

## The 2005 Remote-Sensing Survey of the South-Eastern Bozburun Peninsula, Turkey: Shipwreck Discoveries and their Analyses

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During a month-long survey of the coastline along the south-eastern Bozburun peninsula, Turkey, nine shipwreck sites were discovered. Of these, five have historical significance and represent a chronological range from the Roman Imperial to Renaissance periods. This article provides a description of the sites and associated artefacts, and attempts a provisional analysis for each wreck's operational date as well as the nature of the finds in their historical context.

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The picturesque Turkish coast features a profusion of finger-like projections where sparsely-vegetated cliffs are battered by waves. On the south-easternmost portion of one particular isthmus in the Aegean Sea, the Bozburun peninsula, the ancient settlements of Physkos, Lorima and Tios were founded. Over the centuries, this segment of coast was part of an active trade route between the ancient cities of Rhodes to the south and Knidos to the west, and part of the greater Aegean and eastern Mediterranean mercantile network. During the summer of 2005, a coastal survey of this shoreline was undertaken to locate and document submerged cultural remains. This co-operative project was carried out by the Turkish Ministry of Tourism and Culture, represented by Commissioner Gulnaz Savran, the Institute of Nautical Archaeology (INA), and RPM Nautical Foundation (RPM), a non-profit institute dedicated to nautical archaeology research. Founded by INA director George Robb junior in 2000, one of RPM's aims is to support INA projects all over the world.

INA has been carrying out expeditions along this section of coast over the past 40 years. During the summers of 1965, 1967 and 1968, Dr George Bass led survey expeditions in response

to reports of archaeological finds by sponge fishermen during the 1950s, noted by Peter Throckmorton. In 1968, 26 of 145 side-scan sonar images obtained in previous seasons were investigated and a scattered, unidentified wreck was located at 100 m (Bass, 1976: 29–30). Bass led subsequent side-scan surveys along the south-west Turkish coast, including the Bozburun peninsula, in 1973, 1974, and 1980, and documented an apparently-looted wreck-site near Marmaris in 30 m, as well as several near-shore dump sites, including one near ancient Loryma (Rosloff, 1981: 277–81; Bass, 1982: 45–7). Also located along this section of coast is the small Bay of Serçe Limani where Drs Bass and van Doorninck excavated the 11th-century Byzantine glass wreck in 1977–79, and where Cemal Pulak excavated a Hellenistic wreck in 1978–80 (Pulak and Townsend, 1987; Bass and van Doorninck, 2004). More recently, in 2004, Jeremy Green of the Western Australian Maritime Museum and Faith Hentschel of INA returned to the area from where a bronze statue was reported to have been raised in 1953. A limited side-scan survey produced numerous anomalies; unfortunately, equipment problems and poor sea-conditions hampered the verification process (pers. comm. Jeremy Green, 2005).

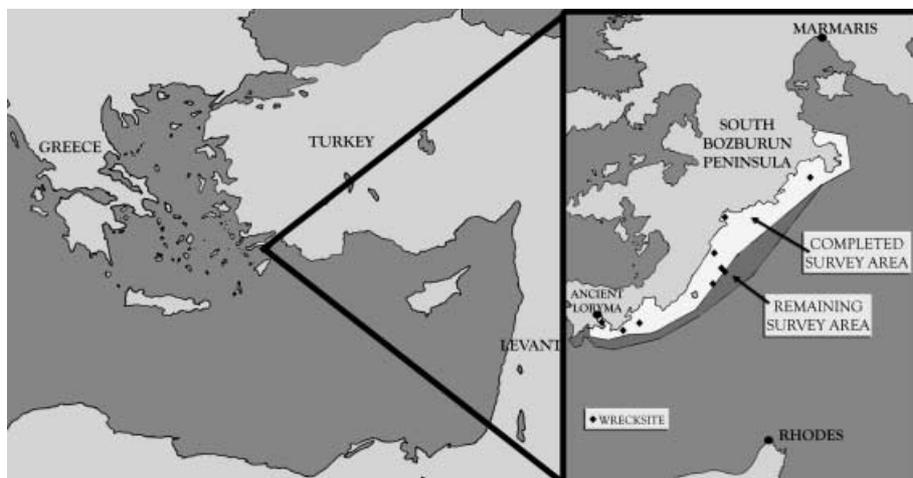


Figure 1. Map of eastern Mediterranean and detail of survey area. (J. Royal)

## 2005 objectives and survey area

Considering the advanced technology available, the nature of the survey area according to Green, and the information on reported wreck-sites in a wider area provided by George Bass and Tufan Turanlı of INA, the scope of the 2005 campaign was significantly expanded from previous expeditions. Our objectives were to conduct a systematic multibeam survey of the entire south-eastern coast from near-shoreline out to a depth of 100 m, and subsequently to locate and document all significant cultural deposits. The survey area extended approximately 37 km from Kadirga Burun at the north-east, just outside the Marmaris approaches, to Bozuk Bükü near the peninsula's south-western end (Fig. 1). Over 120 km<sup>2</sup> were completed, from close inshore to the 80-m contour. The vast majority of this designated area had not been surveyed previously. Considering the greatly increased scope of the 2005 survey relative to previous seasons, the objectives no longer centred on the search for a single hypothesized vessel. Rather, the goals were to locate, document, identify, and assess all submerged archaeological sites within the designated survey area.

This portion of coast is dominated by cliffs which plummet into the sea to depths of 30–50 m. Thereafter, a sandy sea-floor with a relatively gentler gradient is typically encountered until reaching the Rhodes channel. Exposed rocks and small islands dot the coastline, forming natural hazards for maritime traffic. Two particularly interesting small bays within the survey area are Bozuk Bükü, at the end of which the ancient city

of Loryma was situated, and the bay of Serçe Limani, which has produced several noteworthy shipwreck sites.

## Methodology

Survey was conducted by RPM Nautical Foundation's two research vessels: the R/V *Hercules* and R/V *Juno*. Both are equipped with multibeam echosounders among other remote-sensing, verification, and analysis equipment. Based on field experience and the nature of sea-floor in the survey area, the multibeam systems were deemed to have the best potential for locating cultural resources. A dual-head system for depths up to 100–120 m is fixed to the *Hercules*, and a single-head system for depths up to 45 m on the *Juno*. Accordingly, the *Juno* surveyed the areas from the coastline to the 45-m contour, while the *Hercules* surveyed the deeper area. Multibeam survey provides three-dimensional data that can provide highly-detailed topographical maps of the sea-floor, making it possible to exclude many of the geological anomalies which often plague two-dimensional side-scan images, as well as providing a better overall context for all anomalies. This is important as a pile of amphoras or ballast-stones appears very similar to geological formations, which results in significantly more spurious anomalies in side-scan images than in those from multibeam. Moreover, low-profile mounds formed by shipwreck sites can more easily be missed in side-scan survey, and positioning information for multibeam data is much more precise. The 2005 multibeam survey area,

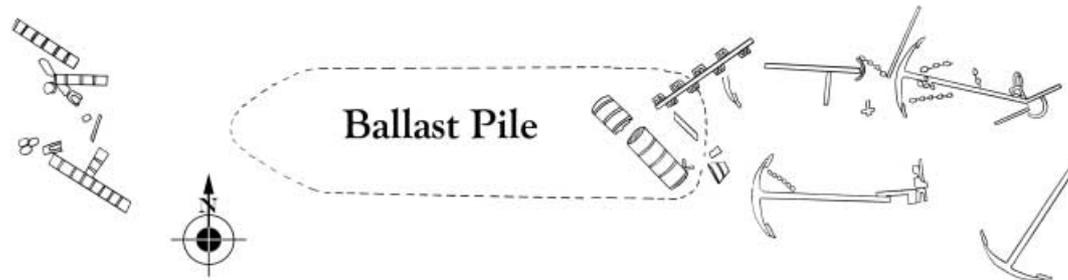


Figure 2. Site TK05-AB: preliminary site-plan; sketch based on video and stills, not to scale. (J. Royal)

therefore, included the entire coastline regardless of previous side-scan survey work.

Multibeam data was processed onboard the R/V *Hercules* and subsequently reviewed for potential shipwreck sites, which were plotted for investigation with the remote operated vehicle (ROV). Outfitted with still and video cameras, lights, and sonar, ROV deployments always recorded video for documentation; where wreck-sites were located, both still and video photography were used. An experimental laser device attached to the ROV provided a photographic scale that assisted in the identification of individual objects and the construction of preliminary site-plans.

To date, a total of 77 anomalies have been identified in the multibeam data. Each of these was assessed on their resemblance to geological formations or potential cultural remains, in order to prioritise verification efforts. Two anomalies located by the *Juno*, designated as sites TK05-AA and TK05-AG, were clearly discernable as shipwrecks in the multibeam imagery. Both vessels appeared modern, intact, and had little sign of burial, so were designated for diver verification at a later time. Of the remaining 75 anomalies, 29 (39%) were investigated by ROV during the 2005 field season, and 7 of these 29 (24%) were shipwreck sites. The following is a preliminary assessment for these nine shipwrecks.

### Site TK05-AA

A clear image of a vessel lying at a depth of 24 m was noted near Kumlu Burun. Three-dimensional analysis of the data indicated an exposed and intact wreck. The vessel's shape and dimensions are consistent with a modern vessel, possibly a sailing craft or one type of the tourist *gulets* which operate out of nearby Marmaris.

### Site TK05-AB: Galley A wreck

The investigation of an elongated mound lying in a flat expanse of sea-bed led to the discovery of a wreck-site comprising anchors, armament, ballast, and potentially other cultural material (Fig. 2). This roughly 16 × 2.5 m deposit lies c.2 km offshore on an E-W orientation at a depth of 75 m, and has relatively few signs of disturbance. A large ballast-pile lies at the centre, with anchors in line to the east and several pieces of armament to the west. At its highest point, where a large gun sits atop the ballast, the site rises to about 70–80 cm off the sea-floor (Fig. 3).

