

THE PARTHENON

by

W. Bro. J.E. Merrett, P.M. Aurora Lodge No. 165, B.C.R.
(A collection of sketches accompany this paper.)

In order to discuss the erection of this building, probably one of the most magnificent ever constructed, a brief review of history is appropriate to outline the circumstances which prompted this undertaking.

Approximately five miles north of the port of Piraeus on the Aegean Sea, a pinkish-white rock knoll rises some 300 feet above the Attic plain. During the Bronze Age the Mycenians erected a fortress on it to safeguard the farming settlement around it. It was then succeeded by an Iron Age fortress.

Archaeological evidence indicates that sometime during the 6th Century, B. C., the fortress as such ceased

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to exist and for a while appeared to have been used as the seat of government for that area. It subsequently assumed the aspect of a religious sanctuary where several shrines were erected in what was then known as the Acropolis.

Excavations here have disclosed the foundation and some walls of these shrines but not too much detail is known concerning them.

In 490 B.C., an invading Persian army under the direction of King Darius I. entered Greece but was defeated by the Athenians at the Battle of Marathon, 26 miles northeast of Athens. The Persians withdrew but in 480 B.C., under the leadership of King Xerxes they returned and captured Athens which they sacked in August of that year. The following month the combined Spartan and Athenian navies defeated the Persian fleet in battle of Salamis, about 20 miles southwest of Athens. The Persians then withdrew from Athens to winter in northern Greece and in the spring of 479 B.C., they returned to recapture Athens and again sacked the city but this time they destroyed the Acropolis shrine. Later that year a combined army of Spartans and Athenians defeated the Persians in the Battle of Plataea, 40 miles northwest of Athens. In addition, the Athenian navy attacked and defeated the Persian fleet at Miletus near the Mycale Mountains in Asia Minor.

In 477 B.C., Athens along with some 400 other city-states formed the first Attican Marine Alliance, otherwise known as the Delian League, as a defense measure against further Persian attacks. The League headquarters were established at Delos and members had the option of providing a levy of ships and crews or an annual fee of 460 talents of silver. (1 talent = 56 lbs. 14oz. avoirdupois). Eventually most of the members opted to pay the fee or tribute as the Athenians called it. Under these circumstances the Athenian navy became the only effective marine combat force within the League. The League capital was then transferred to Athens as well as the League treasury. This situation then gave rise to one of the earliest recorded 'protection' rackets. When a member attempted to withdraw or failed to pay the annual levy a punitive naval force was sent to convince the recalcitrant member that it was not in their best interests to act in such manner. The member then was obligated to pay not only their arrears but also the cost of the expedition that visited them.

The Delian League tributes augmented by income from a successful maritime

trade, and possibly some income from the Laurium silver mines made Athens the richest city-state in the Aegean. (It was the third strongest state in the Mediterranean, following closely behind Persia and Carthage.) Thus with ample funds available, work began on the restoration of the Acropolis and commenced in 447 B.C., on the erection of the Parthenon, - the House of the Maiden, dedicated to the goddess Pallas Athena, the virgin goddess and protectress of the Crafts, Arts and Sciences, and from whom Athens derived its name.

As it will be necessary to discuss the technical details of the construction of this Doric Order temple, the accompanying sketches reproduced from the text "The Archaeology of Greece, An Introduction." by William R. Biers, Cornell University Press, will be used for clarification. In addition, a direct quotation (pp.128 -129) from this publication detailing the typical principal characteristics of the Doric Order follows. "The simple shaft, bearing twenty channels or flutes, with sharp divisions (arrises) between them, tapers slightly from the top. A capital consisting of a swelling member, the echinus, is topped by a block-shaped slab, the abacus, as a transition from the vertical column shaft to the mainly horizontal upper entablature. Above the columns and supported by them is the epistyle, formed of lines of blocks that extend from column to column. The epistyle blocks are plain except for a molding along the top, which is decorated at intervals with raised panels (regglae) from which circular projections called guttae project downward. Above the epistyle is the frieze course, consisting of grooved slab, or triglyphs, which are generally centered over each column. The triglyphs ("three glyphs," so called because each groove is called a glyph and there are two whole and two half glyphs to each unit) are separated by blank panels called metopes, which in the more elaborately decorated temples are adorned with painting or sculpture. Above the frieze comes a horizontal course and above that the roof, double pitched, with open triangular spaces, the pediments, at both ends. The pediments were often filled with sculpture. The roof is usually adorned with architectural devices, sometimes sculptured figures on the ridge or at the corners and usually with brightly painted upright palmettes and lion-head water spouts along the eaves. The

