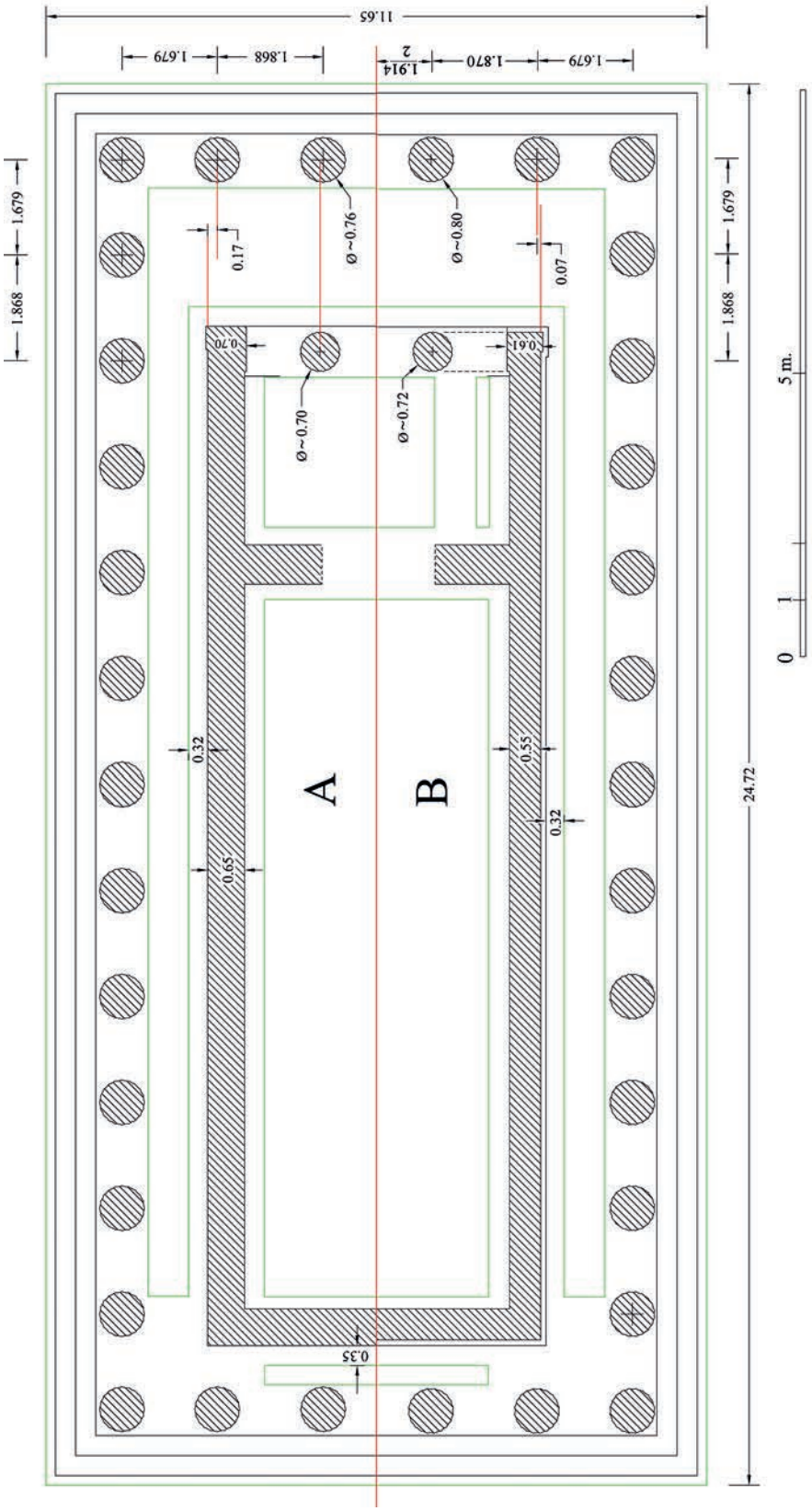

Fig. 9. Reconstructed plan of the Temple of Apollo at Ptoion. A: after Orlandos 1915, fig. 18; B: after Kanellopoulos. Red is for axes; green stands for the outline of foundations.

authors referring to it, Pausanias reports that it was originally an oracular sanctuary of Ptoios, a local hero, while Herodotos mentions the sanctuary as the oracle of Apollo Ptoios.[68]

The site of the ancient Temple of Apollo at Mount Ptoion was first excavated by the French Archaeological Institute under Maurice Holleaux in 1885–1888 with a supplementary excavation taking place in 1891, revealing the foundations and a few of the architectural members of the temple. In 1885 a short paper on the temple's architecture offers dimensions and numbering of architectural finds.[69] The excavations were resumed in 1934–1936, but meanwhile, Orlandos published in detail the temple's architecture (based on the available data) in *Archaiologikon Deltion*, providing classification of the finds in two different architectural phases and offering a groundplan, a section, photographs, and drawings of its architectural members.[70] Further research was undertaken by Pierre Guillon, who studied the tripods, and Jean Ducat, who wrote a fundamental study of the *kouroi*. Cleaning, and additional limited site research took place in 1966. Ducat also summarized the latest excavations and made expedient comments on reconstituting the physical appearance of the sanctuary;[71] however, nothing has been published on the architecture since Orlandos's work in 1915.

The site of the sanctuary contains traces of occupation dating from the Late Neolithic/Early Helladic to the Mycenaean period. By the Late Geometric period the area was being used as a place of worship, as indicated by pottery finds.[72] The Ptoion had its heyday in the Archaic period, as indicated by the votive offerings, and mainly by the impressive number and quality of the *kouros* statues found there. The identity of the deity venerated there, i.e. the cultic name Apollo with the epithet Πτῷος (Ptoios/Ptoieus), has been attested on inscriptions dating to 640–620 BC.[73] The earliest testimony regarding to the identity of the god is provided by a votive inscription to Apollo Ptoieus, on a *kore* of about the third quarter of the 7th century.[74] Prophets of Apollo Ptoios are named in inscriptions that date from the 4th–early 1st century BC and again in the 3rd century BC.[75] The sanctuary maintained its high standing until the Persian Wars, as indicated by the episode of the visit of Mys the Carian. The oracle of Apollo Ptoios is also attested from early in the 5th century BC by Herodotos, Plutarch and Pausanias. The decrease in the number of votive offerings, both private and public, during the 5th and the first half of the 4th century BC might suggest a dwindling of the sanctuary's importance and its influence. In 335 BC the Ptoion probably shared the fate of Thebes and was destroyed. In the Hellenistic period, the sanctuary appears to have been the official oracle of the Boeotian League. According to Albert Schachter, taking into account that the beginning of the period of intense activity in Ptoion, evident from the bulk of *kouroi* and the other finds, coincides with the destruction of the second Temple of Apollo in Delphi, the Ptoion Sanctuary could have been benefitted from the partial disruption of activity at Delphi.[76]

The sanctuary is of an intriguing design, as it is built on three levels on the slope, next to the Perdikovrysi spring, whose waters were conveyed to a cave on the terrace below by means of a channel.[77] It is clear that water had an important role at the Ptoion, possibly used for divination.

