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FIELD REPORT

The Kızılburun Shipwreck and the Temple of Apollo at Claros

DEBORAH N. CARLSON AND WILLIAM AYLWARD

Abstract

At some point in the Late Hellenistic period, an ancient marble carrier sank off the western coast of Asia Minor near the promontory now called Kızılburun. The ship had set out from Proconnesos Island laden with a freshly quarried cargo of architectural parts intended for the Temple of Apollo at Claros, but the vessel sank before reaching its destination. The remains of the shipwrecked cargo, discovered in 1993 and under excavation since 2005, include a Doric capital and eight column drums with an estimated total weight of at least 50 tons. Isotopic and metrological data indicate Proconnesos as the source of the marble and Claros as the destination of the unfinished column found in the Kızılburun shipwreck. The discovery provides a unique snapshot of quarrying processes, long-distance transport by sea, and monumental construction in marble in Late Hellenistic Asia Minor.*

THE KIZILBURUN SHIPWRECK

Discovery

The Institute of Nautical Archaeology (INA) at Texas A&M University has carried out underwater surveys for shipwrecks off the Turkish coast more or less annually since 1980. During the 1993 INA survey, directed by Cemal Pulak, five ancient shipwrecks were discovered at Kızılburun (“Crimson Cape”), a rocky promontory on the southwest coast of the Karaburun peninsula (fig. 1).¹ Kızılburun is exposed to strong winds and treacherous sea conditions that may well have been responsible for the numerous shipwrecks in this area. Four of the five wrecks at Kızılburun are Byzantine or medieval, but the fifth is a Late Hellenistic stone carrier. This ship was transporting eight large marble column drums and a Doric capital, all newly quarried and on their way to the construction site of a monumental building.

The Cargo

In 2005, an INA team under the direction of Donny Hamilton and Deborah Carlson initiated excavation of the Kızılburun column wreck, which lies at a depth of 45–48 m. This article presents the results of three seasons of excavation (2005–2007).² The primary cargo on the ship comprised eight unfinished drums and a Doric capital. All were preserved on the seabed in much the same position they must have occupied in the hold (figs. 2, 3). The drums were arranged in two rows of four, only centimeters apart, and the unfinished capital rested on top of the four drums at the shallow end of the wreck (45 m deep). The size and proportions of the capital and eight drums, which vary only incrementally in diameter, suggest that they were likely intended for one Doric column.

In addition to the column parts, excavation revealed that the vessel was also transporting a subsidiary cargo of roughly finished marble objects, including two large basins with separate pedestal bases, two large tablelike slabs, four rectangular blocks that may have been intended as pillars or steps, and nearly a dozen grave stelae (see figs. 3, 4). Pottery from the wreck includes a wide range of typical Hellenistic shapes in a variety of fabrics: lagynoi, kylikes, fish plates, cooking pans, echinus bowls, moldmade bowls, and lamps. Transport amphoras include about two dozen examples from the Adriatic, East Greece, the Black Sea, and Egypt. The present ceramic corpus, which is still under examination, suggests that the date of the wreck likely falls somewhere in the first three quarters of the first century B.C.E.³ The presence of at least one dozen Lamboglia 2 amphoras, fragments of Italian thin-walled ware, and several cooking pans of the *orlo bifido* type invites speculation about the possibility that the voyage

*The authors are grateful to the anonymous reviewers for the *AJA* for their helpful comments. We also gladly acknowledge the assistance of C. Fant, L. Lancaster, and P. Stinson for reviewing drafts of this article and returning welcome advice for improvement. We are especially grateful to D. Laroche and

J.-C. Moretti for their hospitality and collaboration at Claros.

¹Pulak and Rogers 1994.

²For preliminary reports, see Carlson 2006, 2007, 2009; Carlson and Atkins 2008.

³Carlson 2007, 2009.



Fig. 1. Map of sites mentioned in the text.

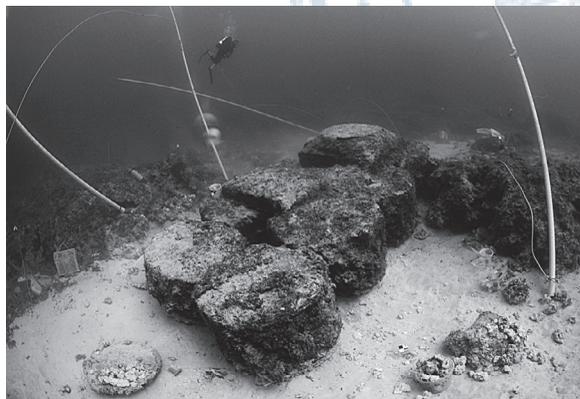


Fig. 2. The Kizilburun shipwreck in 2005, during the first season of excavation. View from the southeast with Drum 8 in foreground (D. Carlson).

⁴Pike reported a maximum grain size of 2 mm, which is consistent with the expected range for Proconnesian marble (S. Pike, pers. comm. 2009). Isotopic analysis has been the traditional method of determining marble origin for at least three decades (Craig and Craig 1972; Herz 1995; Brilli et al. 2005). As the database of quarry samples grows, the ability of isotopic analysis to discriminate between sources has decreased, while spectroscopic analysis is a multimethod approach that

originated in a western port; this may have interesting implications for theorizing about the person or persons responsible for this marble shipment.