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undersurface of the horizontal course (geison) above the frieze course is also ornamented with slab (mutules) bearing guttae and placed over every metope." the roof construction varied and could contain elements of both wood and stone in the purlins, rafters, and sheeting over which customarily, terra cotta tiles were laid, however in the case of the Parthenon we are advised the roof was of white marble slabs.-

Construction work progressed slowly until 443 B.C., when Pericles, who had been active in the government of Athens for at least twenty years was elected demagogue or popular leader. Because of his oratorical skills it was not long before he began to assume autocratic authority. It is recorded he now accelerated the pace of construction to provide employment for large numbers of men formerly in the armed forces but now idle because of a prolonged period of peace. To meet the cost of this and other construction in the Acropolis, funds were made available not only from the public treasury and private donations but also by Pericles expropriating the Doric League treasury which amounted to 5,000 talents or the equivalent of 30 million skilled-man day's pay. This act evoked considerable opposition from members of the government.

The reconstruction of the Acropolis had become an obsession with Pericles and he with the outstanding architect Iktinos outlined the overall plan for this task. Iktinos then, assisted by the builder-architect Kallikrates, commenced with the Parthenon. Up to this time Greek temple construction had followed in

general a rather fixed pattern as is seen in the accompanying typical temple plan. However, in designing and constructing the Parthenon, Iktinos and Kallikrates, while incorporating the foundation of a Doric temple destroyed by the Persians departed radically from the conventional plan, and is herewith outlined.

The stylobate or ground floor dimensions were 101 feet by 230 feet and the height of the building was 60 feet. It was constructed of white Pentellic marble quarried at Mt. Pentellicus, about 16 miles northeast of Athens.

The interior plan had several unusual features. Instead of having the interior columns 'in antis' (i.e. between the ends of the solid walls) the pronaos and opisthodomis had porticoes, each consisting of six columns standing well in front of the short antae (the ends of the side walls). This scheme was apparently inherited from the former temple on this site, as the Parthenon incorporated portions of this building. The number of portico columns however was increased from four to six on both ends. The cells contained two rooms separated by a solid wall. The rear chamber, a bank or treasury, entered by way of the opisthodomus, had four Ionic columns supporting the ceiling. The main room, the hekatepedos, - and indeed the whole building was designed to hold the great chryselephantine (ivory and gold) statue of the goddess Athena Parthenos, constructed on a wooden framework with removable sheets of thin gold. This statue, made by the sculptor Pheidias, was framed by a two-storied colonnade, which design had already been used in the Temple of Aphaia at Aigina and in the Temple of Zeus at Olympia. Here however, the colonnade continued around behind the statue thus visually framing it and allowing visitors to walk around it.

The external fluted columns were shaped in a slender style of the Doric order, being about $5\frac{1}{2}$ ground-level diameters in height. These columns not only tapered but their bulge or entasis was so reduced that it disappeared to the casual viewer, but is clearly visible if one looks aslant between two pillars and at a narrow band of sky. It is suggested this was designed to counteract the diminishing effect of light behind them. Further, the fluting tapered in width but not in depth as they approached the echinus.

The axis of the outside columns slope inward 1 in 106 and the inner columns have a slightly smaller inclination being 1 in 150, but those at the corners slope twice as much since they are inclined in both planes. Moreover, the corner columns have a slightly greater diameter and are slightly longer than the others. It has been calculated, that if produced, the column axes would converge at a height of about

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one mile.(i.e. the vanishing point).

The floor rises slightly in a bulge (not a mathematical curve) to a height of about four inches in the middle of each long side and two and a quarter inches on each end. This rise is followed by the line of the architrave along the top of the columns and by the whole entablature. The whole design effectively mutes the normally massive Doric character thus producing a marvelous slenderized impression.