Also on this terrace was the main the Doric temple under consideration, which was constructed in the 4th century BC. Orlandos conjectured that it probably replaced an earlier wooden temple from 7th century BC, worn parts of which had been replaced during the second half of the 6th century with limestone.[78] The 4th-century BC temple is preserved poorly, as it was made up of local highly friable limestone. It is a Doric peripteral temple, measuring 11.65 x 24.72 m at the *euthenteria*, with 6 x 13 columns at its *pteroma,* a deep distyle *in antis pronaos* without an *opisthodomos*, and an extravagantly oblong cella. In front of the temple lay the foundations of a rectangular structure measuring 4.3 x 6.7 m; according to Orlandos this was either an altar of Apollo or a *naiskos* of Athena Pronaia. On the lowest level was a series of cisterns which apparently trapped water flowing from above. No satisfactory explanation has yet been given for the structures on the intermediate level.[79]

Only fragments of the fluted column shafts, one triglyph jamb and fragments of the cornice with *mutula* and *guttae* have been discovered. The lower column diameter is calculated by Orlandos to be *c.* 0.75 m.[80] The interaxial column spacings are estimated to be 2.686 m and 2.679 m (at the corner) on the basis of the lengths of one *mutula* and *guttae*. Orlandos

[68] Paus. 9.23.6; Hdt. 8.135. For a convenient and complete collection of the sanctuary's literature, published inscriptions, evidence from excavations and bibliography see Schachter 1981, 52–73. For a recent account on the topography see Livieratou 2011.
[69] Ducat 1971, 7–27.
[70] Orlandos 1915.
[71] Guillon 1943; Ducat 1971.
[72] Ducat 1971, 51–55. On the epithet of Apollo at Ptoion see Schachter 1981, 55–56.
[73] For a list of the inscriptions see Schachter 1994, 11.
[74] Schachter 1967, 1; Ducat 1971, 89.
[75] Hdt. 8.135; Plut. *De def. or.* 5 (411F–412A); Paus. 9.23.6; Schachter 1981, 1, 54, 65.
[76] Schachter 2016, 158.
[77] Touloupa 1970, 117; Ustinova 2009, 276.
[78] Orlandos 1915, 96–97.
[79] Orlandos 1915, 100; Schachter 1967, 1.
[80] Quite strangely, Orlandos reconstructs the arris of the flute—instead of the channel of the flute—in the front of the column shaft. The columns of the Temple of Athena Nike were also reconstructed with the arris in the front of the shafts during the *anastylosis* works by Orlandos (1947/1948, 25, fig. 17).

specifically reconstructs these features in the corners of the entablature; he also noted that the traces of the pavers of the *peristasis* are at a distance of 0.32 m from the edge of the foundation of the cella's lateral wall.[81] Orlandos then reconstructed the lateral wall of the cella against the line of the traces and along the longitudinal axis of the foundations. The wall, he concluded, must have been 0.65 m thick.[82] If this much is accepted, then the front of the *pronaos anta* would have been approximately 0.70 m wide. This dimension would be almost equal to the reconstructed lower diameter of the *pronaos* columns. In the plan by Orlandos, features appear thicker than they were calculated. The ground-plan of the temple was redrawn following Orlandos's calculations and it is presented in *Fig. 9A*. The cella, according to Orlandos's calculations, would have been 0.34 m larger than the sum of three interaxial column spacings.[83] Due to this departure from the Doric "*Einbindung*", Knell argues that the plan of the Temple of Apollo at Ptoion falls into the system of Ionic axes.[84]

In our opinion, the lower diameter of the *peristasis* columns could have been slightly larger than the dimension calculated by Orlandos, quite possibly closer to 0.78 m, with a maximum diameter of 0.80 m also possible. Furthermore, the columns should stand closer to the edge of the *stylobate*. In our plan (*Fig. 9B*), the surface of the column is within a reasonable distance of 0.05 m from the edge of the *stylobate*, whilst the corresponding dimension in Orlandos's plan is closer to 0.07 m. This would increase the axial width and length of the colonnade to 9.012 m and 22.04–22.05 m. The thicker foundations of the east flank of the peristyle may indicate more projecting steps in the front portion of the *krepis*. It would also have been possible that the lengths of entablature features varied, that triglyphs and metopes in certain areas of the entablature were each 1 mm longer than the corresponding dimensions offered by Orlandos; the interaxial column spacings flanking the centre could be 1.870 m. The central spacing would, then, be slightly wider (approximately 1.914 m), as in the temples at Delphi, Tegea, Nemea, and, most probably, Gortyn.

The diameter of the *pronaos* columns would have been approximately 90% of those in the *peristasis*, or approximately 0.72 m. The front of the *antae* would be some 15% narrower than the lower diameter of the *pronaos* columns, or 0.61 m wide. The wall behind the *antae* would, therefore, be approximately 0.55 m thick.[85] The remaining space between the wall surface and the extant wear line of the pavers (the latter is 0.32 m from the edge of the foundation) would accommodate the protruding part of a *toichobate* course. The lateral wall of the cella need not be positioned *exactly* along the axis of its foundations. Indeed, Orlandos noted that the rear wall did not stand on the axis of its foundations. This wall sits behind the line of the pavers which, in this area of the construction, is at a distance of 0.35 m from the outer edge of the foundations.

In our reconstructed plan (*Fig. 9B*) the departure from Doric "*Einbindung*" is 0.06–0.07 m on either side; this is insignificant, considering that the flute in the column shaft would have been around 0.13 m wide. In fact, the discrepancy of 0.07 m from the "*Einbindung*" would be almost eliminated had the lateral wall of the cella been built on top of a wider *toichobate* course. With an exterior cella width of 5.80 m (5.99 m after Orlandos), the Temple of Apollo at Ptoion becomes the narrowest known Doric cella.

E. The "Temple of Hippolytos" at Troizen

The so-called Sanctuary of Hippolytos[86] at Troizen is located in the vicinity of the city's Asclepieion. It was established to the west of the Chrysoroos river, outside of the city walls, about 670 m from the city's agora, built on a terrace, at an altitude of 50 m above sea level.[87] The sanctuary and temple were first explored by Philippe-Ernest Legrand at the beginning of the 20th century,[88] while Gabriel Welter excavated the temple's foundations and in 1941 he published the extant remains of the architecture;[89] he also identified the building as the Hippolyteion, described by Pausanias.[90] Welter offered a ground-plan of the actual state and a reconstruction of the temple's plan. He failed to demonstrate the contraction in the intercolumniations of the corners; as such all interaxial column spaces appear equal. Nevertheless, he notes the similarities of the abbreviated *opisthodomos* with the corresponding spaces in the Ionic Temple of Athena at Priene and, most importanty, in the Temple of Apollo Ismenios at Thebes. Some four decades after Welter's investigations, Knell studied the

[81] Orlandos 1915, 106–107.
[82] The ratio for the lower diameter of the *peristasis* columns to the thickness of cella wall would then be equal to 1.16:1, whereas the corresponding ratio is normally above 1.38:1. See in *Table 1*.
[83] Orlandos's publication dates from 1915, before Riemann's (1935) description on the Doric axial "*Einbindung*".
[84] Knell 1973b, 104, fn. 58.
[85] However small a wall thickness of 0.55 m appears, it is consistent with the corresponding thickness in the cella wall of the Metroon at Olympia (0.51 m); in the latter monument the lower diameter of the *peristasis* columns is 0.85 m.
[86] Hippolytos's cult in the temple has been questioned. Knell (1978, 397) does not accept him as the deity worshipped, while Woodward (2012, 458) refers to it as the Unknown Temple at Troizen.
[87] Oikonomidou 2015, 16.
[88] Legrand 1905, 281–286.
[89] Welter 1941.
[90] Paus. 2.32.1.

architecture of the building in detail, providing a new groundplan and correcting some of Welter's misreadings.[91]

The sanctuary was established in the area of an Early Helladic settlement. Pausanias describes the temple as *epiphanestaton* and mentions a temple with an ancient statue inside.[92] The cult was already established in the Geometric period, in the form of a small *temenos* inside a polygonal *peribolos* wall, and continued through the Roman period. Fragments of a clay *sima* prove that a building had been standing since the 5th century BC in the sanctuary.[93] The peripteral temple dates to the 4th century BC, and so do a monumental *propylon* and a fountain. The *temenos* was surrounded by a five-sided *peribolos* of polygonal masonry, with several construction phases; a small temple stood on its west edge. In the sanctuary, there also was an altar, a built underground room and a building with multiple uses, among them dining. The sanctuary had been destroyed by an earthquake following the eruption of the Methana volcano in the middle of the 3rd century BC; restoration works were made during the Roman period.[94]

Most of the finds from the old French and German excavations are considered missing/lost today, although some inscriptions are in Episkope. From the inscriptions, it is made clear that more deities and heroes received a cult in the sanctuary, including Asclepios, Hygeia, Herakles and Aphrodite. The cult of Asclepios, in particular, was intense and Hippolytos also had a healing role, which may be due to the connection of Hippolytos and Asclepios in cult and myth. The finds and the underground building indicate a chthonian cult, while it was also connected with rites of passage.[95]

The peripteral temple north of the Sanctuary of Hippolytos at Troizen is conventionally termed the "Temple of Hippolytos". The construction is poorly preserved; only its poros foundations are extant, measuring 31.85 m by 17.35 m. On them stood a Doric peristyle temple with *pronaos*, *sekos* and a narrow *opisthodomos*. The *peristasis* is comprised of 6 x 11 columns on a three-stepped *krepis*.