#### *Anchors*

Four anchors of the same type and apparent dimensions (c.2 m long) are located at the easternmost end of the site (Fig. 4). Their arms are 0.5 m long with flat-sided faces and triangular flukes, and join the shafts at a slightly curved angle. There is no indication of a protrusion below the arms where they join the rectangular shafts. Two examples have visible structures with rectangular apertures near their crowns where their stocks would normally be placed. One anchor has a large ring at the top of its shaft protruding from the sand. Two have chain of large, rounded links, apparently connected to the top of their shafts. Interestingly, the anchors are lying in two pairs, each aligned end to end, with the axis of each pair converging on the central E-W line of the site. The south-easternmost anchor is displaced from the orientation of the others, its lower end apparently rotated out of position by a later disturbance. The convergence of the anchors towards the easternmost end of the site suggests the shape of a vessel extremity; most likely the bow, as this is where anchors were traditionally stowed. Their

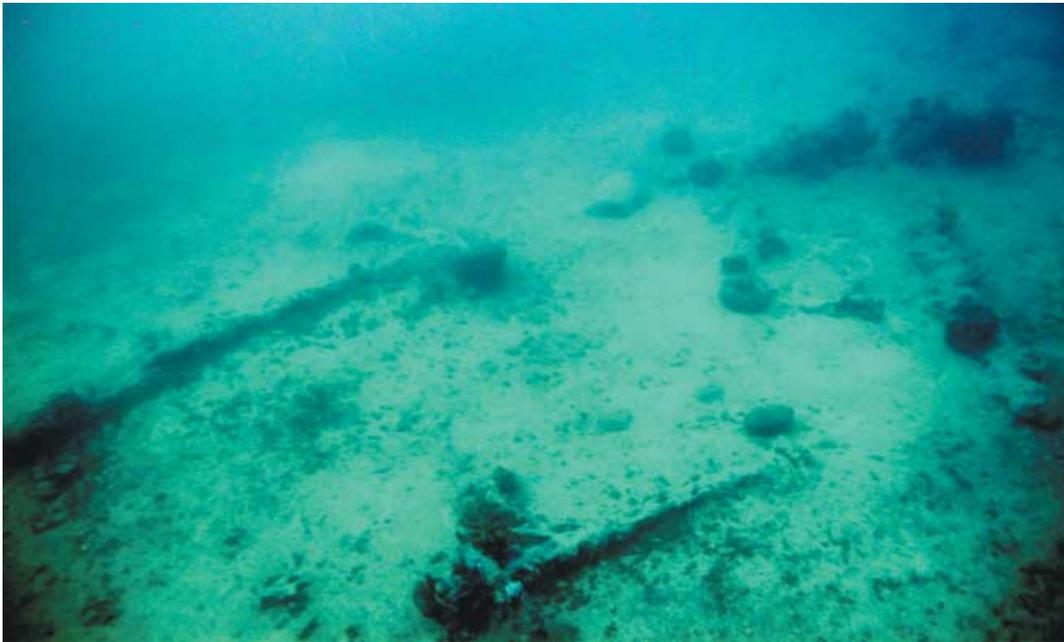


Figure 3. Site TK05-AB: anchors in foreground, large cannon atop ballast (upper right). (RPM Nautical Foundation)

symmetrical alignment indicates that the vessel sank with these anchors in their stowed positions.

#### **Ballast**

The ballast-pile, roughly 0.5 m high, and extending about  $9 \times 2.5$  m, was orientated E-W with clearly-defined edges. Stones on its surface are smooth and light-coloured, and range from pebble to fist-sized; overall, these stones appeared different from the indigenous rock noted along the Bozburun peninsula. The ballast-pile tapers at its western end, and mimics the interior shape of a ship's lower hull where strake runs converge. Close examination of the video and still photography revealed no indication of cultural material within the ballast.

#### **Armament**

The remains of at least three guns are present, all of wrought-iron construction (the reinforcement hoops are clearly discernable along their entire length). One nearly-intact gun is situated at the eastern portion of the site, between the anchors and atop the end of the ballast-pile (Figs 3 and 5). The end of this gun, which has the largest diameter of the three, sits at the centreline of the site and extends to the south-east. A shorter section of the same diameter with reinforcement hoops and an obviously rounded end is separated from the cannon; this is almost certainly its

breech-block. This assessment is supported by evidence from the 16th-century Molasses Reef site, which, although smaller, had breech-blocks of similar shape and dimensions relative to their guns (Keith *et al.*, 1984: 55; Keith and Simmons, 1985: 415, 418–9, fig. 4; Simmons, 1988, 28, fig. 4).

At least two smaller guns are located *c.*5 m west of the ballast-pile. Considering their small diameter, consistent to their *c.*2-m length, as well as the visible bore of one, these are undoubtedly swivel-guns (Fig. 6). The end of one muzzle also has the largest reinforcement hoop typical of a wrought-iron swivel-gun. Adjacent to the southernmost gun are two small cylindrical objects, one of which has an open scoop shape. These are consistent with pieces of a swivel-gun's breech-block, parallels for which were found on the Molasses Reef wreck (Simmons, 1988, 28, fig. 4). The north-westernmost gun appears to be in two sections lying nearly end-to-end to one another. On the end of one section where it presumably joined the other are a concreted bar and a loop connecting the bar to the gun section. This is probably the swivel and stand on which the gun would have been mounted on the vessel. If so, then this mounting-assembly would lie slightly off the mid-point of the gun's length, a placement that conforms to the typical configuration of ship-mounted swivel-guns.



Figure 4. Site TK05-AB: anchor and chain. (RPM Nautical Foundation)



Figure 5. Site TK05-AB: large cannon atop ballast. (RPM Nautical Foundation)

### Other objects

Several metallic fragments are exposed around the anchors, probably portions of the anchors or their chain. A partially-buried bucket-shaped object lies between the cannon and anchors. It is predominantly free of encrustation and appears to be intact and undamaged. An estimated 40–50 cm in height and maximum diameter, with thin walls and a slightly concave bottom, it is as yet unidentified. Another unidentified object is located just north of the cannon, between the ballast-pile and anchors. A long pole-shaped object of *c.*1–1.5 m long, it has 8–10 loops along its length on opposite sides (Fig. 3). The loops appear to be alternately spaced on each side. Each loop has a bar running through its centre, connected to the pole. It has a diameter similar to that of the anchor shafts and does not have any discernable reinforcement hoops. So it is unlikely



Figure 6. Site TK05-AB: southernmost gun at western portion of site. (RPM Nautical Foundation)

that this is some type of armament, as such an extremely small-bored, short, and light gun would not warrant eight or more handles, particularly when guns aboard ships were fixed and not carried. Loop-handles on wrought-iron guns were common, but were typically much fewer in number; for example, each of the *c.*2.5-m *bombardetas* from the Molasses Reef wreck had a total of four loop handles. As this object was unlikely to have been low in the hold if it ended up on top of the arm of an anchor, which would have been at deck level, it is perhaps part of the vessel's rigging.

**Identification and dating**

This site's overall dimensions are relatively small and indicate a narrow vessel consistent with a type of galley. Based on the surviving armament of a single cannon at the presumed bow and two swivel-guns further aft, the preliminary identification is that of a rowed war galley such as an Italian *fustas* or galliot, or perhaps a Turkish *firkate* or *kalite*. Both these vessel types probably carried a single lateen rig, a single large centreline cannon, and several swivel-guns (Alertz, 1995: 142–62; Konstam, 2002: 21–3; Güleriyüz, 2004: 29, fig. III-C; pers. comm. Pulak, 2005). Although no confirmed archaeological example of these galleys has been located to date, historical data indicates they were an estimated 20–28 × 2.5–3.5 m in size, undecked, and had 10–17 oars per side with 2 men operating each oar, *alla scaloccio* (Konstam, 2002: 21–3; Güleriyüz, 2004: 29; pers. comm. Pulak, 2005). The galliot was outfitted, rigged, and operated similarly to the *fustas*, but was somewhat larger at c.27–28 × 3–3.5 m and 18 2-man oars per side (Konstam, 2002: 21–3). A Turkish *kalite* was analogous to a galliot with 19–24 oars (Güleriyüz, 2004: 29; Pulak, 2005). Although each of these galleys had a large centreline gun as their primary armament, they were designed for speed and manoeuvrability for tactical advantage.

The type of armament found here corresponds to that used on smaller galleys such as galliot, *kalite*, *fustas* and *firkate*. A late-15th-century French manuscript illustration depicts a Genoese galley with a large central gun flanked by two smaller ones; all with reinforcement hoops characteristic of wrought-iron armament (Bondioli *et al.*, 1995: 172). Larger guns on small galleys were typically limited to a centreline placement on the *arrumbada*, a special bow platform, to ensure stability. Small arms such as swivel-guns were placed at the bow or along the central gangway to provide supporting fire. As observed in many depictions from the 15th and 16th centuries, small galleys had no other structures, aside from that for the pilot and commander, from which guns could be deployed in their sterns. Stern guns are evident only on the larger galleasses with larger stern superstructures (Guilmartin, 2003: 243–6). The position of the two swivel-guns on this site, therefore, probably marks an area forward of the stern, and suggests that this vessel's length was greater than the site's c.16 m. Although a bergantine was also a small galley type, it rarely carried guns, particularly large centreline cannon.

Galiots and *kalite* are probably longer than this site's dimensions would initially indicate; so the most likely identification is that of a *fustas* or *firkate*. However, it is possible that a portion of the stern is missing or completely buried, so what is visible could represent the remains of a larger galley.