The Source of the Marble

Samples of four marble artifacts from the Kizilburun shipwreck were sent to Scott Pike at Willamette University for maximum grain size and stable isotope analysis; an additional sample from Drum 5 was sent to Donato Attanasio at the Istituto di Struttura della Materia for examination by electron paramagnetic resonance (EPR). The combined petrographic, isotopic, and spectroscopic analyses reveal that this marble cargo very probably originated on the island of Proconnesos in the Sea of Marmara (table 1).⁴ Isotopically, Proconnesian marbles represent “a rather compact and homogeneous population.”⁵ The percentage probabilities presented in table 1 reflect the resemblance between the isotopic values (¹³C/¹²C and ¹⁸O/¹⁶O) of an individual marble sample and those values at the center of a particular quarry field, as defined in the Classical Marble Database developed by Norman Herz.⁶ Many of the marble objects from the Kizilburun shipwreck feature distinct blue-gray bands often associated with Proconnesos and its quarry products (fig. 5). Although such banding is also found on other marbles of western Asia Minor, it is nonetheless a useful diagnostic tool for contrast with other plain white marbles.⁷

Recording Methodology

The coherence of the eight marble drums on the seabed shows that the ship sank quickly, faithfully reflecting their original position on the ship and suggesting that parts of the wooden hull of the vessel lay preserved beneath. In order to examine the nature of the ship construction, the drums—which weigh between 6 and 7 tons each—the capital, and the secondary cargo were all removed from the archaeological site. Each drum was secured with three Lift-All Tuflex lifting slings rigged in a triple choker hitch assembly (fig. 6). The slings were then connected to four 4,000-pound Subsvalve lift balloons, which were subsequently inflated for the lifting and relocation process. One by one, the drums were lifted and carefully redeposited onto the seabed about 25 m away.

can distinguish between quarry fields that overlap isotopically (Attanasio 2003; Attanasio et al. 2006, 2008).

⁵Attanasio et al. 2006, 202.

⁶Herz 1987; see also Asgari and Matthews (1995) for isotopic signatures of 69 samples collected from unfinished artifacts and quarry faces on Proconnesos.

⁷It is apparently also witnessed at quarries around Ephesos and Herakleia, under Latmos (C. Fant, pers. comm. 2009).

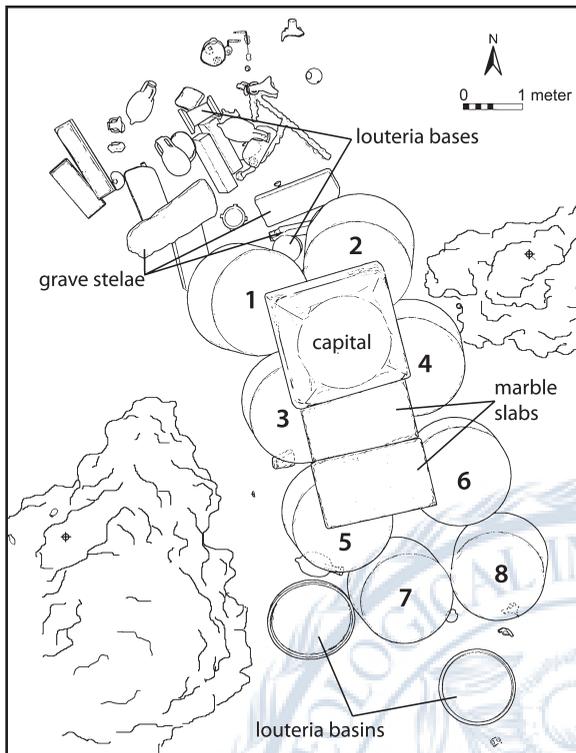


Fig. 3. Plan of the Kizilburun shipwreck in 2005, before excavation. Numbers indicate column drums (drawing by S. Matthews).

After the relocation process, each drum was flipped with a single lifting sling and balloon in order to expose surfaces free of marine encrustation (fig. 7). Reference points of high-contrast mapping putty were applied to as many original, concretion-free surfaces as possible and then captured from multiple angles with a digital camera calibrated for three-dimensional rendering in PhotoModeler (fig. 8). The reference points were used to create a wire-frame model of each drum, which we then draped with a solid surface (fig. 9). This allowed us to study complete, three-dimensional scaled digital replicas in the laboratory, beyond the archaeological site, where decompression dives are limited to 20 minutes each. This digital modeling process facilitated analysis of dimensional data, documentation of details such as uneven quarry-finished surfaces, and calculation of the approximate tonnage of each element. The range of dimensions given in table 2 reflects the erosion and accumulation of marine growth, especially on surfaces unburied by sand (see

fig. 4). Beneath many of the marble artifacts, divers encountered a white, chalky layer as much as 20 cm thick, which presumably represents the accumulated detritus of mollusks that bored into and exfoliated the exposed surfaces. Conversely, marble surfaces beneath the sand were rather well preserved.

THE DORIC COLUMN

The presence of monumental, quarry-finished Doric architectural elements on a Late Hellenistic shipwreck raises questions about the intended destination of the cargo. The form of the architectural elements and the date of the wreck suggest they were destined for a site where a monumental Doric building in white marble was under construction in the late second or early first century B.C.E. The location of the wreck at Kizilburun is also key, as is the presumed direction of travel away from the quarries at Proconnesos. This rules out Thrace and the northern Aegean but allows for anywhere south of the shipwreck, including the Cyclades, Peloponnesos, the south coast of Asia Minor, and even Cyprus or North Africa. Metrological analysis of the quarry-finished architectural parts helps narrow the field of potential buildings because the large size of the drums and capital rules out a portico, propylon, or theater facade—these pieces had been quarried for nothing smaller than a temple.⁸

The marble artifacts from the Kizilburun shipwreck, including the drums and capital, were roughly finished when they were loaded on board. The drums



Fig. 4. The Kizilburun shipwreck in 2005, during the first season of excavation. View from the northeast with Drum 2 in foreground (D. Frey).

⁸For a survey of postclassical Doric temples, see Dinsmoor 1950, 217–21. It is doubtful that the cargo was intended for a freestanding columnar dedication because these are uncommon for the Doric order in Late Hellenistic times.

Table 1. Results of Stable Isotopic Analyses of Four Marble Artifacts from the Kızılburun Shipwreck.