The *krepis* and *peristasis* are preserved to *euthynteria* level. The foundations of the cella are 0.36 m above *euthynteria* level.[96] The dimensions of the *krepis* and intercolumnar spaces can only be conjectured. In 1978, Knell offered an analysis of the plan and the *krepis*. He dates the building to the second half of the 4th century BC and he adds that the plan is "indecisive" and that, although the quality is not excellent, it commands attention. Knell concludes—as Welter did—that the peripteral temple north of the Hippolyteion belongs to the abbreviated or "short" type, with an excessively shallow *opisthodomos* following the Temple of Asclepios at Epidauros that has entirely omitted its *opisthodomos*.

With regards to plan and details of the design, the following are noted by Knell (*Fig. 10*). The length of the *stylobate* is calculated to be 29.463 m or 100 Ionic feet, each foot measuring 0.2946 m.[97] The *stylobate* course itself can be reconstructed as 1.18 m—or 4 Ionic feet—wide. Upon this course would have stood the *peristasis* columns with a maximum lower diameter of 1.18 m. Indeed, one column drum with a diameter of approximately 1.20 m that was found east of the temple can be attributed to the temple.[98]

The average normal interaxial column spacing would be 2.884 m. This hypothesis is correctly based on the lengths of the *euthynteria* blocks which in turn conform to the rhythm of the *krepis* courses. Along the flanks, there are four *euthynteria* blocks with an average length of 0.7219 m for every interaxial column spacing. The added lengths of two *stylobate* blocks (each 1.44 m long) would then correspond to one interaxial column spacing, in a common manner. In the façades, the added lengths of two *euthynteria* blocks correspond to the interaxial column spacing.

No features of the superstructure, such as metopes or triglyphs, that would define the degree and type of the angular contraction, are preserved. The shorter corner interaxial column spacing should be approximately 2.60 m. This calculation is correctly based on the smaller lengths of the *euthynteria* blocks near the corners (*Fig. 10A*).[99]

After Knell, the width of the foundation in the *pronaos* is 1.40 m and, as such, columns that have dimensions equal to the *peristasis* columns (lower diameter of 1.18 m) should also be restored in the *pronaos*.[100] First of all, it is possible for the *stylobate* of the *pronaos* to be considerably wider than the lower diameter of the *pronaos* column.[101] Contrary to Knell's suggestion, the *pronaos* columns are commonly smaller than the columns of the *peristasis*. Statistics for 4th-century temples suggest that the lower diameter of the *pronaos* column is

[91] Welter 1941, 10–11, 37, table 20; Knell 1978.
[92] Paus. 2.32.1. For a collection of the literary sources see Oikonomidou 2015, 95–96.
[93] Cook 1952, 99; Saporiti 2004, 371.
[94] Legrand 1897, 544–547; Welter 1941, 35; Faraklas 1972, 39.
[95] Oikonomidou 2015, 80, 116–117, 149.
[96] Oikonomidou 2007, fig. 6.
[97] There are no parallels for *hekatompedoi stylobates* during the 4th century. See the *stylobate* and *euthynteria* dimensions of all peripteral temples after 400 BC in Sioumpara 2011, 286, table 24. Only the Temple of Apollo at Cyrene indeed has a *stylobate* length of 29.60 m or 100 Ionic feet (Knell 1983b, 221).
[98] Legrand 1905, 291; Oikonomidou 2015, 71. This column drum cannot be located. The site was being looted until the late 1940s (Oikonomidou 2015, 45–46, 50–51).
[99] Knell 1978, 399, fig. 2, 401–402.
[100] In the Temple of Poseidon at Molykreion, Knell (1973a, 459, fig. 7) also reconstructed *pronaos* columns that have a lower diameter equal to those in the *peristasis*; cf. with Orlandos 1922–1925, 60, fig. 8).
[101] Dyggve 1948, 50–51, 247, fig. 245, table 29; Sioumpara 2011, table 15.

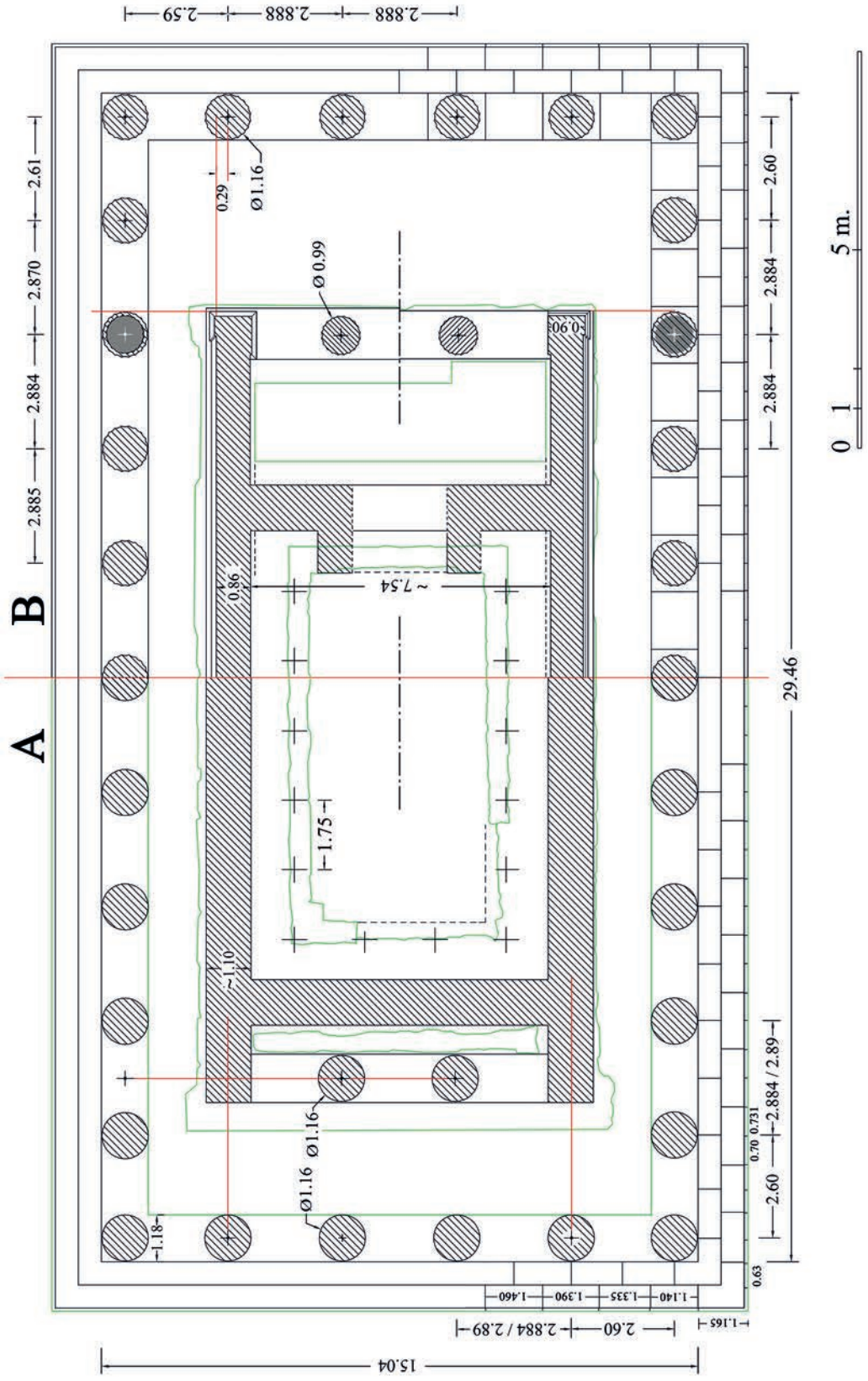

Fig. 10. Plan of the "Temple of Hippolytos" at Troizen. A: after Knell 1978, 676, fig. 2; B: after Kanellopoulos. Red is for axes; green stands for foundations.

consistently 85–93% of the lower diameter of the *peristasis* columns (*Table 1*). As such, the lower diameter of the *pronaos* column in the Hippolyteion is calculated as approximately 1.00 m. The remaining surface of the *stylobate*, in front of the *pronaos* columns, would have been occupied by the moulded base of the *anta*, as explained below.

