

# Three Renaissance Wrecks from Turkey and Their Implications for Maritime History in the Eastern Mediterranean

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**Abstract** This paper summarises findings from three recently investigated Renaissance wrecks in deepwater discovered in the Straits of Rhodes and interprets them in the context of that fast-changing world. Taken together, these vessels of different type provide insight into the maritime infrastructure of European mercantile trade and political relations of the time, as well as the armament used during this contentious era.

**Keywords** Deepwater wrecks · Renaissance · Straits of Rhodes · Shipboard armament · Maritime trade and exchange

Good friend, a storm is in fact a wind and thus it blows. But it is very strong, sometimes abnormally so. Rain storms are also known to have very strong gales. As the waves strike, the sea rises without limit. Those seeing this are amazed. Their vessels shake awesomely. Listen now while I tell you what they can do. They are driven where they would not go and God knows what things will happen there. They may sink at sea or be driven onto rocks. Lord deliver them from such a fate!

Piri Reis, *Kitab-ı Bahriye*, v. 1, p. 71

## Introduction

In 2005 and 2006, with the collaboration of the Turkish Ministry of Culture and Tourism and the Department of Underwater Archaeology, RPM Nautical Foundation conducted a deepwater survey for shipwrecks in the Straits of Rhodes (Fig. 1). That survey located 14 wreck sites, 3 of which date to the Renaissance period, roughly 1450–1600 (Royal 2006,

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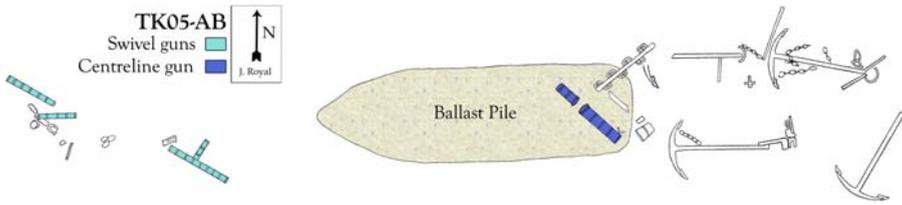


**Fig. 1** Survey area and discovered wrecksites along the SE portion of the Bozburun peninsula

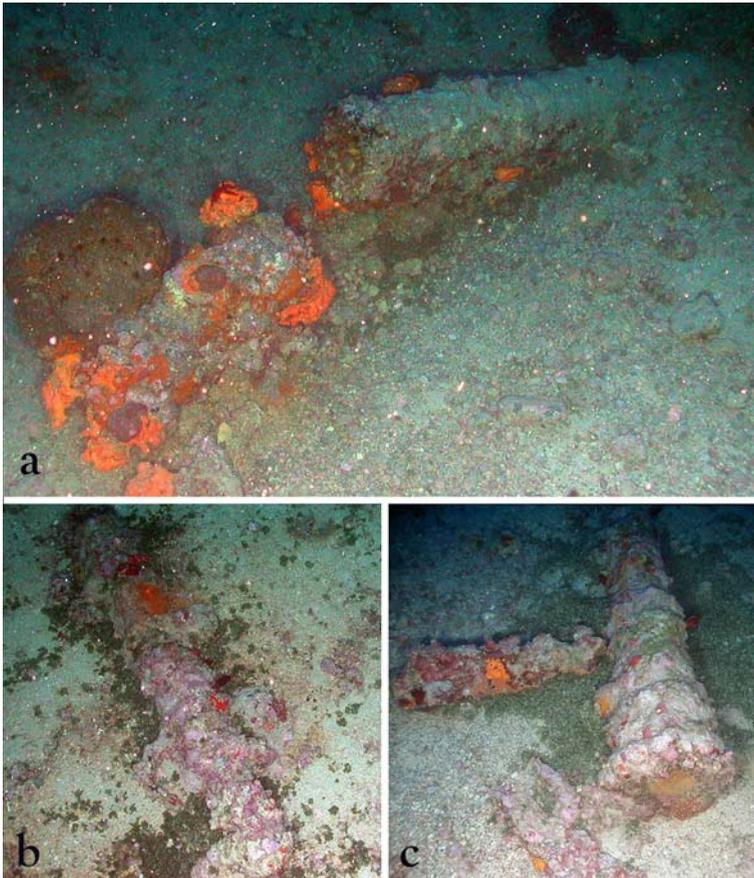
2008a). Given the weapons found at each site, all three vessels were likely prepared for combat. In another study, we address the coastal geography of the region and the visible assemblage of each site (Royal and McManamon 2010). Here we propose to expand our analysis and examine each of the three vessels against the background of maritime history. In terms of strategy at sea, these finds are important because, by the fifteenth century, Europeans had begun to appreciate the effectiveness of guns on vessels, technically known as ordnance. Once placed on ships, early wrought-iron guns were primarily employed as anti-personnel weapons. Advances in manufacturing gradually led to increased reliability and range for the guns. As shipwrights mastered the technology of gun ports and the laws of stability, they built vessels capable of carrying enough guns to capture or sink enemy vessels (Guilmartin 1994; Parker 1996; Rodger 1996; DeVries 1998; Glete 2000, pp. 17–39). The dramatic foundering of *Vasa* approximately 1,500 m into its maiden voyage in August of 1628 illustrates the complicated relationship between form stability (shaping and reinforcing the hull) and weight stability (positioning the guns and ballasting the hull) (Hocker 2006). By summarising the visible components of each vessel's assemblage, describing the interaction between vessel type and armament, and situating the three wrecks in their maritime historical context, we better understand patrolling by oared warships, tramping by small coasters, and trading by merchantmen from north western Europe. The rapid growth of corsairs early in the sixteenth century made Rhodes the “epicenter” of a naval struggle pitting Christian against Ottoman forces (Tenenti 1960, p. 263). The growing presence of English vessels in the eastern Mediterranean late in the same century added a new motive for conflict, as northern Europe undermined the domination of trade by Italian maritime cities.