Artifact	$\delta^{13}\text{C}$	$\delta^{18}\text{O}$	Statistical Probability of Proconnesian Origin
Column Drum 5 (Lot 005)	+1.74	-2.38	81%
Small basin/mortar (Lot 268)	+2.99	-1.37	87%
Pedestal (Lot 374)	+2.75	-1.94	100%
Grave stele (Lot 392)	+2.73	-2.04	100%



Fig. 5. Blue-gray banding visible on a block of Proconnesian marble from the Kızılburun shipwreck (D. Frey).

are not fluted and were shipped with a quarry-coat designed to protect the cargo during transport.⁹ For preparation and assembly of a column, masons at the construction site would have trimmed away the quarry

⁹For quarry finishes at Proconnesos, see Asgari 1988, 1992. For quarry finishes in general, see Coulton 1977, 59; Rockwell 1993, 77–86, 89–98. For specific examples, see Ward-Perkins 1958, 99; 1971, 5, pl. 3a; Martin 1965, 190–91; Kapitän 1969; Peschlow-Bindokat 1981, 162–65, figs. 2, 3, 17–24, 50–60; Kozelj et al. 1985; Beykan 1988; Wurch-Kozelj 1988, 55; Dodge and Ward-Perkins 1992, 29, 131–32; Vanhove et al. 1996, 16–43, figs. 18, 49–50, 91, 98 (Euboea). For quarry finishes at Ro-

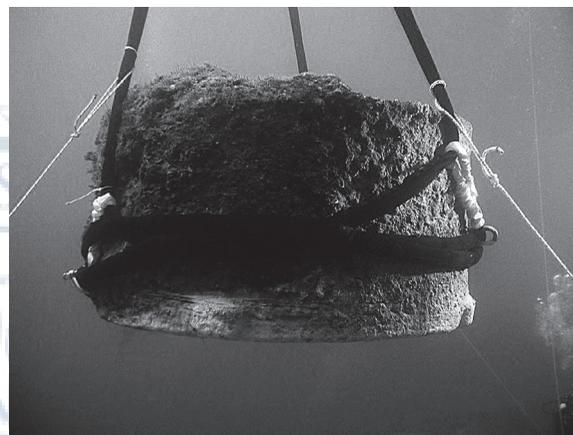


Fig. 6. Drum 4 rigged with the triple choker hitch assembly during removal from the wreck site (S. Matthews).

coat and then added flutes and final finish after the drums and capital had been erected on the stylobate.¹⁰ The Kızılburun drums are unfinished, but the capital is clearly Doric (see figs. 2, 4, 10). It is 0.70 m high and preserves the abacus and echinus in rough form, as well as enough marble below the echinus for carving the very top of the column shaft (see fig. 10). The roughed-out capital shows that the circumference of the echinus was intended to match the full width of the abacus, as expected for the Doric order, and that the echinus has a steep slant, which suggests a date no earlier than postclassical.¹¹

The diameter of the narrowest drum (Drum 7) matches the lower diameter of the capital. The largest drum (Drum 4) features four handling bosses

man and medieval limestone quarries in France, see Bessac 1996, 248–64.

¹⁰Martin 1965, 297–302; Korres 2001, 24–9, 50–9, 108. Columns with drums in place but quarry coat not removed remain standing at the Temple of Artemis at Sardis and the Temple of Apollo at Didyma.

¹¹For proportions of postclassical Doric capitals, see Rumscheid 1994, 302–4; Lawrence 1996, 68–9.

Table 2. Dimensions and Weights of the Kızılburun Column Parts.

Identification No.	Diameter (m)	Height (m)	Volume (m ³)	Weight (kg) ^a	Weight (tons) ^a
Drum 1	1.75–1.77	0.89–1.01	2.14–2.48	5,841–6,781	5.84–6.78
Drum 2	1.67–1.73	0.92–0.99	2.01–2.33	5,499–6,350	5.50–6.35
Drum 3	1.74–1.82	0.87–0.91	2.16–2.52	5,904–6,886	5.90–6.89
Drum 4	1.78–1.83	0.93–0.97	2.31–2.55	6,315–6,962	6.31–6.96
Drum 5	1.64–1.67	0.97–1.03	2.05–2.25	5,591–6,156	5.59–6.16
Drum 6	1.70–1.76	0.94–1.05	2.13–2.55	5,821–6,970	5.82–6.97
Drum 7	1.53–1.59	0.93–0.97	1.71–1.93	4,666–5,255	4.67–5.26
Drum 8	1.63–1.67	0.94–0.98	1.96–2.15	5,352–5,857	5.35–5.86
Capital	1.52–1.58 (lower diam.); 1.94 x 2.00 (top of abacus)	0.70	2.32	6,325	6.33

^a Weight calculations are based on 2,730 kg/m³ for the specific gravity of Proconnesian marble

around its base (see fig. 6); this makes sense as the drum intended for the bottom of a Doric shaft that sat directly on the stylobate. When arranged by diameter, the other seven drums exhibit the diminution characteristic of Doric columns (table 3).¹² The sequence of narrowing diameters and matching capital charted in table 3 does not prove that the drums and capital were intended for use in the same column, but transport in the same cargo certainly suggests this scenario.

The average height of the unfinished drums is just below 1 m (see table 3). In their finished state after removal of the quarry coat, the average height of each drum would have been about 0.90 m, for a total height of about 7.20 m for the shaft. The finished diameter of the largest (lowest) drum would have been 1.73 m, and the height of the finished capital would have been 0.60 m. A column composed of these eight drums and capital would have been 7.8 m tall with proportions of 1:4.51 (i.e., a column just more than four-and-a-half times as tall as its bottom diameter).

Other features of interest are neat bevels carved around the edges of all the drums (see fig. 8) and a large incised tool(?) mark scratched onto the top surface of Drum 3, which, based on its diameter, belongs to the bottom third of the column shaft (see fig. 9). The mark, which was discovered when the drum was

turned over in 2007, was originally facedown in the hold of the ship. Thus, if intentional, the mark probably occurred during production at the quarry rather than during the lading of the vessel before departure from Proconnesos.¹³

DESTINATION OF THE COLUMN: THE TEMPLE OF APOLLO AT CLAROS

Sizing Up the Column

A column of this size and proportion lies well below the range of known postclassical examples, which tend to be much taller (table 4).¹⁴ To make up a complete column, the drums on the ship must have belonged to a larger set that was apparently broken up, presumably for reasons dictated either by availability at the quarry or by maritime transport. The deficiency in the height of the Kızılburun column makes sense if other drums were shipped separately. Because the Kızılburun cargo appears to include both the lowest and highest drums for the column (Drums 4 and 7, respectively), the drums shipped separately very probably belonged somewhere in the middle of the shaft.

The consistency in the height of the column drums is also useful for determining the intended destination of the ship. The maximum difference in height between the tallest and shortest drum is no more than

¹² Entasis is also likely but not demonstrable beyond doubt, given the quarry-finished state of the drums.