In Knell's plan, the *antae* of the *pronaos* have the same thickness as the *pronaos* columns and, as a result, the cella walls are reconstructed approximately 1.10 m wide (*Fig. 10A*). Put simply, cella walls with a thickness in the range of 1.10 m are almost impossible, both in absolute and relative terms. This is the maximum wall thickness met only in large temples. In the Parthenon, the *antae* walls of the *pronaos* are 1.299 m thick, as the *antae* have a width equal to the corresponding *pronaos* columns; however, the lateral cella wall behind the cross wall of the doorway has a thickness of 1.157 m.[102] A wall thickness of 1.14 m is met in the Temple of Apollo at Delphi, which, however, has a lower exterior column diameter of 1.718 m and a lower diameter of 1.496 m in the columns of the *pronaos*. In *Table 1* it is clearly demonstrated that the thickness of the cella wall was made considerably smaller than the lower diameter of the *peristasis* columns, even in temples in which the features of the *pronaos* have not survived and these cannot be included in the analysis (the Metroon at Olympia, the Temple of Apollo at Lepreon, and the Temple of Poseidon at Molykreion).

Had the cella conformed to the Doric "*Einbindung*", given the position and thickness of the extant foundations, this would have allowed for a very thin cella wall (approximately 0.55 m). Knell argues that this is impossible and, therefore, the axis of the cella's lateral wall would have coincided with the axis of its foundation. The plan, after Knell, must have been designed after the Ionic canon, according to which the axis of the cella's lateral wall is aligned with the axis of the second column from the corner. No parallels are offered and the issue is closed with a reference to Riemann.[103] In his lengthy article published in 1983, Knell comments on the plan of the Hippolyteion that "*Die Einbindung der Cella in die Ringhalle erfolgt an allen vier Seiten über nüchterne Achsen*".[104]

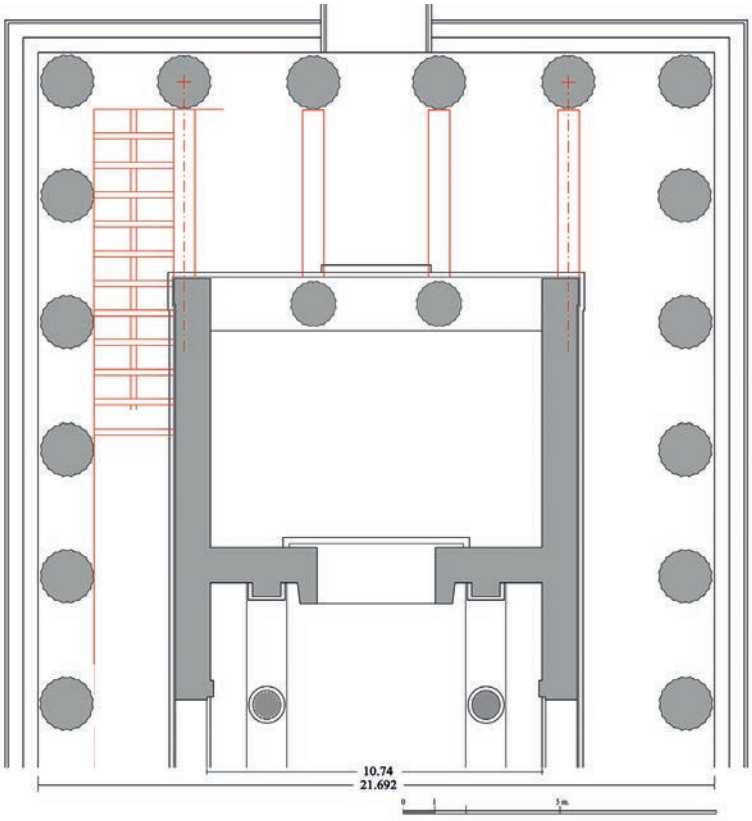

Fig. 11. Plan of the ceiling beams in the Temple of Apollo at Delphi, after Amandry & Hansen 2010, figs. 18.13, 18.19, 18.21 and pl. 9.

In Knell's restoration of the temple at Troizen one hypothesis leads to another; however, each one of them is erroneous *per se*. The relatively thick *pronaos* columns result in *antae* of the same width; consequently, the wall behind the *anta* jamb becomes excessively thick, resulting in Ionic correspondence of the cella relative to the *peristasis* columns. We argue that the *pronaos* columns were approximately 0.87% narrower than the *peristasis* columns and that the *antae* of the *pronaos* were slightly narrower than the *pronaos* columns (*c.* 0.90 m wide), resulting in cella walls that must have been a reasonable 0.80–0.86 m thick (*Table 1*). The lateral walls of the cella would have run eccentrically relative to the 1.20 m wide foundation.[105] The remaining space of approximately 0.24 m on the exterior would accommodate a base course and a projecting

[102] Orlandos 1977, 265, 313.
[103] Knell 1978, 398, fig. 1.
[104] Knell 1983b, 212–213. Knell identifies the Ionic system of axiality in the temple of "Hippolytos" in 1973b, 104, fn. 58. The alignement of the cella inside the *peristasis* takes place on all four sides over the axes.

[105] Similarly, in the Temple of Artemis at Kalydon, the 0.625 m thick cella wall is reconstructed to run eccentrically relative to its 1.00 m wide foundations (Dyggve 1948, 41, table 5, 29). Put simply, it is more probable that the cella wall was eccentrically positioned relative to its foundations, than that there was Ionic correspondence of the cella relative to the *peristasis* columns. The lateral walls of the cella in the Asclepios Temple at Messene also run eccentrically relative to their foundations (Sioumpara 2011, 80–82, pl. 17.1).