Wrought-iron armament dates the galley to the 15th to 16th century AD. Wrought-iron guns were introduced in land warfare during the early 15th century, and were gradually adopted as an effective naval weapon by the mid-15th century (Guilmartin, 2003: 167). Some of the earliest representations of galleys fitted with large central guns are in the 1462 *Hesperis* manuscript illustration from Rimini, and in Breydenbach's 1486 manuscript engraving from *Peregrinatio in Terram Sanctam* depicting a Venetian *galia sotti* (Martin, 2001: 77, fig. 58; Bondioli *et al.*, 1995: 177). The best artillery was normally reserved for siege-trains, then for the flagship; only afterwards were other galleys fitted (Guilmartin, 2003: 50–51). Considering the dates of these representations, and that larger galleys were fitted with guns before smaller galleys, the earliest date for the Galley A wreck-site is probably the last quarter of the 15th century. Cast-bronze cannon were developed by the mid-15th century, but their great expense limited their use and, consequently, they replaced wrought-iron guns only gradually over the course of the 16th century, though it was increasingly rare to find wrought-iron guns after c.1530 on Mediterranean galleys (Konstam, 2002: 12; Guilmartin, 2003: 167–8). Once again, larger galleys assuredly would have had priority over smaller galleys in replacing wrought-iron artillery with the more expensive bronze pieces. Hence, the armament suggests the latest operational date of Galley A was approximately the second quarter of the 16th century.

Although less closely datable, the anchors do provide corroborating evidence for this suggested date. Stefano Medas (pers. comm.) and Marco D'Agostino (pers. comm.), both of whom excavated the 14th-century Boccolama galley wreck near Venice, noted the anchors were consistent with a 15th- or 16th-century date. Their shape is also generally the same as those from the 16th-century Molasses Reef wreck (Keith and Simmons, 1985: 415, fig. 4). Similar anchors are also depicted on ships in Vittore Carpaccio's *Life of St Ursula* dated to 1490–96 at the Galleria dell'Accademia, Venice. In his *Arrival in Cologne* an anchor of the same style

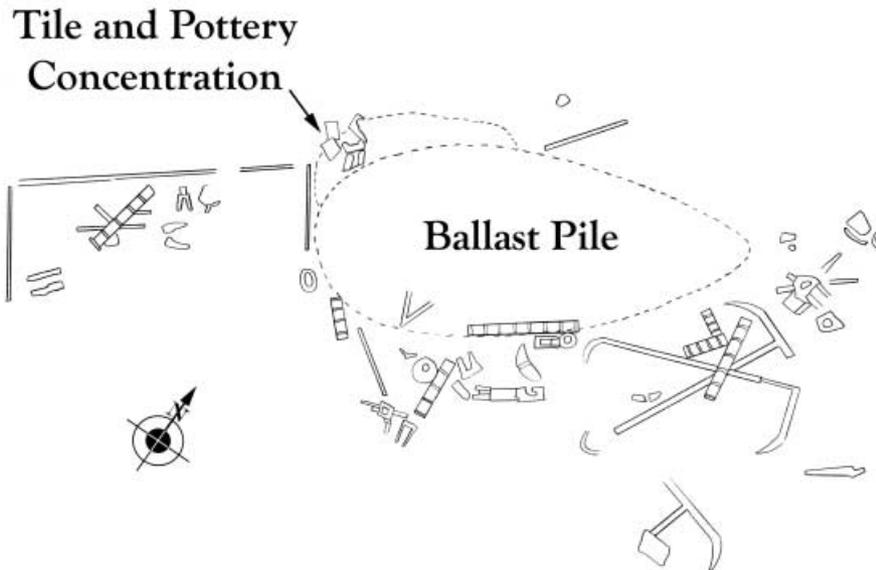


Figure 7. Site TK05-AH: preliminary site-plan; sketch based on video and stills, not to scale. (J. Royal)

has a large ring, a similar arm shape, no shaft extension beyond the arms, large triangular flukes, and similar proportions. Also depicted is a chain hooked to the bowsprit, which is presumably attached to a submerged anchor. Ropes were shown traversing hawser holes high in the extreme bow. Although this depiction is of a merchantman, the anchors are stowed on each bow quarter and in the same orientation (crowns forward and arms aft).

The provisional identification of the Galley A wreck is thus a *fustas* or *firkate* of c.1475–1550 AD. Small galleys such as these were common in the eastern Mediterranean throughout the later 15th and 16th centuries for raiding, patrols, and quick troop delivery and were not designed for full fleet engagement. It is not possible at this stage to assign a particular cultural association to this galley. However, the light armament suggests either the Italian city-states, Ottomans, or Knights of St John, all of whom considered speed and manoeuvrability as primary advantages, rather than the sheer firepower favoured by the French and Spanish (Keith *et al.*, 1984: 55; Keith and Simmons, 1985: 418–9, 423; Konstam, 2002: 12–15, 42).

### Site TK05-AH: armed *nave* wreck

Oriented ENE by WSW in 81 m, this site's debris-field is strewn over an area c.10 × 4 m and dominated by a central ballast-pile (Fig. 7).

Several anchors, a large wrought-iron gun, and other metal debris are lying just off the eastern edge of the ballast. Debris continues along the south-eastern side of the ballast-pile and includes a small gun and several other metal objects. A smaller amount of debris is located on the west side of the ballast, in which is scattered a long, smooth cylindrical object, pottery, large tiles, and large groups of iron concretions. Approximately 3 m WSW of the ballast-pile is another wrought-iron gun surrounded by concretions and wood fragments. During the investigation of this site it was clear that it possessed similarities to site TK05-AB, most notably the guns and anchors. The debris field suggests that the large artefacts have either been shifted by dragging, or were scattered during deposition. Assuming the anchor pile represents the bow, this vessel appears to have listed to starboard on coming to rest on the bottom, and many of the objects near or at deck level fell to the SSE. It is also possible that the site was later disrupted by dragging operations; however, drag lines running NW to SE, to account for the locations of objects in relation to the ballast-pile, would be perpendicular to the natural contours, and thus unlikely.

### Anchors

Three anchors and two rings protruding from the sand are located at the eastern end of the site, and thus the presumed bow. Two loops partially buried in the sand within 0.5 m of one another



Figure 8. Site TK05-AH: crossed anchors with gun lying atop them. (RPM Nautical Foundation)

mark the ENE end of the site. These are the size and shape of anchor rings, and one has an apparent shaft attached. A triangular object lies nearby, but sand cover makes its identification uncertain. Although this object may be associated with the anchors, it appears to be a fragment of a flat-bottomed ceramic container. Three more anchors are located *c.*2 m to the south, at the edge of the ballast-pile. There are additional remains around them indicating that more anchors may be buried in the sand. Two anchors are lying across one another (Fig. 8), and the third is lying parallel and *c.*0.5 m to the south. The bottom anchor of the crossed pair has its ring extending upwards, and identical to the two rings at the ENE end of the site. At least two anchor-types are present, the rounded ‘lunette’ shape and a cruciform example very similar to those from Galley A. The shafts of all three anchors appear to be of the same diameter, and those of the two crossed anchors both *c.*2 m long. The majority of the southernmost anchor’s shaft is either missing or buried. It appears the anchors were either on deck or stowed on the vessel’s quarter when it sank, then shifted together into their current positions. However, it is interesting that all are lying in the opposite orientation to those on the Galley A site and contemporary representations.

#### ***Ballast, ceramics, and associated artefacts***

An ovoid ballast-pile measuring *c.*6 × 2.5 m rises to a maximum of *c.*50 cm off the bottom and forms the centre of the wreck-site. In plan view its shape suggests that of a vessel’s lower hold, and is verified by the presence of a strake which extends along the edge of the ballast towards the SW. On its surface the ballast mainly comprises smooth stones ranging in size from fist to cobble, with gravel mixed among them (Fig. 9). Unlike the Galley A site, this ballast-pile is littered with ceramic sherds, and concretions, which are particularly concentrated in the SW portion, where it appears a large amount of material collapsed off the main ballast deposit (Fig. 9). This area includes the fragments of at least one flat-bottomed container, ceramic sherds, fragments of large tiles, and large concretions. This assemblage may indicate the ship’s galley, a location that would be the presumed port side, aft.

There are also several large ceramic fragments lying near the ballast to the SE. One of these is the top of a moderate-sized container, and lying within a 0.5 m radius are several large fragments including a portion of a flat-bottomed vessel (Fig. 10). It is not possible to discern the type of container represented by the large top portion, as its mouth is turned downwards and partially buried in the sand. However, no handles are

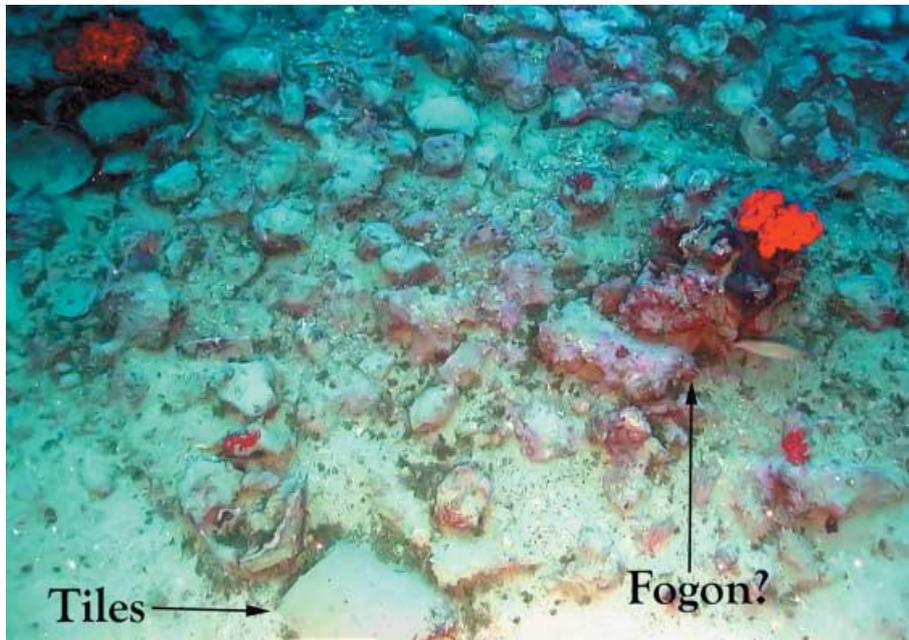


Figure 9. Site TK05-AH: ballast-pile at SW portion of site. (Photo: RPM Nautical Foundation)



Figure 10. Site TK05-AH: top half of ceramic container, and section of gun. (RPM Nautical Foundation)

apparent from any view, and the overall body shape is consistent with that of a jug or small transport container. An interesting unidentified ring-shaped object apparently of ceramic is situated amid the ballast at the eastern edge of the ballast-pile. The majority of the ceramic remains are body

sherds of various sizes, of similar colour and thickness to the larger fragments found on the site.