¹³ For mason's marks on finished temple blocks at Claros, see Martin 1965, 224–25, pl. 21.

¹⁴ The bulk of the data in table 4 derives from Dinsmoor

1950, 340. For the sake of argument, even a generous calculation with hardly any change in height to the quarry-finished drums yields a ratio of 1:4.56 for the Kızılburun column, but even this slightly slenderer and taller column is without a good parallel, especially for the Late Hellenistic period.

0.18 m, and five drums are within 0.04 m of the same height (between 0.94 and 0.98 m). Thus, a similar uniformity of drum height should be a feature of the building for which the Kızılburun column had been quarried. Other requirements are active construction in white marble during the first century B.C.E. and a finished lower-column diameter of about 1.73 m. A survey of sites across the range of possible destinations for the ship yields only one monument that meets all these criteria: the Temple of Apollo at Claros.

Construction at Claros

Construction of the Temple of Apollo at Claros began no later than the third century B.C.E., and an inscription on the architrave naming Hadrian as dedicatory in the nominative case cannot date before December 135 C.E.¹⁵ Thus, construction at the temple was ongoing when the Kızılburun ship sank, very probably in the first century B.C.E. The temple measures 26.00 x 45.49 m on the stylobate.¹⁶ The intended plan called for a 6-column x 11-column peristyle, but no more than 14 columns appear to have been erected—6 on the facade and 4 each on the north and south sides. The original height of the peristyle columns is not certain, but in the most recent study on this matter, Laroche and Moretti conclude that the peristyle columns were composed of either 11 or 12 drums for a total height of either 10.425 m or 11.315 m (figs. 11, 12; table 5).¹⁷ Either reconstruction is consistent with other postclassical temples (see table 4).

At Claros, there are extant from the peristyle seven capitals and about 130 drums, which are slightly smaller than the capital and drums in the Kızılburun cargo (table 6). Comparison of the unfinished and finished parts suggests a match if a quarry coat of 0.03–0.05 m thick per surface is allowed for the Kızılburun drums (see fig. 12). This is well within the practical limits for ancient quarry coats.¹⁸

The extant finished peristyle drums at Claros are also remarkably consistent in height (0.805–0.945 m). Contemporary temples in southwestern Asia Minor have finished drums with far greater variation in

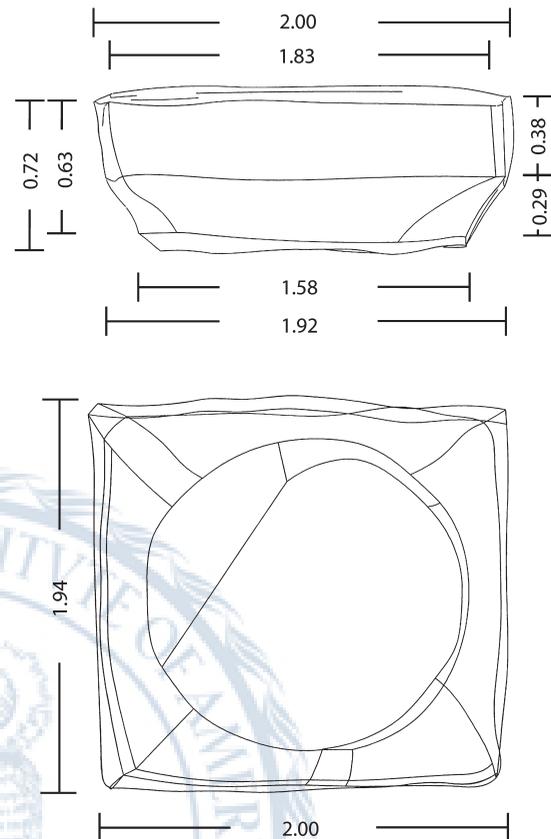


Fig. 10. The Doric capital. Measurements in meters (drawing by S. Matthews).

height. Examples include the Temple of Athena Polias at Priene (0.65–1.40 m) and the Temple of Artemis at Sardis (0.56–1.94 m).¹⁹ Thus, the date of the shipwreck and the sizes and proportions of the unfinished drums at Kızılburun and the finished drums at Claros make the Temple of Apollo at Claros a strong candidate for the destination of the cargo found at Kızılburun.

In addition, some of the extant column drums from the peristyle at Claros bear the same distinct blue-gray

¹⁵ Robert 1980, 404; Rumscheid 1994, 20; Şahin 1998, 37–41; Ferrary 2000. For the temple in general, see de la Genière 1992, 11–19; de la Genière and Jolivet 2003, 197–209; see also the annual reports by Robert (1957, 1958, 1959, 1960) in *Türk Arkeoloji Dergisi*.

¹⁶ The description of the temple here is based on Laroche and Moretti 2008, 359.

¹⁷ Published figures for the peristyle columns before the new work at the temple by Laroche and Moretti (2008) include the following: 12 drums per column, lower diam. 1.725 m, upper diam. 1.406 m, total ht. of column (including capital) 11.42 m, column proportion 1:6.62 (Şahin 1998, 38–9);

11 drums per column, total ht. of column 10.26 m (Rougetet 1992, 102–3 n. 2); 12 drums per column (Martin 1965, 225). For comparison, peristyle columns on the Parthenon were 10.43 m tall and composed of 11 drums and a capital.

¹⁸ E.g., Martin 1965, 190–201, pls. 17–20, 27–8 (Claros and elsewhere); Waelkens et al. 1988, 19, fig. 12 (Docimion); Asgari 1992, 76, fig. 21 (North Hall at Pergamon); Korres 2001, 24–5, 28–9, 76, 88–9, figs. 17, 18 (Pentelikon and Spelia).

¹⁹ For quarry-finished drums at Herakleia under Latmos, destined for the Temple of Apollo at Didyma with a range of preserved heights between 0.90 and 1.90 m, see, e.g., Peschlow-Bindokat 1981, 162–65, cat. nos. 12, 15, 20, 26, 38, 42, 47, 51.

Table 3. The Kızılburun Column Drums Sorted by Diameter.