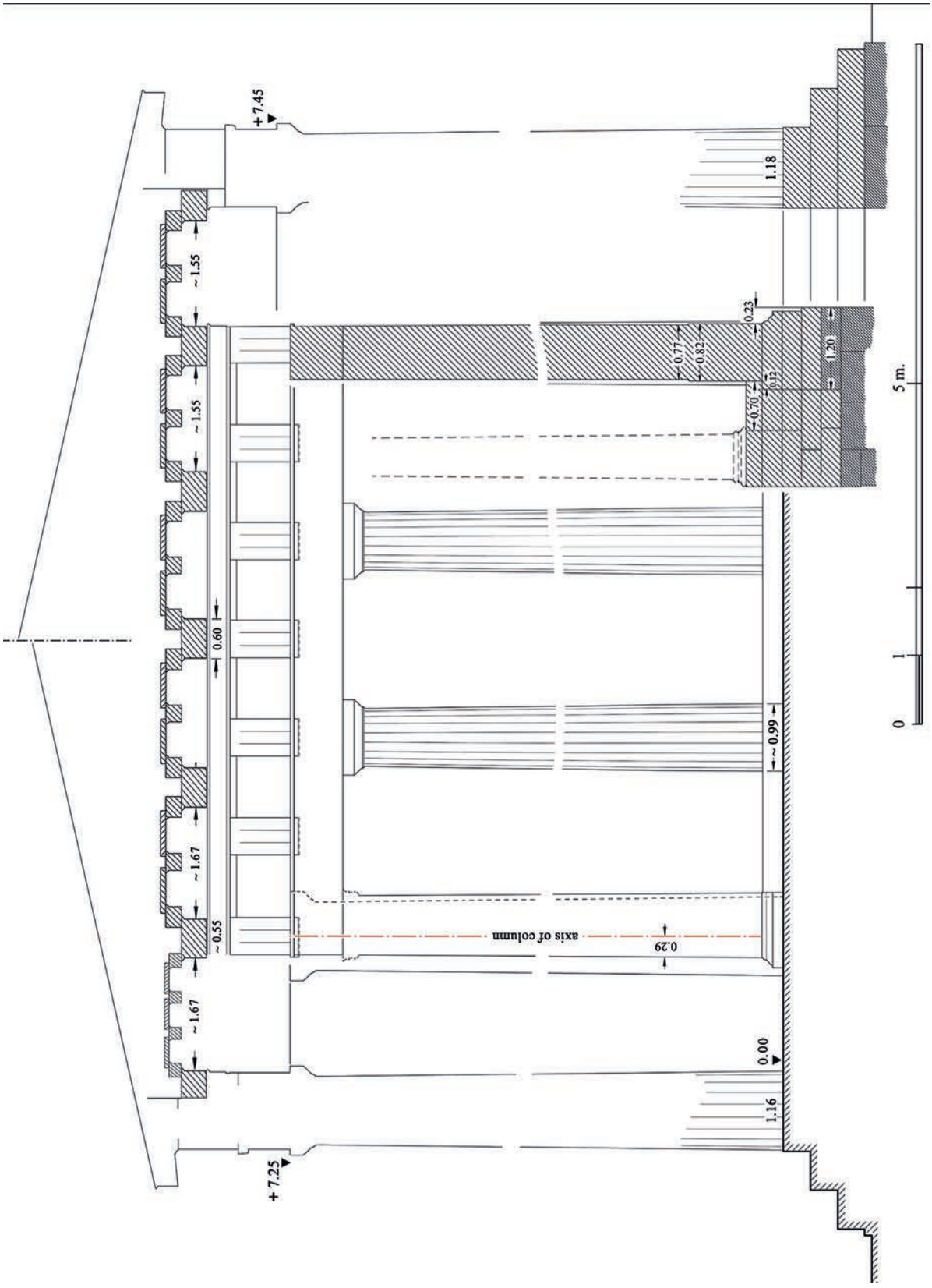

Fig. 12. Reconstructed N-S section of the "Temple of Hippolytos" at Troizen.

Temple	*Location*	*Date*	*Declination: lower diameter*
A. Cellas narrower than 3 interaxial column spacings			
Poseidon	Isthmia	570s	
Athena	Alipheira	*c.* 500	
Athena	Ermione	Late 6th century	
Unknown	Gkremoulias	Late 6th century	
Temple C	Pallantion	Late 6th century	
Temple D	Pallantion	Late 6th century	
Great Temple	Mamousia (Keryneia)	*c.* 500	
Unknown	Melpeia	*c.* 500	
Hera	Argos	*c.* 400	
B. Cellas with perfect correspondence to the Doric canon			
Hera	Olympia	600s	
Apollo	Corinth	540s	
Athena	Skillountia	500	
Temple D	Karthaia	*c.* 500	
Unknown	Trapeza	*c.* 500	
Proparthenon	Athens	490	
Hephaisteion	Athens	460	
Parthenon	Athens	447	
Apollo	Bassae	410s	
Asclepios	Epidauros	380	
Artemis	Kalydon	400–350	
Poseidon	Molykreion	400–350	
Unknown ("Demeter")	Lepreon	350s?	
Zeus	Nemea	320s	
Zeus	Stratos	310s	
Zeus	Levadeia	3rd century BC	
Asclepios	Cos	150s	

Temple	*Location*	*Date*	*Declination: lower diameter*
C. Cellas slightly wider than 3 interaxial column spacings			
Aphaia	Aegina	*c.* 500	0.06:0.99
Zeus	Olympia	470	0.08:2.21
Metroon	Olympia	*c.* 400	0.07:0.85
Apollo	Thebes	400–350	0.16:1.60
Asclepios	Gortyn	400–350	0.12:0.90
Apollo	Ptoion	end of 4th century	0.07:0.80
D. Cellas considerably wider than 3 interaxial column spacings			
Peripteral Temple	Delos	460s	0.15:0.945
Poseidon	Cape Sounion	*c.* 440s	0.277:1.043
Hippolyteion	Troizen	350–300	0.29:1.16
Apollo	Delphi	370s	0.30:1.806
Asclepios	Messene	190s	0.18:1.00
E. Ionic correspondence			
Athena Polias	Athens	520	0.10:1.63
Apollo	Delphi	*c.* 500 (Alcmaeonids)	
Older Poseidon	Cape Sounion	490s	
Nemesis	Rhamnous	425	
F. Unknown			
Archaic Parthenon	Athens	550s	
Unknown	Hyampolis	5th century	
Athena	Pyrgoi/ Prasidaki	478–456?	
Ares	Athens	*c.* 440s	
Apollo Delphinios	Athens	Mid 5th century	
Apollo	Aegina	4th century	
Athena Alea	Tegea	354	
Dionysos	Eretria	350s	

Table 2. Doric cellas classified with relative correspondence to the canon of of cella alignment.

toichobate, in the common manner (*Figs. 10B, 11*). The latter could have been moulded and it would have also run around the *anta* of the *pronaos*.[106]

The outer width of the cella is estimated to be 9.24 m, which is 0.58–0.59 m larger than the sum of three interaxial spacings (8.655 m). The cella would, on either side, be approximately 0.29 m larger than the Doric "*Einbindung*". The interior N-S width of the cella is, therefore, estimated to be approximately 7.54 m. This reconstructed dimension is half the calculated width of the *stylobate* (15.04 m). This would not be unprecedented. The cella of the Temple of Apollo at Delphi has an interior width of 10.74 m or 1:2.02 the width of the *stylobate* (21.692 m, *Fig. 11*).[107] The discrepancy from ratio 1:2

[106] During the 4th century moulded *toichobates* appear in the Temple of Hera at Argos, the Temple of Apollo at Delphi, in the Temple of Athena Alea at Tegea and, later, in the Temple of Asclepios at Messene. It cannot be ascertained whether the *toichobate* in the third Temple of Artemis at Kalydon was also moulded. Cf. Dyggve 1948, pl. 31 and pl. 29. Quite possibly, the moulded *toichobate* ran only along the outer surface and the front of the *anta*, as in the Temples of Hera at Argos (Pfaff 2003b, 151–153, fig. 84) and Asclepios at Messene (Sioumpara 2011, table 15). By contrast, in the Temple of Poseidon at Cape Sounion the moulded *toichobate* of the cella runs against all three sides of the *anta* (Orlandos 1958, 234, fig. 188).

[107] The cella of Apollo at Delphi is also 0.60 m wider than the sum of 3 interaxial column spacings (Amandry & Hansen 2010, 199, 436, fig. 18.5 & pl. 9.); in the Temple of Aclepios at Messene the width of the cella

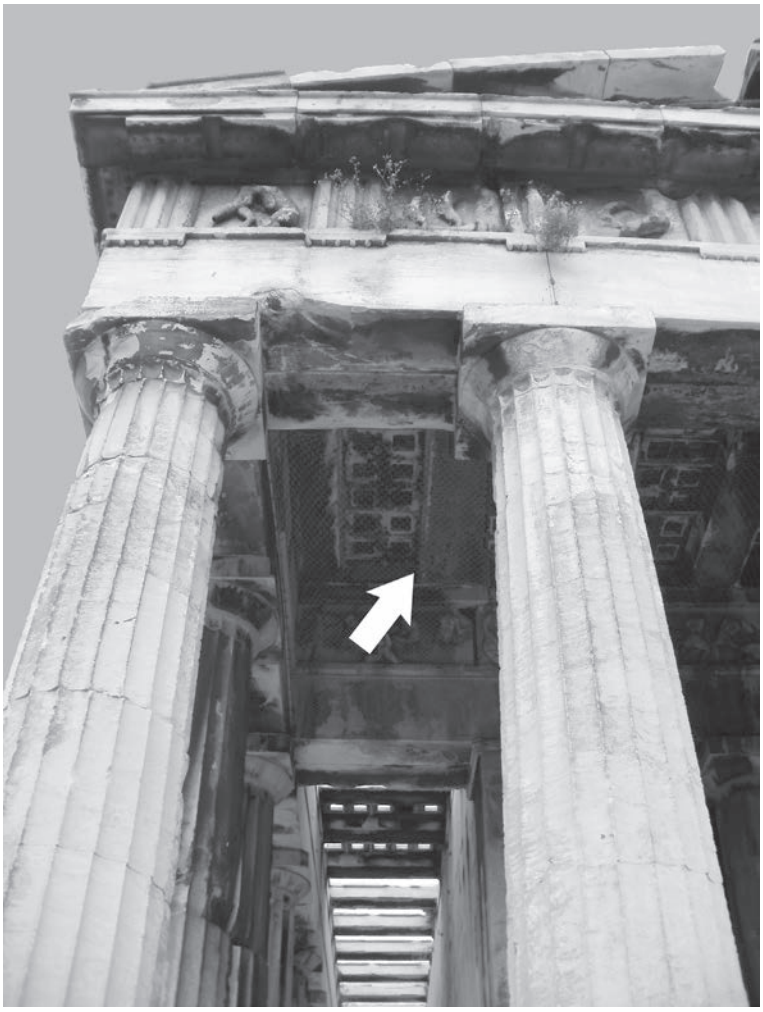

Fig. 13. The eastern pteroma *of the Hephaisteion at Athens. Photo by C. Kanellopoulos.*

(for the cella interior width and *stylobate* width respectively) is only 11 cm or less than 1%.