#### *Armament*

There are indications of four, possibly five, wrought-iron guns, each with clearly-discernable



Figure 11. Site TK05-AH: gun at presumed aft portion of site, note strake remains at top of photo. (RPM Nautical Foundation)

reinforcement hoops and of a similar diameter. At the ENE end of the site, sections of at least one gun are lying atop and beside the two crossed anchors (Fig. 8). Taken together, the three pieces form a gun 1–1.5 m long. Its small diameter, particularly relative to its length, indicates this is a wrought-iron swivel-gun. One of the three sections has the general shape and dimensions of a breech-block; and attached at the centre of the longest section is a bracket, consistent with the mounting assembly for swivel-guns, similar to one found on the 16th-century Molasses Reef wreck (Simmons, 1988, 28, fig. 4). A second wrought-iron swivel-gun is located at the edge of the ballast-pile SW of the first. Although it is difficult to ascertain its dimensions as it is covered by sand and ballast, it has an estimated length of 1.5 m. Located midway on the SSW side of the ballast-pile are at least two additional swivel-gun sections; one is 50–75 cm long (Fig. 10). To the SW of these gun sections a concreted object resembles the part of a swivel-gun's tiller where it joins the breech opening, parallels for which were found on the Molasses Reef wreck (Keith *et al.*, 1984: 54, fig. 10), as well as another shorter section of gun. Taken together, these gun sections to the south of the ballast would form a

single swivel-gun of *c.*1–1.5 m long, though it is not clear whether they are from one or several weapons. The final swivel-gun section is lying at the extreme WSW of the site, at what is presumably the stern (Fig. 11). This piece is *c.*1 m long and of the same diameter as the other swivel-guns. One end is flared in a manner similar to the swivel-guns on Galley A. A concretion near the middle of this piece could be the mounting bracket, while smaller concretions lying nearby have the initial appearance of breech-block fragments.

#### **Other objects**

Many concreted objects lie scattered about the site, each in a state that conveys a rudimentary shape but not the detail required for positive identification. A number are located around, and undoubtedly associated with, the anchor deposit at the ENE end of the site or items carried at deck level. Several have the appearance of breech-blocks and are located near several of the guns. Interestingly, a particularly large concretion in the port-stern section of the site, near the large tile fragments, has the general shape of a ship's oven, or *fogon* (Fig. 9). At the extreme WSW end, in the presumed stern area, there is clear hull

**Table 1.** *Anchor Dimensions and Comparative Dimensions*

Anchor	Est. Length (m)	Est. Width (m)	Length-to-Width Coeff.	Form
TK05-AD I	3.00	1.70	1.76	Lunette
TK05-AD II	2.80	1.70	1.64	Cruciform
TK05-AD III	3.40	2.00	1.70	Cruciform
TK05-AD IV	2.00	1.50	1.33	Cruciform
Dramont F I	1.70	0.86	1.98	Cruciform
Dramont F II	1.40	0.68	2.06	Cruciform
Dramont F IV	1.36	0.64	2.13	Cruciform
Yassiada An 1	2.14	1.41	1.52	Cruciform
Yassiada An 3	2.19	1.29	1.70	Cruciform
Yassiada An 4	2.04	1.58	1.29	Cruciform
Yassiada An 5	2.38	1.53	1.56	Cruciform
Yassiada An 6	2.57	1.42	1.81	Cruciform
Yassiada An 7	2.25	1.35	1.67	Cruciform
Yassiada An 8	2.47	1.57	1.57	Cruciform
Yassiada An 9	2.00	1.54	1.30	Cruciform
Yassiada An 10	2.41	1.50	1.61	Cruciform
Yassiada An 11	2.42	1.55	1.56	Cruciform

structure protruding from the sand (Fig. 11). The top of a strake runs NW of the gun, and extends at least 3 m ENE along the NW edge of the ballast-pile. Another exposed edge of timber is situated perpendicular to this strake run at the extreme WSW end of the site. Other wood remains include fragments aligned with the long strake, and a small segment running perpendicular to the long axis of the ballast-pile and marking its WSW limit.

#### *Identification and dating*

Taken as a whole, this site's shape, denoted by the ovoid ballast-pile and surviving timbers, indicates a low length-to-beam coefficient of *c.* 3.0–4.0:1. The typical length-to-beam ratio for small Venetian galleys in the mid-15th century was 8.4:1 and in the mid-16th century 8.1:1 (Lane, 1934: 236, table B). A 16th-century galley in Lake Garda, Italy, had a length-to-beam coefficient of just over 8.0:1 (Scandurra, 1972: 209–10). Records indicate that the length-to-beam coefficients were typically much less, at just over 3.0:1, for sailed Venetian and Spanish merchantmen of the mid- to later-16th century (Lane, 1934: 235, table A). Research by Bonino on several Italian *naves* dating from 1202–1550 resulted in length-to-beam coefficients ranging from 3.2–4.0. Similarly, the remains of the Logonovo wreck, a river cargo-carrier of *c.* 1400 AD, indicate a vessel with a coefficient of about 4.0:1 (Bonino, 1978: 12, table 1). The remains from the Armed *Nave*

wreck denote a vessel with a coefficient much closer to 3.0:1 than 8.0:1; thus, that of a merchantman. The dispersal of ceramic fragments throughout the site, and the concentration of tiles suggesting a cooking hearth, is also consistent with the remains of a merchantman. The ENE end, the presumed bow, has a lower ceramic concentration than the WSW end, the presumed stern; a distribution consistent with medieval merchantmen. Based on the ballast-pile, timber remains, and artefact distributions, the size of the vessel is estimated to have been 13–16 × 4–5 m.

As flat-bottomed pottery is common throughout the medieval period, the armament and anchors on this wreck-site are more chronologically diagnostic. As discussed in the Galley A site, armament for galleys became widespread during the later 15th century. The concept of arming sailed merchantmen spans all of maritime history, but during the Renaissance it was nearly an imperative due to the conflicts between the various Italian states, Turks, and Barbary pirates.

We, Officers of the Sea or of the Provisions for the Genoese Shipping, ... in order to protect the ship of the nobleman Megollo Lercari, which is preparing to sail to the Orient, in such a way as to render futile the assaults of corsairs, we have now increased ... the usual crew of said ship ... by 25 arbalesters for the present voyage as far as Chios ... (Lopez and Raymond, 2001: 246–7, letter, Genoa, 1 September 1408).

Developments in both rigging and naval armament by the mid-15th century had made the use of smaller-sailed roundships more cost-effective than the great merchant galleys requiring a larger crew. The arming of sailed merchantmen appears to have become common with the Venetians, Genoese, and Ottomans by 1500; typically by the mounting of small arms such as swivel-guns (Lane, 1934: 24–30; Konstam, 2002: 13–14). Each of the guns on the *Armed Nave* wreck-site was a wrought-iron swivel-gun, which, as noted earlier, were commonly used until the mid-16th century when cast bronze cannon were favoured. However, smaller merchantmen may have continued to use wrought-iron armament because it was less expensive. Thus it seems reasonable to assume that the armament on this vessel can be dated to c.1475–1575. Thus far, the anchors on the site cannot narrow this date range. It is possible that the anchor with lunette arms may indicate an earlier style, as Martin noted this type was commonly represented in 14th-century iconography of Venetian ships (Martin, 2001: 168–71).

Historical evidence from Venetian lists indicates merchantmen were increasing in size over the 15th century (Lane, 1934: 238, table D). It is not clear if this trend was common to Genoese and Ottoman merchantmen, but it is likely given the similar nature of trade and economic environment in the eastern Mediterranean at this time. The *Armed Nave* wreck-site is that of a small merchantman. Taking into account the type of armament, the trend of increasing vessel size over the 15th century, the arming of merchantmen, and the location of the wreck, the *Armed Nave* wreck is probably a small Venetian, Genoese, or Ottoman merchantman from around the late-15th to mid-16th century.

### **Discussion: Galley A and *Armed Nave* wreck**

Given that two wrecks of the five historical ones discovered were roughly from the Renaissance, a few comments about the historical period in which these vessels were operating are warranted. With the conquest of western Anatolia during the later-14th century, Turkish forces gained coastal Aegean bases for launching seaborne attacks against the Italian city-states, as well as raiding commercial and military shore-installations. The Ottomans extended their military influence at sea during the later-14th century with the conquests of Saruhan, Aydin,

Menteshe, and Karaman Emirates, completing the conquest of western and southern Anatolia. This afforded Ottoman naval forces access to all the Aegean Sea as well as the eastern Mediterranean. From these bases, the Turkish ghazi emirs steadily increased their attacks on overseas shipping as well as raiding commercial and military shore-installations; a task made easier due to the perpetual naval conflicts between the Venetians and Genoese (Lewis and Runyan, 1990: 59). The fall of Constantinople to the Ottomans in 1453 provided them with a nucleus around which to solidify and expand their empire, and afforded consequent enhancements in their maritime capabilities. Throughout the rest of the 15th, and into the beginning of the 16th century, Ottoman sea-power strengthened and became an important tool of their expansion.