Identification No.	Diameter (m)	Height (m)
Drum 7	1.53–1.59	0.93–0.97
Drum 8	1.63–1.67	0.94–0.98
Drum 5	1.64–1.67	0.97–1.03
Drum 2	1.67–1.73	0.92–0.99
Drum 1	1.75–1.77	0.89–1.01
Drum 3	1.74–1.82	0.87–0.91
Drum 6	1.70–1.76	0.94–1.05
Drum 4	1.78–1.83	0.93–0.97
Range of sizes	1.53–1.83	0.87–1.05

Table 4. Chronological List Showing Proportions of Columns in Doric Buildings After 400 B.C.E.

Monument	Date	Lower Column Diameter (m)	Proportion
Temple of Asklepios at Epidauros	380 B.C.E.	ca. 0.94	ca. 1:5.59
Temple of Apollo at Delphi	366–326 B.C.E.	1.80	ca. 1:5.86
Temple of Athena Alea at Tegea	350 B.C.E.	1.55	1:6.11
Temple of Zeus at Nemea	340 B.C.E.	163.2	1:6.35
Temple of Zeus at Stratos	321 B.C.E.	131.5	1:5.42
Nikias monument at Athens	319 B.C.E.	0.845	1:6.05
(Peripteral) Temple of Apollo at Delos	ca. 460–280 B.C.E.	0.945	ca. 1:5.50
Temple of Athena Polias at Pergamon	250 B.C.E.	0.755	1:6.98
Temple of Athena at Ilion	ca. 225–150 B.C.E.	1.20	ca. 1:6.00–6.50
Temple of Dionysos at Pergamon	170 B.C.E.	0.62	1:7.24
Propylaia of Artemis at Eleusis	125 C.E.	ca. 0.79	1:5.76

banding (fig. 13) found in the Kızılburun cargo (see fig. 5) and identified as a characteristic of Proconnesian marble.²⁰ The capitals from both of the in antis columns have slightly smaller proportions, while the associated drums measure only about 0.47 m tall, indicating that the Kızılburun column was intended for the peristyle, not the pronaos, at Claros.²¹

Another important piece of evidence from Claros is a partially finished drum that was evidently intended as the bottom drum for a peristyle column (fig. 14).²² The drum is 0.82 m high with a maximum diameter of 1.88 m. The dimensions, quarry coat, and beveled edge of this drum are all consistent with the appearance of the drums at Kızılburun (see fig. 9). At some point af-

²⁰ Rougetet 1992, 104: "Le plus représenté est le marbre blanc veiné de bleu."

²¹ Rougetet 1992, 102–3, figs. 2–4, 10, 11; de la Genière and Jolivet 2003, plan A; Laroche and Moretti 2008, 355–59.

²² The drum is described and illustrated in Laroche and Moretti (2008, 359–60, fig. 4), and it was examined firsthand by the authors in consultation with Laroche and Moretti in 2008.

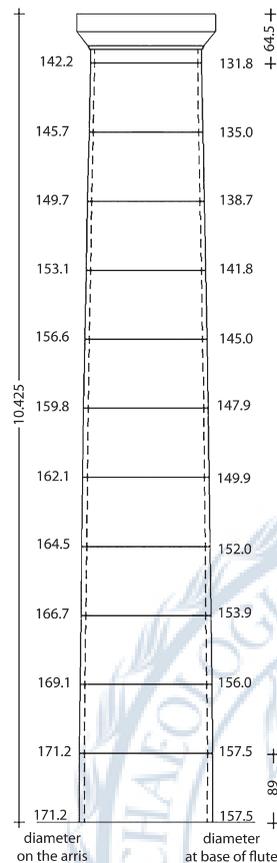


Fig. 11. Restored elevation of a peristyle column at Claros with 11 drums and a ratio of 1:6.09. Drum dimensions in centimeters, overall column height in meters (drawing by D. Laroche).

ter the drum arrived at Claros, masons began to carve Doric flutes into one end. The widths of the flutes and arrisses match those on other bottom drums from the peristyle columns. The partially finished drum represents an important intermediate stage of processing between the roughly finished, unfluted drums found at Kızılburun and the finished, fully fluted drums at Claros. The drum may have been abandoned during the last phase of temple construction or, alternately, it may have been rejected from an earlier building phase, perhaps contemporary with the Kızılburun

shipwreck, because of a fissure that appears to run diagonally through the entire drum.

Also noteworthy are the lewis holes at Claros. The peristyle drums at Claros all have lewis holes, except for the bottom drums, including the partially finished drum described above.²³ Lewises were used in Hellenistic and Roman temples in western Asia Minor to hoist and lower drums into position on top of other drums.²⁴ Bottom drums, by contrast, were maneuvered laterally into position on the stylobate with pry bars, and thus did not need lewis holes. This feature of the Claros drums explains why there are handling bosses only on the drum with the greatest diameter (Drum 4) at Kızılburun (see fig. 6). The four equidistant bosses on the lower edge of Drum 4 would have protected it from damage during handling with pry bars. It is also possible that the bosses were used to lever the drum upward to allow for the carving of flutes around the lower edge.²⁵ Consequently, there is no reason to connect the handling bosses on Drum 4 to the lading of the ship, since the other drums on board do not have them.²⁶ These details illuminate the careful process by which architectural parts took on their final shape and appearance between initial production at the quarry and final placement and fin-

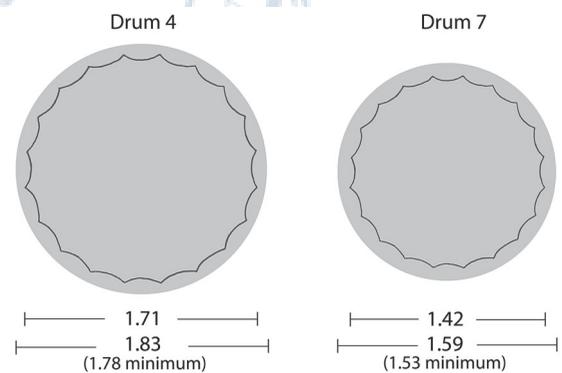


Fig. 12. Lowest and highest column drums from the peristyle for the Temple of Apollo at Claros superimposed on the largest and smallest drums from Kızılburun. Measurements in meters.

²³ de la Genière (1992, 102–3, fig. 3) identified seven bottom drums. Two have been restored to their approximate original location at the east end of the north peristyle.