The interior N-S width of the cella is, therefore, estimated to approximately 7.54 m. This dimension is nearly half the calculated width of the *stylobate* (15.04 m). This is not unprecedented. Similarly, in the Temple of Asclepios at Messene, the width of the *stylobate* is exactly twice the internal width of the cella (12.711 m and 6.355 m correspondingly).

Had the lower diameter of the *peristasis* column been 1.16 m—slightly smaller than the 1.18 m wide *stylobate*—and the columns had low proportions, their overall height would reach a minimum 7.07 m. With columns that had a lower diameter of 1.18 m—closer to the corresponding dimension in the drum measured by Legrand—and with the slender proportion of 6.30:1, the column would have reached a height of 7.45 m (*Fig. 12*).[108]

Knell is justifiably reluctant to attempt a reconstruction of the cella interior, although he successfully did so for the cellas at the Temple of Poseidon in Molykreion and the Temple of Asclepios at Gortyn.[109] In the Temple of Hippolytos, a solid construction runs against the foundations of the cella walls. This construction survives 0.36 m above *euthynteria* level and is an average 1.43 m wide; the innermost course is meticulously built of harder limestone blocks, connected with Z-clamps.[110] Clearly, this sturdy construction was the foundation of an interior colonnade that would have run close to the walls of the cella.

Conclusions

Knell reconstructs Doric peripteral temples of the 4th century with Ionic correspondence of the cella relative to the *peristasis* columns.[111] In order to do so, the reconstructed plans offered by Knell involve excessively thin or excessively thick walls, *pronaos* columns that have the same lower diameter as those columns in the *peristasis*, lack of *toichobate* courses, and insignificant corner contraction in the intercolumnar spacings. The cellas at Thebes, Gortyn, Lepreon and Ptoion either conform perfectly to the "*Einbindung*" or they must have been only slightly wider than the sum of three interaxial column spacings. Only the cella at Troizen is substantially wider than three interaxial column spacings, as are the cellas in the Temple of Apollo at Delphi and later, in the

(7.56 m) is 0.366 m wider than the corresponding sum of 3 interaxial column spacings (7.194 m) (Sioumpara 2011, pl. 15).

[108] The ratio column height: lower diameter in the Temple of Asclepios at Epidauros is 6.20:1; in the Temple of Athena Alea at Tegea, 6.60:1; in the Temple of Zeus at Nemea, 6.33:1; in the Dodekatheon on Delos, 6.69:1; in the Temple of Zeus at Stratos, 6.12:1 (initially planned 6.72:1).

[109] In the Metroon in Olympia, the Temple of Asclepios at Epidauros, and the temples at Gortyn, Molykreion and in Stratos the interior colonnades were similarly accommodated on *stylobates* that were almost attached against the lateral walls.

[110] On clamping of foundations for safety reasons after the earthquakes of 402 and 373 BC, see Partida 2016, 303. Z-shaped clamps are not uncommon in the 4th century. See e.g. the small temple at Mamousia (Kanellopoulos & Kolia 2011, 165), the temple of Lepreon, above, and temple at Kalydon (Dyggve 1948, 242, 260–262). Quite strangely, the late Hellenistic Temple of Asclepios at Lissos also employs Z-type clamps in the entablature features (Kanellopoulos, in press).

[111] In the Doric Temple of Apollo at Cyrene, the lateral walls of the cella are indeed aligned behind the second and fifth columns of the front, in the Ionic fashion (Knell 1983b, 220, fig. 6).

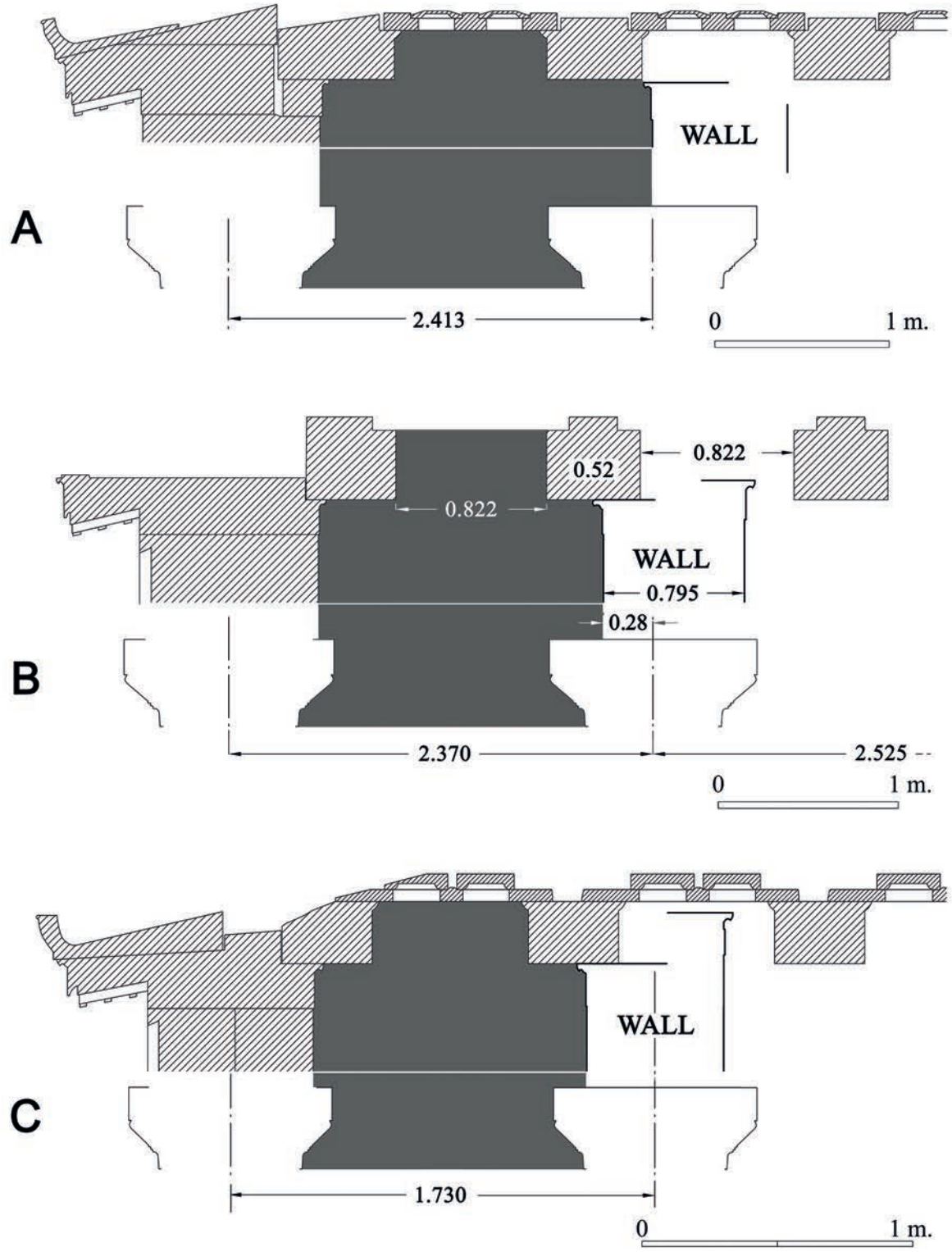

Fig. 14. Sections through the ceilings of the eastern pteromas *in the Hephaisteion, Athens; the Temple of Poseidon, Cape Sounion and the Temple of Nemesis, Rhamnous, with corresponding columns of the façades and projection of the cella walls. Not in uniform scale; sections have a common abacus width.*

