the doric essence
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do not remove this notice
from masonry to timber
to masonry

proto-doric column chamfering & fluting

the echinus and abacus capital

synthesis of the echinus and the fluted shaft

from rubble to ashlar (dressed stone) at Samos

from wooden to stone columns at Olympia
proto-doric chamfering and fluting

tomb chapel of Amenemhat, Beni Hasan, c 2000 BC ; Portico of Anubis Deir-el-Bahari, Egypt, c 1490 BC ; column from Assur, c 1050 BC

Lewis, *Architectura*, p 176; Miles Lewis
the echinus and abacus capital
Palace of Knossos, c 1600-1400 BC; Treasury of Atreus, Mycenae, c 1325
Knossos slide set, no 1; Miles Lewis
the synthesis of the echinus capital and the fluted shaft
model column fragments: fluted column; chamfered half column: National Museum, Athens, no s 7529,7591; Minoan column from Gortyn, C13th BC, Herakleion Museum
Miles Lewis
the first Heraeum, Samos, mid C8th: plan

the 2nd Heraeum, Samos, mid C7th: plan and reconstructed section

Scranton, *Greek Architecture*, pl 23
J J Coulton, *Greek Architects at Work* (London 1977), p 33
Heraeum, Samos

visible masonry of the second temple, C7th BC

with excavated masonry of the first temple, C8th BC

Miles Lewis Coulton, *Greek Architects at Work*, pl 3
Temple of Hera, Olympia, as rebuilt late C7th
inset: the opposite end, showing the opisthodomos, including a stone base for a wooden column

Jeff Turnbull
the archaic Doric

early Doric capitals

early 6th BC, Temple of Artemis, Corfu
  c 580 old tholos, Delphi
  c 570 BC, older Temple of Aphaia, Aegina
  c 565 'Basilica' Paestum, Italy
  c 530 Temple of Athena or Ceres, Paestum
  c 510 Temple of Hercules, Agrigento (Sicily)
archaic doric capitals

old tholos, Delphi, c 580

older Temple of Aphaia, Aegina, c 570 BC

Temple of Artemis, Corfu, early C6th BC

?Temple of Hercules, Agrigento, c 510

Scranton, *Greek Architecture*, pl 29
Miles Lewis
Paestum, Italy: aerial view of the Temple of Neptune or Poseidon, c 450 (top), and the 'Basilica', c 565 (bottom)

MUAS 15,775
'Basilica', Paestum, c 565: east flank

Miles Lewis
'Basilica', Paestum, c 565: detail of a capital

Miles Lewis
Temple of Athena or Ceres, Paestum, c 530

details of capitals

view

Miles Lewis
Robertson, *Greek and Roman Architecture*, p 80
MUAS 3,451
Temple of Athena Pronaia at Delphi, c 570 BC

Temple of Apollo at Syracuse, 570-560 BC

first Temple of Aphaia at Aegina, 570 BC

**early Doric columns**

the Doric order

elements of the capital

restoration of the order at the Temple of Zeus, Olympia, c 460

Miles Lewis
Robertson, *Greek and Roman Architecture*, p 40
comparative Doric orders

Miles Lewis
Doric columns at Delphi, by Gruben

Helmut Berve & Gottfried Gruben, Greek Temples Theatres and Shrines Harry N Abrams, New York, no date), p 331
Temple of Aphaia,
Aegina, c 490 BC
cutaway view by Mansell
Second Temple of Hera (‘Poseidon’), Paestum, c 460 BC
the Parthenon, Centennial Park, Nashville, Tennessee, 1897-1939

Monumentum, IX (1973), p 46
Hephæsteion, Athens, c 449-444 BC: view from south-west

unspecified: 1979
Hephæsteion
Athens

C 449-444 BC

View & (new) plan

Miles Lewis
Scranton, *Greek Architecture*, fig 4
Hephæsteion, Athens
c 449-444 BC
plan
Scranton, Greek Architecture, fig 4
the $2n + 1$ rule for columns

- 2:5 distyle
- 4:9 tetrastyle
- 6:13 hexastyle
- 8:17 octastyle
- 10:21 decastyle
- 12:25 dodecastyle
Temple of Hephaestos, Athens
 c 449-444 BC
 plan