²⁴ In addition to the Temple of Apollo at Claros, lewis holes are known at the Temple of Athena at Iliion (Goethert and Schleif 1962, 10, pls. 4d, 5a), the Temple of Dionysos at Pergamon (Bohn 1896), the Temple of Apollo Smintheus at Chryse (Özgünel 2001, pl. 62), as well as the Temple of Athena at Priene, the Temple of Artemis at Magnesia, and the Tem-

ple of Artemis at Sardis.

²⁵ This interpretation for the handling bosses on Drum 4 is consistent with conclusions of Coulton (1974, 2–3) regarding the function of such bosses for lateral shifting, not vertical hoisting; cf. Korres 2001, 76.

²⁶ For maneuvering blocks onto ships, see Ward-Perkins 1971, 18; Dodge and Ward-Perkins 1992, 73; Wurch-Kozelj 1988, 58, 63.

Table 5. Restored Diameters, Height, and Proportions for a Peristyle Column for the Temple of Apollo at Claros.

Dimension	11 drums	12 drums
Lower diameter	1.712 m	1.712 m
Upper diameter	1.422 m	1.422 m
Height of total column (including capital)	10.425 m	11.315 m
Column ratio (lower diam. to total ht.)	1:6.09	1:6.61

Table 6. Total Range of Actual Size for Column Drums at Kızılburun and for the Peristyle of the Temple of Apollo at Claros.

Site	Height	Diameter
Column drums at Kızılburun (unfinished)	0.87–1.05 m	1.53–1.83 m
Peristyle of the Temple of Apollo at Claros (finished)	0.805–0.945 m	1.440–1.725 m

ishing at the building site. This in turn implies detailed communication about architectural specifications between Claros and Proconnesos, where bosses were added to the bottom drum to assist maneuverability at the construction site.²⁷

ANCIENT MARITIME TRANSPORT OF PROCONNESIAN MARBLE

The marble quarries of ancient Proconnesos (near modern Saraylar on Marmara Island) produced one of the Mediterranean's most famous and widely exported white marbles.²⁸ Proconnesos was known as a source of white marble since at least the sixth century B.C.E.,²⁹ and it was an important source of architectural marble for monuments in Asia Minor throughout classical and Hellenistic times.³⁰ In the Roman period, Proconnesian marble also became an important

source for garland sarcophagi.³¹ In Diocletian's *Edict on Maximum Prices* (301 C.E.), Proconnesian marble ranked least expensive (40 denarii/pes) of the 19 varieties of stone mentioned.³²

Extensive research in the Proconnesian quarries by Asgari has revealed scores of quarry-finished sarcophagi, sculptures, and architectural elements, including architrave blocks, capitals, bases, and column shafts ranging in date from the second to the sixth century C.E.³³ The absence of consistent dimensions or proportions led Asgari to conclude that the architectural parts "were not prefabricated in large series to be stockpiled and exported when a proper customer came up"³⁴ but custom ordered on an ad hoc basis for specific projects. Proconnesian exports from other shipwrecked marble cargoes corroborate Asgari's conclusions about quarry products manufactured on Proconnesos, and the Kızılburun cargo now

²⁷ Handling bosses also survive on quarry-finished column bases of the Roman Imperial period at the Proconnesos quarries but not on Byzantine examples (Asgari 1992, 75).

²⁸ For the quarries at Proconnesos and Proconnesian marble, see Magie 1950, 1:44; Ward-Perkins 1958; 1971, 8, 12; 1980, 328–34; Monna and Pensabene 1977; Asgari 1978, 467–80; 1988; 1992; Walker 1985, 1988; Throckmorton 1987, 74–6; Beykan 1988; Dodge 1991, 39–45, fig. 4; Dodge and Ward-Perkins 1992, 32–5, 61–105, 131–39, 144–51. Ward-Perkins (Dodge and Ward-Perkins 1992, 131) refers to some Proconnesian sarcophagi at Tyre as "exceptionally yellowish."

²⁹ Monna and Pensabene 1977, 151; Rose et al. 2007, 74–5.

³⁰ Zöldföldi and Satir 2003 (Ilion); Cramer 2004, 110–23 (Pergamon); Tykot and Herrmann (forthcoming) (Assos).

³¹ Ward-Perkins 1958; 1971, 8, 12; 1980, 328–34; Walker 1985, 1988; Dodge and Ward-Perkins 1992, 32–5, 61–105,

131–39, 144–51.

³² Giacchero 1974; Corcoran and DeLaine 1994; Arnaud 2007. Ballance (Erim et al. 1970, 134–36), commenting on the copy of the Edict at Aphrodisias, notes that the attribution to Proconnesos is not at all certain.

³³ Asgari 1978, 1988, 1990, 1992; cf. Magie 1950, 1:44; Monna and Pensabene 1977; Dodge 1991, 39–45, fig. 4.

³⁴ Asgari 1990, 117: "Toutes les observations démontrent que les mesures devaient être spécifiées par le client"; see also Asgari 1992, 74. For some finished products completed at the Proconnesos quarries before transport, see Asgari 1988, 1992. For finished products elsewhere, see Merlin and Poinssot 1956, pls. 1–10 (Mahdia shipwreck); Ward-Perkins 1971, 8 (Egypt); Waelkens 1982, 50; 1985, 652 (Docimion); Dodge and Ward-Perkins 1992, 29, 32, 37.

shows that the quarries were operating in this way as early as the first century B.C.E.³⁵

This is not the first time that quarry-finished blocks from Proconnesos have been found on a shipwreck, but the shipwreck at Kızılburun is now the earliest known example. Later examples include the Şile wreck in the southwestern Black Sea (100–125 C.E.), which was carrying a column base, five Ionic capitals, two large blocks, a sarcophagus lid, a few marble bowls, a bust of a woman, and an imperial cuirassed statue more than 4.5 m tall, all in Proconnesian marble in a quarry-finished state.³⁶ The Punta Scifo A wreck, near Croton (ca. 200 C.E.), was carrying unfinished blocks and statues in Proconnesian marble as well as eight quarry-finished pavonazetto columns from Dokimeion (lgh. 12 and 20 Roman ft.).³⁷ The Capo Granitola A shipwreck, off the Mediterranean coast of Sicily (225–275 C.E.), was laden with at least 67 quarry-finished blocks of Proconnesian marble for an estimated burden of 350 tons. Small chips of other marble types (Parian and verde antico) were also found among the wreckage. If these belonged to earlier cargoes, then the Capo Granitola A shipwreck may have been engaged exclusively in the transport of stone cargoes.³⁸ The so-called Church Wreck at Marzamemi, Sicily (500–550 C.E.), had a nearly complete set of bases, shafts, and capitals for a basilica with more than two dozen columns, as well as fragments of other blocks in verde antico.³⁹