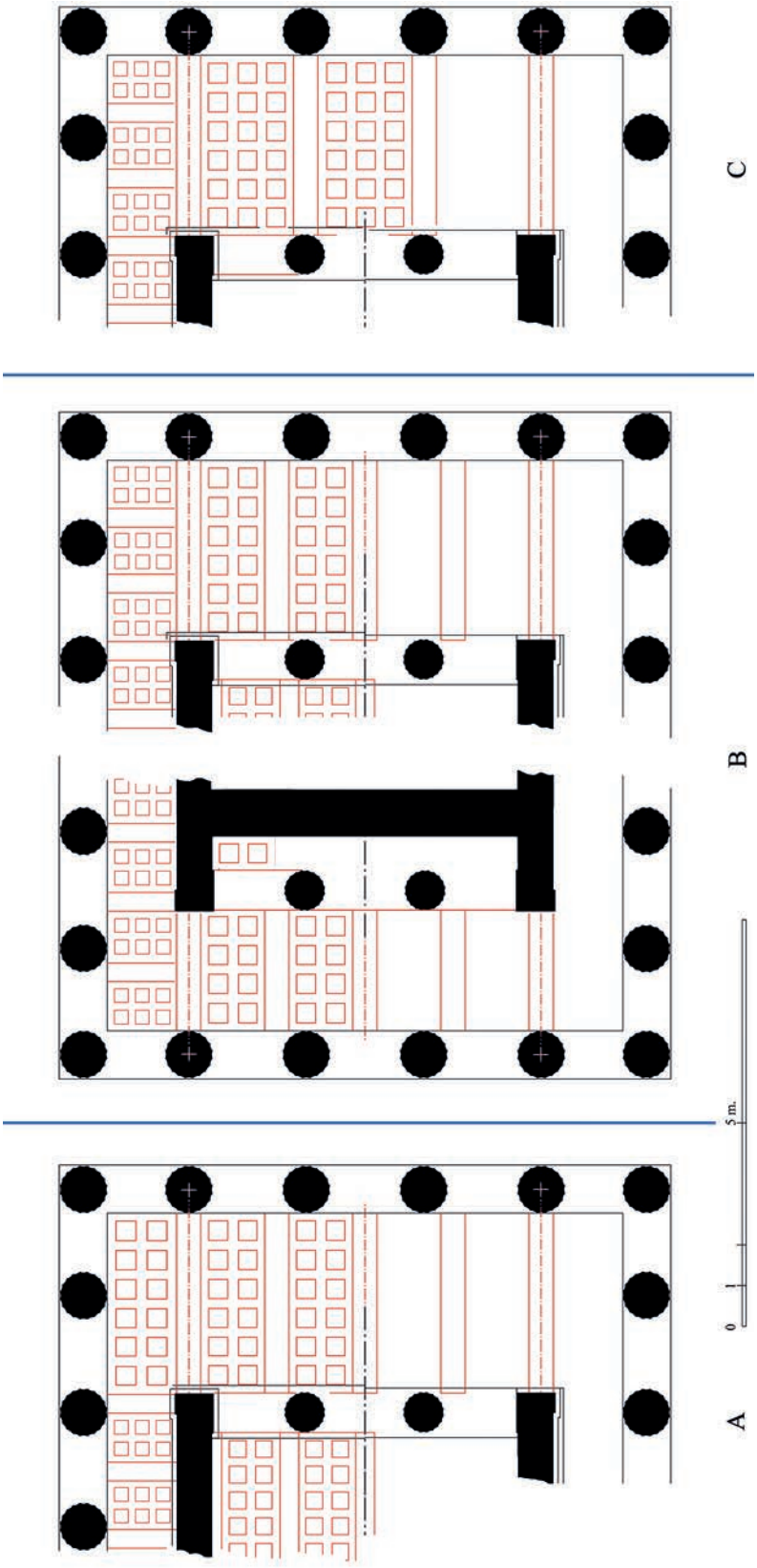

Fig. 15. Reconstructed plan of the "Temple of Hippolytos" at Troizen with possible ceiling layouts. A: after the Temple of Zeus at Stratos (Orlandos 1923, fig. 14); B: a variation of layout A; C: after the Temple of Apollo at Delphi (Amandry & Hansen 2010, figs. 18.13, 18.19, 18.19, 18.21).

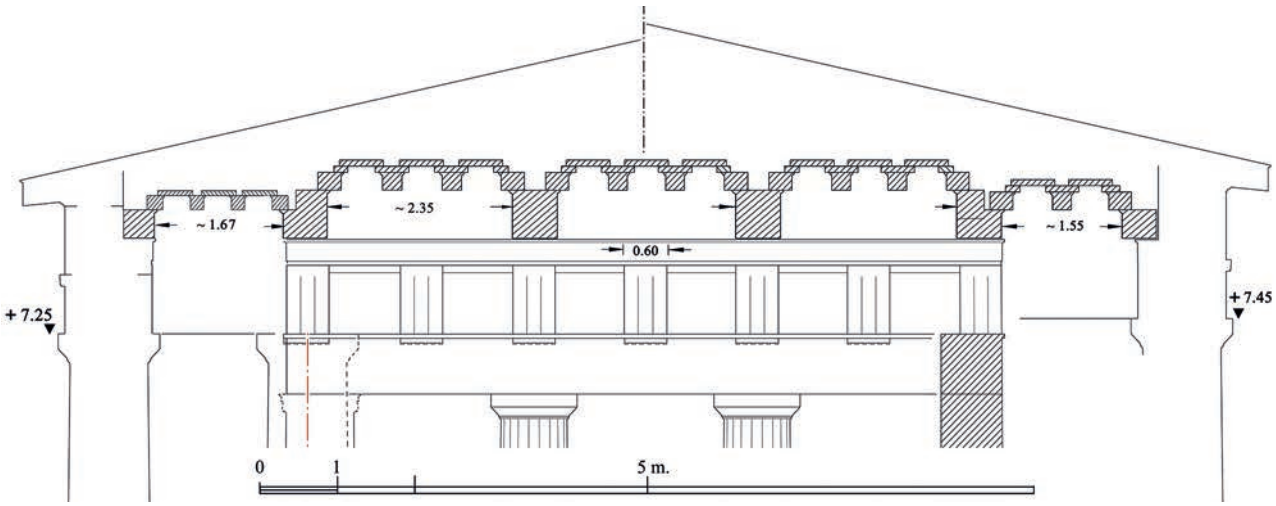

Fig. 16. Reconstructed N-S section of the "Temple of Hippolytos" at Troizen with elevated ceiling beams in the east wing of the peristasis.

Temple of Asclepios at Messene. It has been well established that in Messene the internal width of the cella is half the width of the *stylobate*.

In *Table 2*, temples in group A largely belong to the so-called Arcadian Temple Type which dates to the second half of the 6th century; the type is to be found in other sanctuaries of the Peloponnese. The temples of group C practically conform to the canon; departure is negligible. It is very probable that most of the temples in group F conform to the rule of the Doric "*Einbindung*". Overall, a total of six temples are considerably wider than the rule of the "*Einbindung*" (the 4th-century Temple of Apollo in Delphi essentially adopts the plan of its Archaic predecessor).

Cellas that are broader than the Doric "*Einbindung*" have an advantage with regard to aesthetics in the ceiling features. The issue is vividly displayed in the façades of the Hephaisteion (*Fig. 13*). The ceiling beam adjacent to the corner is not above the same vertical plane with the outer surface of the cella; this beam is "dangling" across the façade with no correspondence to any of the features in either the *peristasis* (i.e. second column from the corner) or the cella.[112] Apparently, had the cella of the Hephaisteion been wider than the Doric "*Einbindung*", it would have been possible for the former to "carry" the ceiling beam that spans the eastern portion of the *peristasis*. In fact, this was made possible in the cella of the Poseidon Temple at Cape Sounion, which is on either side 0.28 m wider than the rule of the "*Einbindung*" and also has six ceiling portions in the east wing of the *peristasis* (*Fig. 14B*). Narrower ceilings beams help resolve the issue of asymmetry seen in the Hephaisteion (cf. *Fig. 14A*). In the Temple of Nemesis at Rhamnous, which presents Ionic correspondence, there is perfect correspondence of the cella wall and the second column from the corner, resulting in overall symmetry between the ceiling beams and space in the *peristasis* (*Fig. 14C*). The resolution of the issue of asymmetrical images by the "Theseion Architect" during the 5th century demonstrates the evolution of Athenian architects within the same generation.