Scranton, Greek Architecture, fig 4

Temple of Poseidon, Cape Sounion,
 444-440 BC
 axonometric restoration

the possible wooden origins of the Doric order
by A von Gerkan, 1948-9, & anonymous

Jim Harter [ed], Images of World Architecture (New York 1990), p 54
the Archaic hexastyle peripteral temple of Athena, Athens: reconstruction of the wooden origins of the Doric order
Economakis, Acropolis Restoration, p 21
wood construction of the Doric order

Cyclopedia of Architecture, Carpentry and Building (10 vols, American School of Correspondence, Chicago 1909), vol 8, p 54
Hephæsteion, Athens, c 449-444 BC
detail of the entablature
Miles Lewis
Hephaesteion, Athens, c 449-444 BC
underside of the roof
Miles Lewis
Hephaisteion, ceiling plan
conjectural sections of the Parthenon, Athens
Royal Institute of British Architects Journal, 25 February 1928, p 265
Parthenon, Athens, by Iktinos & Kallikrates, 447-432 BC
view from the Propylaeas
Frank Sear
the Parthenon: revised plan

Parthenon, reconstruction view, British Museum
Miles Lewis
the Parthenon
Lewis, *Architectura*, p 181
OPTICAL ADJUSTMENTS

IRREGULARITIES

OPTICAL REFINEMENTS

OPTICAL CORRECTIONS
optical adjustments 1
TAPER

Parthenon: central intercolumniation of the west end

unsourced
### Tapering of Columns According to Vitruvius

<table>
<thead>
<tr>
<th>Column Height</th>
<th>Ratio Neck : Base</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 4.5 m [15 ft]</td>
<td>5 : 6</td>
<td>83</td>
</tr>
<tr>
<td>4.5 - 6 m [15-20 ft]</td>
<td>5 1/2 : 6 1/2</td>
<td>85</td>
</tr>
<tr>
<td>6 - 9 m [15-20 ft]</td>
<td>6 : 7</td>
<td>86</td>
</tr>
<tr>
<td>9 - 12 m [15-20 ft]</td>
<td>6 1/2 : 5 1/2</td>
<td>87</td>
</tr>
<tr>
<td>12 - 15 m [15-20 ft]</td>
<td>7 : 8</td>
<td>88</td>
</tr>
</tbody>
</table>

and so on, proportionately

the taper of columns as prescribed by the Roman architect Vitruvius, in his *De Architectura*
These proportionate enlargements are made in the thickness of the columns on account of the greater heights to which the eye has to climb. For the eye is always in search of beauty, and if we do not gratify its desire for pleasure by a proportionate enlargement in these measures, and thus make compensation for ocular deception, a clumsy and awkward appearance will be presented to the beholder.
the columns of the Parthenon

optical adjustments 2

ENTASIS

it is a swelling outside
the line of the taper, but inside the vertical

it is (approximately) an arc of a circle

no part of the column is wider than the base – it is not cigar-shaped
Vignola’s rule for entasis
(compared with the actual entasis of the temple of Mars Ultor in Rome)
Marcus Vitruvius Pollio [translated M H Morgan], *The Ten Books on Architecture* (1916), p 87
a purported rationale for entasis
to counteract the visual necking effect of a column when seen against the light

early examples of entasis are clearly perceptible

**ergo**, it cannot be an optical correction

the 'Basilica', Paestum, mid-C6th to early C5th: corner

Miles Lewis
optical adjustments 3
ADJUSTED SPACING

ideal rules:
• the columns are evenly spaced
• the triglyphs are evenly spaced
• every second triglyph is on the axis of a column

Tholos, Delphi, c 400
view & detail of entablature & view.

MUAS 14,007
the Parthenon, part-elevation

in a rectangular building you cannot satisfy the ideal rules, ie
the columns are evenly spaced
the triglyphs are evenly spaced
every second triglyph is on the axis of a column
unless you leave a spare piece of metope at the corner
the problem of the angle triglyph: three approaches

Miles Lewis
Temple of Artemis, Garitsa, Corfu, c 600 BC, reconstructed end elevation.

Robertson, *Greek and Roman Architecture*, p 107
moving the corner column inwards

Temple of Artemis, Garitsa, Corfu, c 600 BC, reconstructed end elevation.