This growing Ottoman presence at sea was perceived as serious by the west, as efforts to curb what was characterized as a piratical menace began early in the 14th century. The Knights Hospitallers (Knights of St John) moved their base to Rhodes in order better to check Turkish maritime activities. With the Turkish conquest of the Menteshe emirate in 1390, and the Hospitallers' occupation of the ports of Bodrum and Castellorizon, the adversaries were brought into direct contact. Increased forays by the Barbary pirates and the persistent naval threat of the Mamluk dynasty in Egypt during the first half of the 15th century made the waters off SW Anatolia particularly perilous for maritime ventures. The reaction to this aggressive new sea-power, and the increasingly hostile operating environment, manifested itself in a rapid proliferation of larger cannon on galleys during the later 15th century. Furthermore, the character of naval warfare changed to more co-ordinated attacks on port towns and fortifications, a tactic which also necessitated larger guns (Rose, 2002: 111).

Placed within this context are the Galley A and *Armed Nave* wrecks off the southern Bozburun coast, situated between the former Ottoman emirate of Menteshe and the fortress city of Rhodes. This stretch of water lies along the maritime pilgrim path to the Levant and the Eastern-Mediterranean trade routes of the Genoese, Venetians, and Ottomans, rivals whose ventures were vulnerable to attacks by Barbary pirates, as well as from one another. In addition to these constant threats, there were three major naval operations during the 15th and early 16th



Figure 12. Site TK05-AC: preliminary site-plan; sketch based on video and stills, not to scale. (J. Royal)



Figure 13. Site TK05-AC: layers of amphoras in an oblong deposit. (RPM Nautical Foundation)

centuries. Each targeted Rhodes in attempts to dislodge the Knights of St John. Two assaults, in 1444 by the Mamluk forces of Egypt, and in 1480 by the Ottoman forces, were repulsed by the resilient Hospitallers. The third attempt by an overwhelming Ottoman force in 1523 wrenched the city from the Knight's control and sent them in search of a new operating base in the central Mediterranean. Considering the intensity of maritime activity and hostilities during the 15th and early 16th centuries, it is not extraordinary that two of the five historic vessels located during the survey of this section of coast were from this period. Without excavation and a full examination of the artefacts, one cannot hope to associate them with any specific cultural group or historical event during the period. However,

when placed within a historical context, these two wrecks provide tantalizing prospects for the examination of cultural remains relating to events known primarily from written sources.

### Site TK05-AC: Çomlek Burun wreck

Of all the historic wreck-sites discovered, TK05-AC was the closest to shore, some 150 m from the cliff-face near the promontory of Çomlek Burun, though lying on a sandy bottom 65 m deep. A mound comprised of roughly 60 amphoras covers an area  $c.10 \times 3$  m (Fig. 12). Additional buried amphoras are evident in several areas, particularly to the SW. How far the deposit extends below the sand is unknown, but there are at least three visible layers (Fig. 13). The

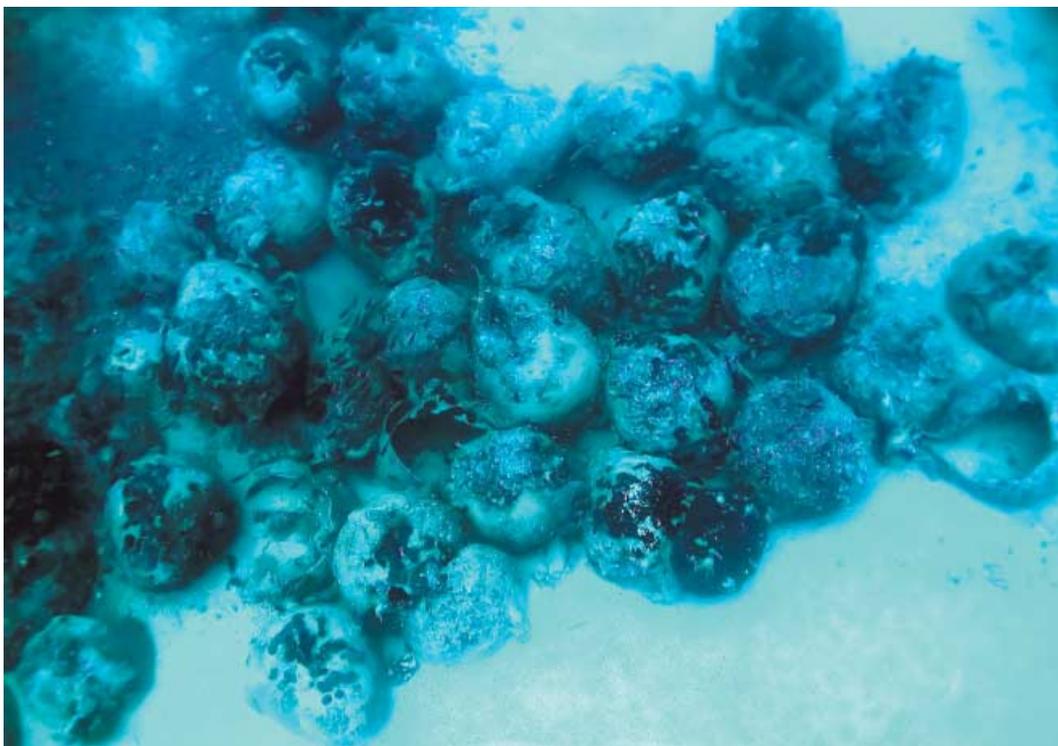


Figure 14. Site TK05-AC: plan-view of amphorae showing jumbled nature of deposit. (RPM Nautical Foundation)

amphorae in the upper two layers appear jumbled, with little or no observable stacking pattern (Fig. 14). Proximity to the shoreline and rock outcrops seems to have protected this wreck from dragnets and other disturbances. Most of the amphorae remain intact and concentrated in a pile with only a few off the mound. The area where most damaged amphorae were located was near the grapnel anchor just off the N end of the site (Fig. 15). The amphorae in the upper two layers provide evidence of at least two forms of a single type.

Form 1: Handles begin at the base of the neck, round upward, then turn sharply to join the shoulder; the neck is straight and extends above the handles; the rim appears to be everted; the pyriform body tapers with a waist into a small rounded base (Fig. 16.1).

Form 2: The handles and body are similar to Form 1, but the body appears somewhat more bulbous; the neck shorter in some examples than those of Form 1, and in some instances looks as if it is nearly level with the apex of the handles; the rims look more rounded than those of Form 1 (Figs 16.2 and 16.3).

Although these amphorae share some similarities with Late Roman 2 amphorae

(Peacock and Williams, 1991: class 43, LRA2, Key LXX), particularly the rim-shape and handle locations, they exhibit a significantly different body-shape to published examples. The closest parallel is the small pyriform amphorae found on the 11th-century Serçe Limani site along this same section of coastline (Bass and van Doorninck, 1978: 126, fig. 9; Bass and van Doorninck, 2004, fig. 15.3). The Form 2 amphorae are remarkably similar to those from the Serçe Limani wreck, particularly two subtypes defined by van Doorninck (1989: 253–5, figs. 4.1–2). Although that wreck is dated to *c.*1025 AD, the amphora types may have persisted into the following century.

The *c.*1.5 m-long grapnel anchor has large triangular flukes and is situated at the extreme northern limit of the amphora mound (Fig. 15). The two exposed arms are badly corroded, as is its crescent-shaped crown that curves downward towards the arms. This anchor provides some general dating parameters for the site. Grapnel anchors were in use as early as the Roman period; but the large-fluked types became common in the 12th century AD. Martin notes the frequent depictions of grapnel anchors in the 15th century (Martin, 2001: 167, fig. 150), such as the example

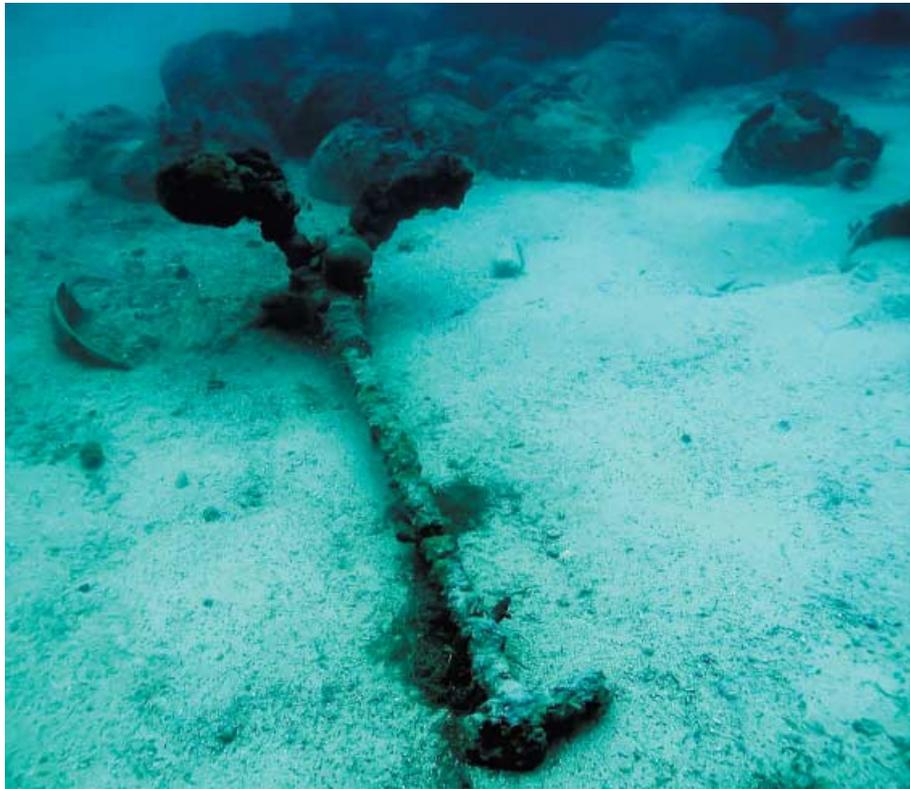


Figure 15. Site TK05-AC: anchor located at north end of site. (RPM Nautical Foundation)