The construction which commenced in 447 B.C. was completed in 438 B.C., however the sculptured decorations were not completed until 433 B.C. This work was done by or under the direction of Pheidias who was a close personal friend of Pericles and with whom he maintained a close liason concerning these decorations. They included not only the 92 metopes around it; the 50 guilt shields or wreaths attached to the architrave also extending around the

building; the east and west pediments; the ridge, corner and gutter decorations; the 40 foot high: chryselephantine statue of Athena; but also a 524 foot X 4 2/3 foot statuary frieze extending completely around the outer upper face of the cella wall. This frieze, the bottom of which is 39 feet above the stylobate, began at the west end and appeared to move along both the north and south sides of the building to the east front where a ritual appeared to be taking place. It is generally believed that the frieze is a representation of the most important ceremony in Athens, the Panathenaic procession

It is of interest to note that about 437 B.C., when Pericles was being attacked through his friends, Pheidias was accused of embezzling some of the gold entrusted to him to make the statue. Apparently Pericles had presupposed this eventuality and had instructed Pheidias to attach the gold in such a manner it could be removed and weighed. This was done and Pheidias was exonerated of the accusation. My text source of this information states that Pheidias used £150, 000 of gold to fabricate Athena's raiment. As the text was first printed in 1911 and had several revisions up to 1962 one cannot be sure what the actual weight was or its current value.)

Having thus detailed the construction features of the Parthenon, my first comment is that not having had an opportunity to visit Greece , my presentation has relied wholly on printed source material and I trust my perception of it has been correct. If not, I would welcome any advice concerning possible errors.

While preparing this paper, several thoughts and questions have arisen which I am sure will lead me to further investigations. My principal thought concerns the concept of designing a building in such a manner that the traces of the principal features extend to a vanishing point. While not being a painter or an architect whose presentations I believe often contain this element, I wonder if any constructions elsewhere have incorporated it. Further to this thought is the question, "What type of instrumentation or surveying enabled Iktinos and Kallicrates to achieve the minute control which the member parts of the building demonstrate?"

It is obvious each column is composed of drum sections, each having been joined with iron or bronze pins firmly set with lead caulking. Caulking one half of the joint would be simple, but how about the other side? Further, the drum sections are sufficiently regular as to appear to have been turned in some form of lathe on which close control was exercised to permit ever decreasing diameters as shaping approached the upper end and also to make due allowance for the entasis bulge. I have been unable to find any reference to such equipment. Again the fluting on the columns gives rise to further speculation as to how it might have been done with accuracy.

References indicate that the largest blocks of marble handled at the quarries were about ten tons in weight and were moved with the use of ropes, pulleys and booms. As limestone is relatively soft and iron tools were available, it is altogether possible the marble was quarried by drilling holes and breaking dimension sizes with wedges, but this would be very difficult to do when thin slabs are required. I would like very much to know how it was done. Today it is done with an abraiding wire.

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The preparation of this paper was completed with the aid of the following listed reference sources which I acknowledge with thanks:-

The Archaeology of Greece, An Introduction. R. Biers

Cornell Univ. Press		
The Glory that was Greece	J.C. Stobart	New English Library
Ltd.		
The Pelican History of Greece		A.R. Burn
Penguin Books		
The Anchor Atlas of World History	H. Kinder & W. Hilgemann	Anchor Books
The Acropolis	M. Andronicos	Ekdotike Athenon S.A,

Presented with 29 slides

Detail of slides accompanying Parthenon Lecture

1. Acropolis.
 2. Parthenon N. & W. faces
 3. Doric Order column.
 4. Temple Plans.
 5. Isometric view of typical temple. Hephaisteion.
 6. Model of Athena Parthenos.
 7. Left - Southside pteroma. Right - Superstructure north side.
 8. Doming stylobate.
- The following slides are all of the Parthenon
- 9, Parthenon - East face
 - 10 Northeast corner view.
 - 11 Northeast corner detail
 12. Top - East pediment restored. Bottom - South side east pediment.
 13. Northwest corner. Note frieze.
 14. Northwest corner detail.
 15. Interior east section.
 16. Only portion of west frieze in situ.
 - 17.- 21 Parts of west frieze.
 22. Central portion, east frieze. Elgin Marbles British Museum
 23. Part of frieze. Elgin Marbles British Museum
 24. Slab from north side frieze 25 Slab from east side frieze.
 26. Hydria bearers. 27. Mourning Athena
 28. Reconstructed model. 29. Parthenon.