Robertson, *Greek and Roman Architecture*, p 107
diagram showing the angle contraction achieved by reducing the intercolumniation (ie moving the corner column inwards)

Coulton, *Greek Architects at Work*, p 61
Temple of Athena (Ceres), Paestum, c 510 BC: reconstruction

F Krauss, *Die Tempel von Paestum* (Gasamptpublikation, 1959 ff)
moving the corner triglyph outwards

Temple of Athena (Ceres), Paestum, c 510 BC: reconstruction

F Krauss, *Die Tempel von Paestum* (Gasamptpublikation, 1959 ff)
Temple of Concord, Agrigento, c 450 BC: detail of the east end
Miles Lewis
the Parthenon, Athens
detail of north-east corner of the entablature
part elevation

Doric entablature by Vignola, 1562

optical adjustments 4
THICKENING THE CORNER COLUMNS

the Parthenon, Athens
detail of north-east corner of the entablature
part elevation

the columns at the corners should be made thicker than the others by a fiftieth of their own diameter, because they are sharply outlined by the unobstructed air round them, and seem to the beholder more slender than they are. Hence we must counteract the ocular deception by an adjustment of proportions.

Vitruvius, *De Architectura*, book III, ch III, 11
optical adjustments 5

CONVEXITY OF HORIZONTAL LINES

Hephaisteion, Athens: diagram showing the curvature of the stylobate

Dinsmoor, *Architecture of Ancient Greece*, p 167
Temple of Poseidon, Cape Sounion, 440-420

view along the south aisle of the peristyle, demonstrating the absence of curvature in the stylobate

Miles Lewis
the Parthenon, Athens

view showing the curve in the stylobate
exaggerated diagram of the distortion in the north colonnade

Lawrence, *Greek Architecture*, p 173
the reason for curvature in the stylobate

optical?

foundation settlement?

drainage?
the level of the stylobate must be increased along the middle by the 
scamilli impares; for if it is laid perfectly level, it will look to the eye as though it were bowed a little

Vitruvius, De Architectura, book III, chapter IV, 5 (p 99)

scamilli impares means 'unequal levellers'
the case for drainage

(1)

the Parthenon, Athens view along the south pteroma showing the gutter

Jeff Turnbull
the case for drainage (2)

Temple of 'Juno Lacinia', Agrigento, c 470 BC: view along the south pteroma, showing the slope of the floor

Miles Lewis
optical adjustments 6
CURVATURE IN PLAN
optical adjustments 7 SLOPE (in columns and other elements)

inclination of Doric columns, by Dinsmoor

Dinsmoor, Architecture of Ancient Greece, p 173
exaggerated diagram of the refinements in a Doric temple

the Parthenon, exaggerated model of refinements

Coulton, *Greek Architects at Work*, p 108
A Mavrikios, 'Aesthetic Analysis concerning the Curvature of the Parthenon', *American Journal of Archaeology*, LXIX (1965)
Temple of Hephæstos, Athens, c 449-444 BC

Miles Lewis
more optical adjustments in the Parthenon (1)

the vertical faces of the steps, the frieze and the architrave all lean inwards

the ends of the antae or wing walls slope forwards by 110 mm and their capitals slope outwards

the edge of the abacus, the square block on top of the capital, has an outward slope of 1 in 140

the Parthenon
View along the south pteroma
MUAS 14,831
more optical adjustments in the Parthenon (2)

the corona, or flat face of the cornice, which has an outward slope of 1 in 100

the antefixes and the acroteria have an outward slope of 1 in 20

the Parthenon roof construction

fragment of an antefix from the Parthenon, British Museum

Miles Lewis
more optical adjustments in the Parthenon (3)

in the Panathenaic Frieze the face of the carving tilts slightly forward, so that it is deeper at the top of the Parthenon:
details showing the Panathenic Frieze

Dontas, *The Acropolis and its Museum*, p 46
Jeff Turnbull
Parthenon, detail of Panathenaic Frieze from the north side, young pitcher bearers (hydriaphoii), now in the Acropolis Museum
Dontas, *The Acropolis and its Museum*, p 126
Parthenon, detail of the inner frieze

Lewis, *Architectura*, p 180
the Parthenon, from the north-west

Miles Lewis