In addition to these examples from Proconnesos, quarry-finished products from other quarries have been found on other shipwrecks.⁴⁰ A cargo of quarry-finished blocks in Carrara marble that went down near Saint-Tropez has some striking similarities to the Kızılburun shipwreck. On board were 13 quarry-finished architectural elements for a temple, including one architrave, three column bases, one ashlar block, and eight quarry-finished column drums.⁴¹ The ship that sank at Giardini Naxos (Sicily) was carrying about 90 tons of quarry-finished blocks of cipollino marble from Euboea and quarry-finished column shafts in white marble with gray veins.⁴² The unexcavated ship wrecked at Isola delle Correnti, off the Mediterranean coast of Sicily (ca. 200–400 C.E.), was transporting



Fig. 13. Blue-gray banding on a finished marble column drum for the peristyle at the Temple of Apollo at Claros (D. Carlson).

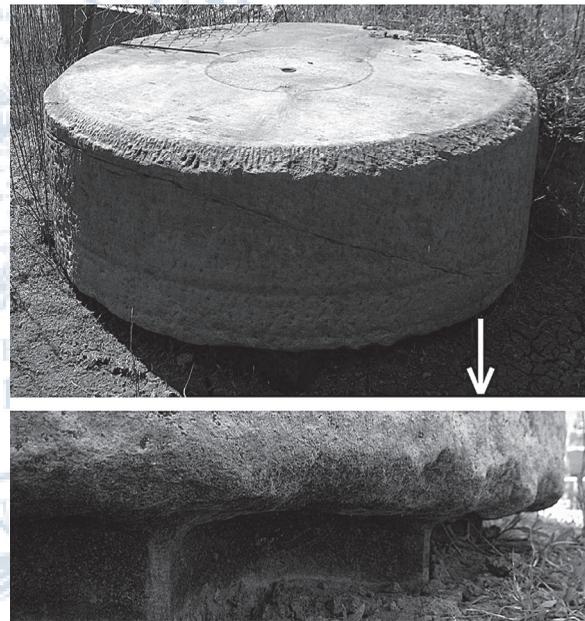


Fig. 14. Partially finished drum at the Temple of Apollo at Claros, presumably intended for the lowest position on a column in the peristyle. The bottom face of the drum is partially buried and has not been examined (W. Aylward).

³⁵ See Carlson (2009) for a list of known stone cargoes; to this list can be added the Byzantine wrecks at Altinkum and Kızılburun, described in Pulak and Rogers 1994.

³⁶ Beykan 1988; cf. Rockwell 1993, 93.

³⁷ Pensabene 1978; Throckmorton 1987, 76–7.

³⁸ Purpura 1977, 1983, 1991. For petrographic analysis of the marble, see Lazzarini et al. 1980. Purpura (1991) mentions another marble cargo (Capo Granitola D) nearby, with a consignment of Ionic and Corinthian capitals of white marble with blue veins; cf. Purpura 2008.

³⁹ Kapitän 1969; Throckmorton 1987, 84–5. The ship prob-

ably departed Proconnesos in the time of Justinian. The columns were 3.4 m long with protective collars like shafts found at Proconnesos; cf. Asgari 1992.

⁴⁰ Other Late Hellenistic stone carriers include the wreck at Carry-Le-Rouet, France, which was transporting limestone blocks apparently destined for Marseilles (Long 1986).

⁴¹ Benoit (1952, 240–44, figs. 1–3) suggested Gaul or North Africa as the destination. The drums had diameters between 1.80 and 2.20 m and heights between 1.70 and 1.95 m.

⁴² Basile 1988.

a cargo with about 40 bluish-white, quarry-finished marble blocks, the largest weighing almost 30 tons.⁴³ Architectural elements are also discovered in shipwrecks as recycled building material intended for secondary use, but such shipments did not originate at quarries. For example, the Methone 3 (C) wreck had a cargo of red Aswan granite columns, perhaps from Caesarea, in Palestine.⁴⁴ The Mahdia shipwreck, off Tunisia (ca. 90–80 B.C.E.), was also laden with finished architectural elements intended for reuse.⁴⁵ Nor are sarcophagi uncommon. For example, the Methone 7 (G) wreck was carrying sarcophagi in the porous *lapis sarcophagus* from Assos described by Pliny the Elder,⁴⁶ and 24 quarry-finished sarcophagi of Thasian marble were found in the San Pietro wreck near Taranto.⁴⁷ The shipwrecks cited here illustrate the broad range of configurations that characterize the more than two dozen marble cargoes presently known, but they also underscore the relatively modest size of the Late Hellenistic shipment found at Kızılburun (at least 50 tons) (see table 2).⁴⁸

The Cargo Ship at Kızılburun

The evidence from Kızılburun and Claros shows that the ship was evidently too small to carry all elements of a column, if in fact they were quarried at the same time as part of the same consignment. In light of Laroche and Moretti's conclusion that 11 or 12 drums comprised the column shafts at Claros, three or four drums for this particular column were apparently shipped separately, and it is not impossible that the cargo was limited by the size of the available ship.⁴⁹ The calculated total weight of the secondary marble blocks, louteria, and stelae is only about two tons, whereas the smallest column drum weighs five tons (see table 2).