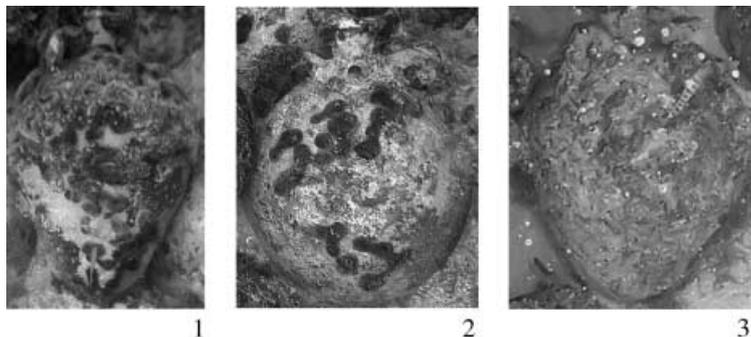


Figure 16. Site TK05-AC: amphora examples. (RPM Nautical Foundation)

from the *c.*1400 *Fabrica di Galere* (Lane, 1934: 12, fig. III). Considering a parallel for the amphoras in the 11th century along with the large-fluked grapnel anchor, the provisional operational date for the vessel is the late 11th to 12th century. This encompasses the first three crusades and the steady rise in Christian pilgrim traffic from the west to the Levant. This, combined with the general growth in western European population levels, and the corresponding demand for imported goods, spurred overseas trading ventures in the eastern Mediterranean during the 11th and 12th

centuries. Frequent changes in control of eastern Mediterranean cities caught in the wars between Christendom and Islam also spurred logistical shipping and personnel transports for military operations. The potential urgency of such operations is demonstrated in a letter from the East to the Master of the Hospitallers in 1187:

Moreover, the following cities are still safe and are awaiting aid from the western Church; namely, Jerusalem, Sur, Saehea, Marchat, Antyoehia, Lassar, Saona, Triplis. Moreover, so great is the multitude of the Saracens and Turks that from Tyre,

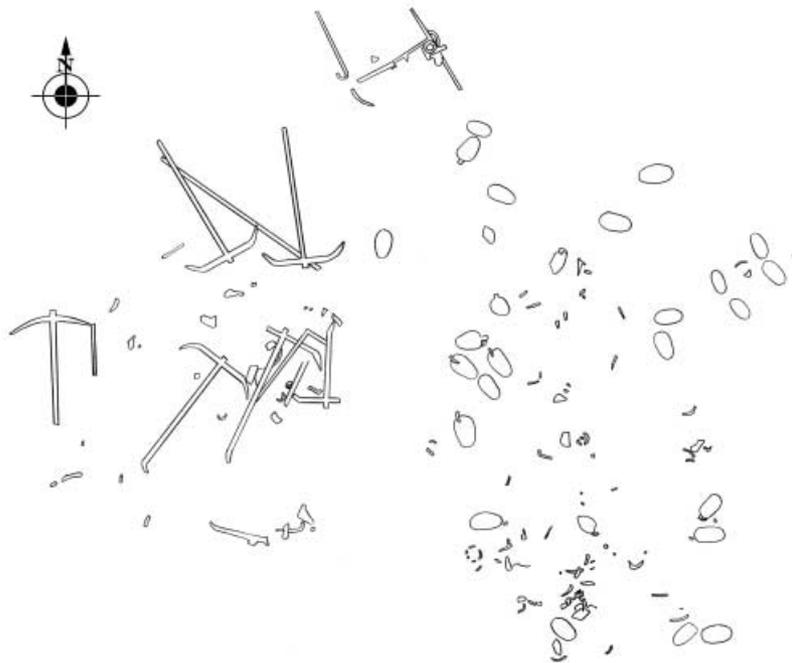


Figure 17. Site TK05-AD: preliminary site-plan; sketch based on video and stills, not to scale. (J. Royal)

which they are besieging, they cover the face of the earth as far as Jerusalem, like an innumerable army of ants, and unless aid is quickly brought to the remaining above-mentioned cities and to the very few Christians remaining in the East, by a similar fortune they will be plundered by the raging infidels, thirsting for the blood of the Christians (Letter from the East to Master of Hospitallers, 1187).

The discovery of the Çomlek Burun wreck, in addition to the Serçe Limani wreck in the vicinity, help substantiate the importance of the trade-route along the southern Bozburun peninsula during this historically-significant period.

### Site TK05-AD: late antiquity anchor wreck

Investigation of a small anomaly 85 m deep and 2 km offshore, yielded an amphora deposit with an associated collection of anchors (Fig. 16).

#### *Amphoras*

The amphoras form a  $c.9 \times 3$ -m oval that narrows to a point at both ends; suggestive of a merchantman's hold (Fig. 17). Apparently the site has been dragged, as it has very little relief off the sandy sea-floor; this relief is formed by a single layer of mostly broken amphoras. (Fig. 18). Moreover, a trail of sherds extends



Figure 18. Site TK05-AD: some of the scattered amphoras and sherds that form the deposit's oval shape. (RPM Nautical Foundation)

off the main deposit. Initial observation of the amphoras indicates a minimum of least three types, provisionally described as follows.

Type 1: Averaging 51 cm maximum length and 27 cm maximum diameter; the body is slightly tapered from shoulder to base; above its rounded shoulder the body slightly flattens at its top; the

handles begin just below the rim, extend upward in a curve *c.*8 cm from the neck, then fall at a sharp angle to join the shoulder; the handles are *c.*2 cm thick and have a central ridge; the neck is straight and *c.*10 cm high with a *c.*1.5 cm-thick everted rim; the mouth is *c.*8 cm diameter; ridges are present along the entire body, and are more closely spaced at the shoulders and base than at mid-body (Figs 19.1 and 19.2).

Type 2: This averages 60 cm maximum length and 30 cm maximum diameter; the body is more bulbous than Form 1, having a more ‘beehive’ shape; although examples were partially buried, the handles join high on the neck, extend *c.*7 cm out at a slightly downward angle, then form a sharp angle to fall nearly straight onto the shoulder; handles are *c.*2.5 cm thick and appear to have a shallow groove along their length; generally closely-spaced ridging is clear along their entire length, with tighter spacing at the ends than that at mid-body (Figs 19.3 and 19.4).

Type 3: A smaller amphora than Types 1 and 2, with an overall length of *c.*45 cm and a *c.*17 cm maximum diameter (at the shoulder); the *c.*40-cm long body is pyriform, tapering from the shoulders to a foot at the base which appears to be *c.*5 cm long; the short strap-handles, *c.*1.5 cm wide, join just below the rim and curve to join at the base of the neck; the rim appears flat; ridges along the body are relatively wider at mid-body than Types 1 and 2 (Fig. 19.5).

### *Anchors*

There are at least nine, and possibly as many as 11 anchors, located within a few metres of the amphora pile with amphora fragments scattered between them (Fig. 20). They are lying in two concentrated groups near one another, which suggest they were in their stowed position when



Figure 20. Site TK05-AD: group of anchors near amphora deposit, note the lunette-shaped anchor to left; second group beginning at top of photo. (RPM Nautical Foundation)

the vessel sank. Seven have clearly discernable arms, six of which are cruciform with arms that are upturned at their ends (Fig. 21). A single anchor has lunette-shaped arms that curve gently from the joint with its shaft through to their ends (Fig. 20). A short concreted nub continues the shaft beyond its junction with the arms on each of the anchors. The shaft concretions are a maximum of *c.*10 cm in diameter, and the arms have a similar height. One example appears to have a 2.1-m stock lying perpendicular to a shaft with a large ring attached. Problematically, this particular shaft has no indication of arms; although it may be broken as only *c.*1.8 m is present, significantly shorter than most of the other complete anchors on the site.

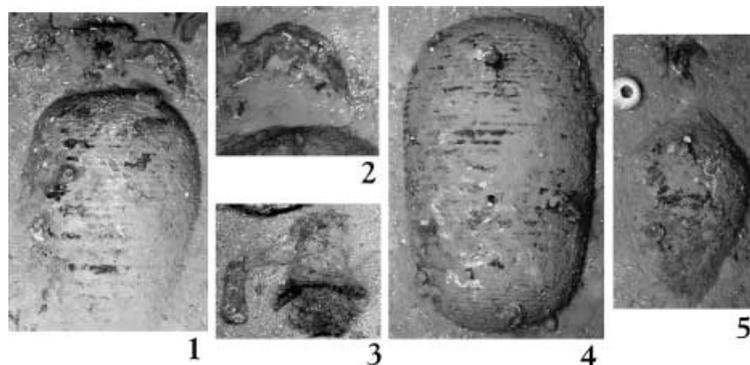


Figure 19. Site TK05-AD: amphora examples. (RPM Nautical Foundation)



Figure 21. Site TK05-AD: close up of cruciform anchor, shafts of anchors, and ceramic sherds. (RPM Nautical Foundation)

### Identification and dating

The amphoras and anchors provide insight into the size and possible itinerary of this vessel; and, moreover, are in accord in regards to dating the wreck. Type 1 amphoras are unambiguous examples of Riley LRA1b (Keay, LIII) amphoras (Peacock and Williams, 1991: class 44), used to ship both olive oil and wine. The general date range for this type is *c.*475–625 AD, and corresponds to the amphora fragment with similar handles from Caesarea dated to the 5th–7th century (Magness, 1992: 151–2, fig. 68.1; pers. comm. van Doorninck, 2005). However, this particular sub-type, LRA1b, which matches well with the Type 1 from this site, is more commonly dated to the end of this range; for example the intact amphora from Carthage found in a secure context dated to *c.*600+ (Fulford and Peacock, 1984: 119–20, fig. 34, 2). Another parallel is the LRA1-Type IV amphoras found on the Yassiada wreck and dated to the early 7th century (van Alfen, 1996: 195, fig. 6).