During the 4th century BC two recorded ceiling systems were devised in order to overcome this issue. One, is at Stratos,[113] where the ceiling beams in the façades of the *peristasis* are extended above the triglyphs and metopes of the *pronaos*; in the Hippolyteion, these beams would also correspond axially to the second column from the corner of the façade (*Figs. 12 right* and *15A*). Given the fact that the cella wall is shifted 0.29 m from the axis of the second column of the front, each ceiling beam would be a reasonable 0.58–0.60 m wide (or as wide as the underlying triglyph of the *pronaos*). More importantly, the ceiling beams would have also extended over the corner of the cella. In a variation of this system, with ceiling parts that are two coffers wide (*Figs. 12 left* and *15B*), the central ceiling portion of the façades was as wide as the cella.

Alternatively, the central ceiling portion in the eastern wing of the Hippolyteion was as wide as the cella, as is the ceiling in the Temple of Apollo at Delphi (*Fig. 11*).[114] The cella of this temple is also 0.60 m wider than the sum of three interaxial spacings. In the Hippolyteion, it would have also been possible to have ceiling beams that are approximately 0.55 m wide

[112] In the Mnesiclean Propylaea the ceiling beams correspond to columns of a hexastyle *prostasis*, however the corner portion of the ceiling is, exceptionally, one coffer wider, due to the angular contraction (Dinsmoor & Dinsmoor 2004, figs. 14.15, 14.22.

[113] Orlandos 1923, fig. 14.

[114] Amandry & Hansen 2010, 433, fig. 18.21.

and arranged on a similar configuration, in a ceiling system that has three main wide partitions—instead of the common layout with six narrow ceiling partitions (*Figs. 12 left, 15C* and *11*).[115] Again, the beams adjacent to the corner in this portion of the ceiling would be perfectly aligned behind the second and fifth columns of the front and rear and they would also extend above the cella wall. More importantly, this layout connects the features of the *pronaos* (ceiling beams that are as wide as the triglyphs and correspond with the latter) with the main features in the front and rear of the *peristasis*. The span between this main portion of the ceiling and the entablature in the flanks of the *peristasis* would be bridged with smaller beams and coffers accordingly. The same ceiling scheme, with beams that extend above and in front of the walls of the cella and with three large portions in the central part, is well attested in the east wing of the *peristasis* (τοῦ περιστύλου τοῦ κατὰπροσθεν) in the Peripteral Temple on Delos; this is feasible in the Temple of Delos which also has a cella 0.30 m wider than the sum of three interaxial spacings.[116] Quite interestingly, René Vallois suggests that the central part was elevated (τὰς κλιμακίδας τὰς ἀνω) relative to the ceiling in the rest of the *peristasis*.[117] It is tempting to reconstruct such elevated ceilings in the middle part of the east wing of the *peristasis* also in the Hippolyteion (*Figs. 15C* and *16*) and date this new treatment of ceiling systems as early as the 4th century BC.

In the Hippolyteion, the axis of the *opisthodomos* columns is supposed to be aligned with the midpoint of the interaxial spacing between the second and third columns of the flanks (*Fig. 10A*); incidentally, the distance between the *opisthodomos* and the rear of the *peristasis* accommodates four ceiling coffers and this should not be overlooked. The eastern wing of the *peristasis* is six identical-sized coffers deep while the depth of the *opisthodomos* itself must have been one same coffer deep (*Fig. 15B*). Ceiling parts become the moduli in a complete system of correspondence. The ceiling features of the eastern wing could be the reason for a *pronaos* located about 0.20 m east of the third column of the flanks in the Temple of Apollo Ptoios and the one of Artemis at Kalydon—what Knell calls an abstract layout.[118]

Certain Classical cellas are a maximum 0.30–0.60 m wider than the added lengths of three interaxial column spacings and, as such, they do not substantially increase their size or spatial qualities in their interiors (*Table 2D*). None of these cases can be categorized in the temples with Ionic correspondence. The configuration in the ceiling features could, in fact, be the *raison d'être* for most cellas that are wider than the Doric "*Einbindung*", as explained above. Ionic correspondence in the plans of Doric peripteral temples is an affair of the Athenian School during the 6th and 5th centuries for a number of reasons (*Table 2E*): emancipation from the Doric orthodoxy is evident in the Peloponnese, Cycladic influence and the Attic preference for broad cellas. The wider cella in the 4th-century temple at Delphi does not seem to be intentional. As with the Poseidon Temple at Cape Sounion, the plan of the 4th-century Temple of Apollo at Delphi was largely dictated by the dimensions of the extant foundations of the Archaic temple on which it was founded. Given the width of the foundations of the Archaic cella, which yielded Ionic correspondence, the new cella of Apollo was designed—on the same foundations—only 0.60 m wider than the Doric canon, however with a new layout of ceiling partitions; the latter would allow connection between the individual features of the cella and *peristasis*, as explained above (cf. *Fig. 11*). This cohesive system allows alignment of all elements—even of those which appear secondary relative to the canon of the Doric axiality. Quite possibly this resolution and the advantages that come with it consciously became the model for the Temple at the Hippolyteion; this temple, unlike the Classical temples at Cape Sounion and Delphi, was not restricted by the extant foundations of an Archaic temple with Ionic correspondence.

To summarize, the outer vertical plane of the cella corresponds to the ceiling beams when the former is approximately two feet larger than the "*Einbindung*" or when the cella internal width reaches half the width of the *stylobate*. In certain temples this correspondence, incidentally, reaches the ratio 1:2 with a declination (as in the Temple of Apollo at Delphi) and in other temples this is standardized to exactly half the *stylobate* width (in the Hippolyteion and later, in the Temple of Asclepios at Messene). Cellas of the 4th century that are only slightly broader than the Doric "*Einbindung*", and in combination with an appropriate width of ceiling beams (cf. *Figs. 14A* and *14B*), would lessen the effect of asymmetrical design ceilings of the *peristases* (this would be the case for the

[115] This configuration would have resulted in ceiling portions between beams that would each have plan proportions of approximately 1:2 (or a 3 x 6 coffer scheme, instead of narrower ceiling portions that are each 2 coffers wide, in the common manner); cf. *Figs. 10B, 10C* and *15*. Except for the ceiling in the Temples of Apollo at Delphi and Delos, such wide ceiling portions between the beams are well attested in the Temple of Athena Pronaia, which also dates to the 4th century BC (Michaud 1977, pl. 76. 99).

[116] The construction dates to the year 279 BC (Holland & Davis 1934, 79, pl. 9). In the temple of Messene, with a cella that is 0.36 m wider than the sum of three interaxial spacings, it would also have been possible for the ceiling beams to extend above the cella corners and also be aligned behind the second column from the corner (Sioumpara 2011, cf. pls. 20, 21 and 22).

[117] Vallois 1978, 415–417; Fraisse & Llinas 1995, 189, fig. 710, 190, fig. 711.

[118] Knell 1978, 405.

Metroon in Olympia, the Temple of Apollo in Ptoion, the Temple of Apollo Ismenios at Thebes, and the Temple of Asclepios in Gortyn).

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Appendix: Glossary

After Miles 2016, 546–549.

anta*, pl. *antae*, /*in antis: an *anta* is the thickened end of a wall, usually crowned with decorative moldings. Columns are "*in antis*" when they are positioned flush with the *antae*.

distyle: two columns, typically *in antis*, positioned so that they are set flush between *antae*.

euthenteria: the leveling course of the foundations of a building. In a temple, the *krepidoma* is set directly on the *euthynteria*.

krepis: the stepped platform of a temple.

opisthodomos: the back porch-like room in a Greek temple, typically *distyle in antis*.

orthostate: square blocks usually set in pairs on the *toichobate* to form the base course of a wall.

peristasis*, *pteron*, pl. *ptera*; *pteroma: part of the peristyle or colonnade, including the space between the columns and the walls.

pronaos: the room in a temple that leads into the cella.

sekos: the inner room of a temple, also called *naos* or cella.

tetrastyle: a façade with four columns.

toichobate: the stone course that supports a wall. It may be articulated with mouldings.

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