One explanation for employing a ship too small to carry all the parts required for a column might be found at Claros, where building was driven by benefactions, or at Proconnesos, which experienced its boom in production and export sometime after the first century C.E.⁵⁰ Given the apparent need to partition the cargo, it does not seem accidental that the three key parts for the column design—the capital and the top and bottom drums—were shipped together. This is perhaps another clue to communication between the quarry and the sanctuary about design specifications for the temple. Also worth considering is the notion that the striking consistency in the size and height of the drums was deliberately designed to facilitate maritime transport.⁵¹

The Shipwreck and the Sanctuary

The Kızılburun shipwreck provides new evidence for the maritime transport of marble between the quarry and the construction site. Other shipwrecks often reveal evidence for points of origin or destination, but rarely can both be determined for a single voyage. The cargo of eight column drums and a Doric capital were quarried to specifications for a column on the peristyle of the Temple of Apollo at Claros. Comparison of the unfinished parts from Kızılburun with the finished parts from Claros provides a measurable value (between 0.03 and 0.05 m per surface) for the amount of marble used to protect blocks of this size during maritime transport from Proconnesos in the first century B.C.E. The match in size and shape between the unfinished capital and drums on the shipwreck and the finished parts at Claros suggests close contact between masons at the quarry and builders at the sanctuary.⁵² It is conceivable that a builder from Claros made the trip to Proconnesos with specifica-

⁴³ Kapitän 1961, 1971. The marble has not been analyzed but appears to be Proconnesian. Bartoli (2008, 58–65) notes some conspicuous parallels with the unpublished Punta Scifo B shipwreck at Croton.

⁴⁴ Throckmorton 1987, 75–6. The cargo weighed ca. 131 tons.

⁴⁵ Merlin and Poinssot 1956, pls. 1–10; Throckmorton 1987, 72; Salies et al. 1994. For the architectural elements from the Mahdia wreck, see Ferichou 1994; von Hesberg 1994. For five column shafts (lgth. ca. 8.5 m, diam. 0.90 m) off the coast of Croton, see Roghi 1961.

⁴⁶ Plin. *HN* 36.131; Throckmorton and Bullitt 1963, 16–23; Throckmorton 1987, 74; cf. Dodge and Ward-Perkins 1992, 56–9.

⁴⁷ Ward-Perkins and Throckmorton 1965; Throckmorton 1987, 76–7.

⁴⁸ Rougetet (1992, 104) calculated 52 tons for the weight of a peristyle column at the Temple of Apollo at Claros. The total calculated weight range of the column parts is 51.31–57.56 tons.

⁴⁹ Pomey and Tchernia (1978) provide cogent discussion of

the role of harbor facilities in determining the size of the largest vessels; Houston (1988) suggests that the majority of Roman cargo ships probably did not exceed 100 tons.

⁵⁰ Proconnesos: Asgari 1988, 119–20; Rose et al. 2007, 74–5. For evidence of a large imperial reorganization of quarries in the first century C.E., see Dodge 1991, 32–4; Dodge and Ward-Perkins 1992, 131.

⁵¹ In general, the drums are consistent with the preference in Greek architecture for several smaller blocks of stone in place of fewer larger ones to create the same monumental form; cf. Coulton 1974, 14–16; 1977, 144.

⁵² For prefabrication and building specifications applied to finished blocks at the quarry, see Kapitän 1969; Ward-Perkins 1971, 12; Beykan 1988, 129; Dodge 1991, 36–8; Dodge and Ward-Perkins 1992, 25–6, 29, 63. It is not inconceivable that marble workers with ties to Proconnesos were engaged in temple construction at Claros. For movements of marble workers between quarries and building sites, see Ward-Perkins 1971, 5, 12–13, 21 n. 10; 1980, 329–31; Dodge 1991, 39, 43; Dodge and Ward-Perkins 1992, 26 n. 21, 37, 61, 63, 69–72, 75 n. 56.

tions for the peristyle and perhaps even accompanied the shipment of marble back to the temple.⁵³ This connection between Kızılburun and Claros is further strengthened by the evidence of beveled edges and handling bosses on the drums in the shipwrecked cargo. Claros also may have been the intended destination for the smaller marble objects in the cargo, especially the louteria and tablelike slabs (see figs. 2, 3). Marble louteria have been found in the sanctuary at Claros, and cuttings on the foundations for the Altar of Apollo suggest that two marble tables once stood there.⁵⁴ All of this sharpens the picture of ancient quarrying, transport, and monumental construction provided by the Kızılburun shipwreck and underscores the interdependence of maritime and terrestrial archaeology for meaningful analysis and interpretation.

The shipwreck suggests that the sanctuary received columns in small shipments, no more than one column at a time, and this has further implications for the duration of the building program.⁵⁵ Until now, a pair of inscriptions has provided the only evidence for the date of the peristyle of the Temple of Apollo at Claros. An inscription of Tiberius on the pronaos architrave suggests that the outer peristyle architrave was not yet erected by the early first century C.E. An inscription of Hadrian on the east architrave shows that the east peristyle and architraves were in place some time before 135 C.E.⁵⁶ The Kızılburun shipwreck now reveals that some of the peristyle columns were under construction during the first century B.C.E. but not in sufficient numbers to allow for the completion of the east architrave before the time of Tiberius. This marks the first time that a construction phase of a monumental temple has been dated by a shipwreck.⁵⁷

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⁵³For quarrymen and masons moving with marble, see Burford 1969, 206; Asgari 1978, 478–80. For contracts for quarry and transport, see Burford 1965, 27–9.

⁵⁴Cf. Robert (1987, 84) for worship of Apollo and Dionysos on the altar before the Temple of Apollo at Claros.

⁵⁵For Greek and Early Roman builders ordering material block by block in the order required for construction, see Peña 1989, 130; Asgari 1992; Dodge and Ward-Perkins 1992, 20 n. 19, 21, 61 (for the Parthenon and temples at Epidaurus and Didyma). But stockpiling raw material at the destination

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(e.g., marble yards at Rome and Ostia) appears to have been a limited phenomenon, if it happened with any regularity at all; cf. Throckmorton 1987, 74; Dodge 1991, 36; Dodge and Ward-Perkins 1992, 25, 27–9, 63–4; Fant 2001. The so-called Church Wreck off Marzamemi (500–550 C.E.) apparently had all marble parts for a columned basilica and its ambo on board the same ship (Kapitän 1969, 1980; Throckmorton 1987, 84–5).

⁵⁶Ferrary 2000.

⁵⁷Long 1986.

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