Precise archaeological equivalents for Type 2 amphoras have not been located to date. They are similar in body-style to the later 7th/8th century example from the Trinconch Palace in Albania, but the handles are more robust (Bowden *et al.*, 2002: 225–7, fig. 23.34). There are some similarities in handle shape with the LRA1 Subtype Vc amphoras found on the 7th-century Yassiada wreck; however, the body profile of the Type 2 amphoras is much more

bulbous (van Alfen, 1996: 197, fig. 8). The Skerki Bank Type III amphoras have similar handles as well, but their body shape is more pyriform and the base has a small nub not present on amphoras from the Late Antiquity Anchor wreck (McCann and Freed, 1994: 81–2, figs 58c, 61). Similar handles and rims are also found on the Class K amphora from Caesarea Maritima dated to the 5th–6th century (Oleson, 1994: 22, fig. 5-A35). One possible parallel for the Type 2 amphora handles is those found at Bir Umm Fawakhir, Egypt, dated to the 5th–6th century (Meyer, 1995: 218–19, fig. 15a–3). Interestingly, Freed points out that a similar type of bulbous amphora is represented on the Great Palace mosaic from Istanbul, dated to the 6th century (Jobst *et al.*, 1998; Dunbabin, 2001: 233, fig. 246; pers. comm. Freed, 2005). The single Type 3 amphora is almost certainly a Riley LRA3b type. While the overall range of this type dates from the end of 4th to the end of the 6th century, the example on this site has overall dimensions and body shape analogous to those associated with the end of this type's development in the 6th century (for example those found in the Athenian agora, Sciallano and Sibella, 1994). Taken as a whole, the assemblage suggests a date in the 6th century AD.

Additional dating evidence is provided by the anchors. Cruciform anchors were used in the Mediterranean from the 4th to 10th centuries, so their presence alone does not assist in narrowing the date of the site (pers. comm. van Doorninck, 2005). However, prior to the medieval period, the lunette-shaped anchor was used primarily during the early Roman Imperial period. Thus, the presence of the two types suggests an earlier date for this anchor assemblage somewhere around the 4th to 7th century. Anchors with similar cruciform arms have been located on the Dramont F wreck, France, dated to end of the 4th or beginning of the 5th century (Joncheray, 1977: 7), and on the 7th-century Yassiada shipwreck (Bass and van Doorninck, 1982: 121–32). Despite the similarity in arm morphology, the sets of anchors from the Dramont F and Yassiada wrecks differ in the relationship of arm length (total width) to the total anchor length. This is represented in the length-to-width coefficient values in Table 1. Anchors from the Dramont F wreck have short arms relative to their total length, resulting in an average coefficient value of 2.01 (Joncheray, 1977: 7). Those from the Yassiada vessel, however, have

longer arms in relation to their overall length, resulting in a lower average coefficient value of 1.56 (Bass and van Doorninck, 1982: 125–31). Although somewhat larger in size, the anchors from site TK05-AD have an average coefficient value of 1.61, almost identical to those from the Yassiada vessel. Hence, the date suggested by the anchors is closer to the 7th century than the end of the 4th century. Considering both the amphora and anchor evidence, the operational date for this wreck is provisionally set in the 6th century AD.

It is unclear what proportion of the cargo is represented by the amphora mound at site TK05-AD, so it is difficult to judge vessel-size. A review of shipwreck excavation reports from the Mediterranean demonstrates that the size of amphora deposits on discovery is a poor indicator of vessel-size. Possibly a better indicator of size for the Late Antiquity Anchor wreck is the 9–11 anchors present. Only four anchors, all smaller than those from this wreck, were located on the Dramont F wreck, a cargo-carrier *c.*10–12 m long (Joncheray, 1977: 7). The number, dimensions, and types of anchors found on the Late Antiquity wreck-site correspond well to the 11 anchors found on the 7th-century Yassiada wreck, estimated to be *c.*21.5 × 5.5 m (Bass and van Doorninck, 1982: 124, 312). Similarly, the amphora mound of the Yassiada wreck upon discovery was only 11 × 8 m and the anchors grouped at one end of the mound's periphery (Frost, 1963: 166–8; Bass and van Doorninck, 1982: 5, fig. 1–4). The Late Antiquity Anchor wreck was probably *c.*20 m long and capable of overseas trade.

The amphora identifications provide some rudimentary insight into this vessel's operational area, or, at least, that of its final journey. Riley LRA1b amphoras were produced in the Eastern Mediterranean, in areas such as Syria, Cyprus, Rhodes, along the SW Anatolian coast and the W Black Sea coast of Anatolia. Although there is a lack of firm dating or provenance evidence for the Type 2 amphoras, it appears they were present in the Aegean during the Late Roman/Antiquity period. The areas of possible origin for Riley LRA3b include those of LRA1b amphoras, as well as the Aegean.

Placing the wreck within the events of the 6th century AD indicates interesting potential for research on overseas shipping. The 6th-century Mediterranean was dominated by Emperor Justinian's reconquest efforts which restructured

trade-patterns, altered the political landscape, and resulted in large building campaigns. North African trade, widespread in the Mediterranean under Vandal control, was relegated to Roman ports after their conquest of Carthage in 533 AD. Consequently, further Roman campaigns in the western Mediterranean fostered a movement of goods from east to west. With a cargo comprising at least three types of amphoras, and numerous anchors, site TK05-AD provides an excellent prospect for studying this period of Late Antiquity.

### Site TK05-AE

ROV investigation of an anomaly in 72 m yielded the remains of a small, modern wooden vessel. Oriented NE-SW, the remains were slightly buried and extended *c.*1 m off the sea-floor at their highest point. The overall length of the extant timber remains was *c.*10 × 2 m. The hull timbers extend from the keel up to the turn of the bilge, and appear to have little rot or teredo damage. Included among them are frames, planking, ceiling planking, posts, and what appears to be a gripe, all articulated and relatively undisturbed. Nail-heads have suffered only minor corrosion and no large concretions were noted. A small anchor was located at the SW end. Metal sheathing was observed along the length of the hull; although the exact material is unclear. This sheathing was bent outwards, undoubtedly from the weight of the collapsing hull.

### Site TK05-AF

The remains of a vessel and much scattered debris was located in 87 m. The timbers were slightly buried and formed a low mound on the flat, sandy sea-floor. Only the lowest portion of the hull was preserved, yet both extremities were visible and rose from the sea-floor. These formed fine planking runs that appear to have been joined to a series of chocks placed over the posts. Overall the timbers appeared in good condition with little degradation or teredo damage. The site contained much loose debris including ceramic sherds, concretions, other timber fragments, and possibly a battery. Much of this appears to be associated with the wreck, but some of the ceramic sherds may be intrusive. East of the site is a concentration of debris including a long object similar to a boom, possible chain, and several other



Figure 22. Site TK05-AI: site photo showing oval shape. (RPM Nautical Foundation)

metal and large ceramic fragments. The shape of the vessel and nature of debris suggest this wreck-site is that of a sailboat from the last 50 years.

### Site TK05-AG

During survey by the R/V *Juno*, an obvious modern vessel was located within Bozuk Bükü harbour, *c.*22 × 8 m and 39 m deep. It is clear from the multibeam image that the superstructure is intact and there has been little major structural damage. The image is consistent with that of a modern vessel, possibly a sailing ship or one of the tourist *gulets* that operate out of Marmaris.

### Site TK05-AI: Julio-Claudian 1 wreck

Not far from site TK05-AH, ROV investigation of an anomaly at 83 m produced a large, relatively-undisturbed oval amphora mound (Fig. 22), *c.*15 × 5 m, consistent with many ancient Mediterranean merchantmen wrecks. Only a few amphoras are lying separate from the primary mound. It is difficult to discern a stacking pattern as the upper amphoras are tumbled and a large amount of marine growth covers the entire site (Fig. 23), making the production of a general site-plan from photography unworkable. However, it is evident

that in the uppermost levels there are at least three types of Rhodian amphoras.

Type 1: These have slightly-curved handles joining the shoulder and upper neck with a sharp peak formed at their apex; the long neck ends with a simple rounded rim; the slanted shoulders transition into an elongated body which tapers into a conical base; the bottom features a button (Fig. 24.1).

Type 2: Also have curved handles joining the shoulder and upper neck with a sharp peak at their apex, as well as the long neck and simple rounded rim; however, the shoulders are slightly fuller and more rounded than those of Type 1; the body is approximately 3/4 the length of Type 1 examples, and slightly wider through to the base; the bottom features a button (Fig. 24.2).

Type 3: No handles were visible on the most complete example, although a similar long neck suggests handles of similar length as the other two types; the body was much fuller and rounded, with its maximum diameter approximately twice that of Types 1 and 2; the bulbous body tapers to a small base; the bottom also features a button (Fig. 24.3).

Type 1 amphoras are readily discernable as a Rhodian type consistent with those discovered in Lyon, France, and dated to the 1st century BC to



Figure 23. Site TK05-AI: close-up of deposit, note the heavy growth on most of the amphoras. (RPM Nautical Foundation)

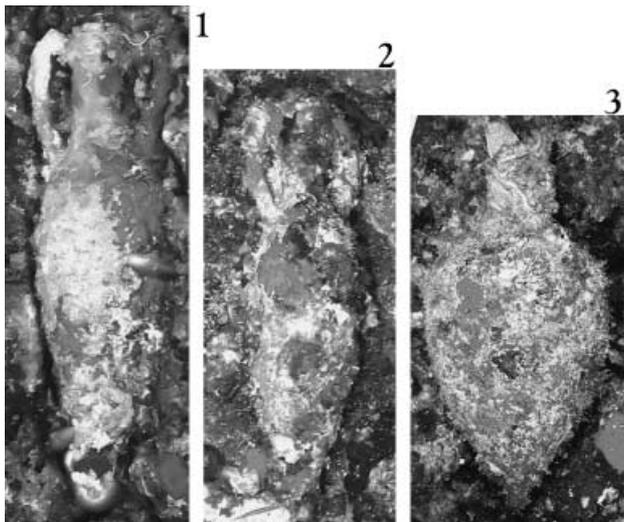


Figure 24. Site TK05-AI: amphora examples. (RPM Nautical Foundation)

1st century AD (Sciallano and Sibella, 1994). The Type 2 amphoras are similar to Peacock and Williams' (1991) Class 9 (Camulodunum 184) amphoras dated to the late 1st century BC to early 2nd century AD, as well as those found in various Adriatic sites dating to the same period (Junšić, 2000: 14, 109). Type 3 amphoras are analogous to examples in the Bodrum Museum dated to the 1st century BC and to those from

the Antikythera shipwreck, Greece, dated to 80–70 BC (Grace, 1965: 5–7). Based on the presence of these three amphora types, a provisional date of *c.*50 BC–50 AD is offered as the operational date for this vessel.

The cargo suggests that this merchantman almost certainly originated in Rhodes, which lies about 20 km to the SSE (Fig. 1). Each of these Rhodian amphora types typically carried wine, but could also be used for shipping fruits. Ancient Rhodes made great strides on the political and commercial landscape when it sided with Rome during the First Mithridatic War in the first quarter of the 1st century BC, and shortly thereafter when Pompey spared Rhodes from the revocation of tribute immunities. Despite the temporary rise in piracy associated with the fall of the Republic, which impaired seaborne trade throughout the eastern Mediterranean, the Roman state provided stability by the end of the 1st century BC and throughout the Julio-Claudian period. This nurtured a rise in Mediterranean trade through the 1st century AD. Imperial consolidation of new territories, growing population centres, and expanding aristocratic exchange networks fuelled the early Imperial economy. Demand for goods in Rome itself was substantial; some 150–300,000 tons of grain with nearly equivalent amounts of wine and

oil were imported by ship each year (Rickman, 1980: 10). Further study of this wreck-site could shed new light on this complex and vibrant period of Roman economic history.

### Conclusions and further study

During the 2005 survey of the SE coastline of the Bozburun peninsula, the sea-floor from the 10–80 m contour was mapped with multibeam echosounders. Analysis of the data produced 77 anomalies, 29 of which were investigated with ROV. In the investigation of these 29 anomalies, 7 shipwrecks were discovered; 2 additional shipwrecks were noted in the multibeam data but not investigated due to their shallow depth and probable modern date. Five of the wrecks were

historically significant, and represent a span of seafaring history from the 1st century BC to the early 16th century AD. Four of the wrecks were merchantman, one an oared galley. Each of these wreck-sites represents a distinct and interesting era in this part of the SE Aegean, eras which have poor archaeological representation.

In 2006 the survey will continue to the 100-m contour, and the 48 remaining anomalies, along with any newly-discovered ones, will be investigated. Additionally, further video recording of the five historically-important sites may be conducted, and it is possible that diagnostic artefacts could be raised for further study. If the SE Bozburun coastline survey is completed and time permits, the survey of a new section of Turkish coastline will commence.

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### References

- Alertz, U., 1995, The Naval Architecture and Oar Systems of Medieval and Later Galleys, in Gardiner, R. and Morrison, J. (eds), *The Age of the Galley: Mediterranean Oared Vessels since Pre-Classical Times*. London.
- Bass, G., 1976, Underwater Archaeological Expedition to Turkey, 1968, *National Geographic Research Reports*, 1968 Projects, vol. 6, 29–31. Washington, DC.
- Bass, G., 1982, Survey of Ancient Shipwrecks in the Mediterranean, *National Geographic Research Reports*, vol. 14, 29–31. Washington, DC.
- Bass, G. and van Doorninck Jr., F., 1978, An 11th-Century Shipwreck at Serçe Liman, Turkey, *IJNA* 7.2, 119–32.
- Bass, G. and van Doorninck Jr., F., 1982, *Yassi Ada, A Seventh-Century Byzantine Shipwreck*. College Station, TX.
- Bass, G. and van Doorninck Jr., F., 2004, *Serçe Limani, An eleventh-Century Shipwreck*. College Station, TX.
- Bondioli, M., Burlet, R. and Zysberg, A., 1995, Oar Mechanics and Oar Power in Medieval and Later Galleys, in Gardiner, R. and Morrison, J. (eds), *The Age of the Galley: Mediterranean Oared Vessels since Pre-Classical Times*. London.
- Bonino, M., 1978, Lateen-rigged medieval ships. New evidence from wrecks in the Po Delta (Italy) and notes on pictorial and other documents, *IJNA* 7.1, 15–18.
- Bowden, W., Hodges, R. and Lako, K., 2002, Roman and Late-Antique Butrint: Excavations and Survey 2000–2001, *JRA* 15, 199–229.
- Dunbabin, K., 2001, *Mosaics of the Greek and Roman World*. Cambridge.
- Fulford, D. and Peacock, D., 1984, *Amphorae and the Roman Economy*. London.
- Frost, H., 1963, *Under the Mediterranean*. London.
- Grace, V., 1965, The Commercial Amphorae from the Antikythera Shipwreck, *Transactions of the American Philological Society* 55.3.
- Guilmartin, J., 2003, *Gunpowder and Galleys: Changing Technology and Mediterranean Warfare at Sea in the 16th Century*. London.
- Güleryüz, A., 2004, *Kadırgadan Kalyona Osmanlıda Yelken—Mikyas-ı Sefain, Denizler Kitabevi*. Istanbul.
- Jobst, W., Erdal, B. and Gurtner, C., 1998, *Istanbul: The Great Palace Mosaic: The story of its Exploration, Preservation and Exhibition: 1983–1997*, Arkeoloji Ve Sanat Yayınları, Istanbul.
- Joncheray, J-P., 1977, Mediterranean Hull Types Compared: Wreck F from Cape Dramont (Var), France, *IJNA* 6.1, 3–7.
- Junšić, M., 2000, *Ancient Shipwrecks of the Adriatic*. BAR Int. Series 828, Oxford.
- Keith, D. and Simmons III, J., 1985, Analysis of Hull Remains, Ballast, and Artefact Distribution of a 16th-Century Shipwreck, Molasses Reef, British West Indies, *Journal of Field Archaeology* 12.4, 411–24.
- Keith, D., Duff, J., James, R., Oertling, T. and Simmons, J., 1984, The Molasses Reef Wreck, Turks and Caicos Islands, BWI: A Preliminary Report, *IJNA* 13.1, 45–63.

- Konstam, A., 2002, *Renaissance War Galley: 1470–1590*. Oxford.
- Lane, F. C., 1934, *Venetian Ships and Shipbuilders of the Renaissance*. Baltimore, MD.
- Letter from the East to Master of Hospitallers (1187), *Translations and Reprints from the Original Sources of European History*, Hanover Historical Texts Project, Department of History, Hanover College, vol. 1, no. 4, 17–19.
- Lewis, A. and Runyan, T., 1990, *European Naval and Maritime History, 300–1500*. Bloomington, IN.
- Lopez, R. and Raymond, I., 2001, *Medieval Trade in the Mediterranean World, Illustrative Documents*. New York.
- McCann, A. and Freed, J., 1994, *Deep Water Archaeology: A Late-Roman Ship from Carthage and an Ancient Trade Route near Skerki Bank off Northwest Sicily*. JRA Suppl. Series 13, Ann Arbor, Michigan.
- Magness, J., 1992, Late Roman and Byzantine Pottery, Preliminary Report, in R. Vann (ed.), *Caesarea Papers: Straton's Tower, Herod's Harbour, and Roman and Byzantine Caesarea*. JRA Suppl. Series 5, Ann Arbor, Michigan.
- Martin, L. R., 2001, *The Art and Archaeology of Venetian Ships and Boats*. College Station, TX.
- Meyer, C., 1995, A Byzantine Gold-Mining Town in the Eastern Desert of Egypt: Bir Umm Fawakhir, 1992–93, *JRA* 8, 192–224.
- Oleson, J. (ed.), 1994, *The Harbours of Caesarea Maritima, Results of the Caesarea Ancient Harbour Excavation Project 1980–85*. BAR Int. Series 594, Oxford.
- Peacock, D. P. and Williams, D. F., 1991, *Amphorae and the Roman Economy*. London.
- Pulak, C. and Townsend, R. F., 1987, The Hellenistic Shipwreck at Serçe Limani, Turkey: Preliminary Report, *American Journal of Archaeology* 91, 31–57.
- Rickman, G., 1980, *The Corn Supply of Ancient Rome*. Oxford.
- Rose, S., 2002, *Medieval Naval Warfare, 1000–1500*. New York.
- Rosloff, J., 1981, INA's 1980 Turkish Underwater Survey, *IJNA* 10.4, 277–86.
- Scandurra, E., 1972, The Maritime Republics: Medieval and Renaissance Ships in Italy, in G. Bass (ed.), *History of Seafaring*. New York.
- Sciallano, M. and Sibella, P., 1994, *Amphores, Comment Les Identifier?*. Aix-en-Provence.
- Simmons III, J., 1988, Wrought-Iron Ordnance: Revealing Discoveries from the New World, *IJNA* 17.1, 25–34.
- van Alfen, P., 1996, New Light on the 7th-century Yassi Ada shipwreck: Capacities and Standard Sizes of LRA1 Amphoras, *JRA* 9, 189–213.
- van Doorninck Jr., F., 1989, The Cargo Amphoras on the 7th Century Yassi Ada and 11th Century Serçe Limani Shipwrecks: Two Examples of a Reuse of Byzantine Amphoras as Transport Jars, in V. Déroche and J-M. Spieser (eds), *Recherches sur la Céramique Byzantine*, Bulletin de Correspondance Hellénique, Suppl. 18, 247–57.