### Wreck TK05-AB

This small wrecksite, approximately  $26 \times 2.5$  m, features a lengthy ballast pile that runs E–W, four anchors that came to rest in their stowed position, and three wrought-iron guns deployed at the bow and along the sides of the vessel (Fig. 2; Royal 2008a, b; Royal and McManamon 2010). The crescent-shaped anchors have a small protrusion at the crown, triangular flukes, rounded shank, and rectangular eye. All three wrought-iron guns have their breech-blocks nearby, and none exhibits evidence of a tiller (Fig. 3). The barrel



**Fig. 2** Preliminary plan of site TK05-AB



**Fig. 3** Wrought-iron guns found on site TK05-AB: (a) centreline gun at bow, two wrought-iron swivel guns near midpoint of the site to port (b) and to starboard (c)

length and diameter of the single gun at the bow is measurably greater than the other two that are located near the middle of the site. One of the smaller guns appears to have its forked swivel mount. The larger bow gun is likely a carriage gun mounted along the centreline, while the smaller ones are probably swivel guns used to rake enemy decks or repel boarding efforts. No hull timbers or small finds are visible, though they may be

covered by sediment. The site's length-to-breadth coefficient at ca. 10:1, peculiarly elongated ballast mound, absence of cargo items or crew possessions, and disposition of ordnance suggest a small oared warship operating in the years from around 1450 to 1600.

### Vessel Type and Strategic Considerations

Although warships historically utilised varied means of propulsion, those propelled primarily by oars dominated Mediterranean naval activity from ancient times to the Renaissance. Builders of oar-powered warships faced two related imperatives: constructing a vessel that was fast in short bursts and manoeuvrable in crowded formations. Accordingly, Renaissance shipwrights lightened oared warships by minimising the ship's timbers, weaponry, equipment, and ballast. Shipwrights who adapted vessels to carry wrought-iron guns faced new problems for form stability and weight stability. Additional weight high in a ship's hull increased the risk that a ship would capsize or founder when it heeled. Some vessels actually sank upon launching (Imber 1980, p. 212).

The wrought-iron carriage gun on the bow of wreck TK05-AB reflects changes in Mediterranean naval tactics. In the sixteenth century, a centreline gun fixed along a central gangway or on a specially built platform became customary on the bows of galleys and continued in use until the end of the century, often flanked by smaller guns (Lane 1973a, 356–357; Guilmartin 1974, pp. 72–73, 199–200, 207–210, 299; Guilmartin 1994, p. 145). By the early 16th century, cast-bronze bow guns habitually replaced wrought-iron ones on oared warships, as they had a greater accuracy and resistance to corrosion (Guilmartin 1974, pp. 157–158, 173–175; Smith 1993, pp. 154–155; Caruana 1994, p. xvii; Ágoston 2005a, p. 65). Because the small vessel near Bozburun has a wrought-iron bow gun, in addition to the wrought-iron swivel guns amidships, it more likely operated in the late fifteenth to mid-sixteenth centuries. The ballast at the centre of the site helped stabilise a vessel fitted with a centreline gun and anchors at the bow. Overall size, number of guns, iconographic clues, and historical evidence suggest that the vessel is a type of smaller rowed galley akin to a *fusta*.

The term *fusta* is of Italian derivation, and Venetian manuscripts from the fifteenth and sixteenth centuries supply skeletal information on the vessel type. In the fifteenth century, *fuste* had 10–26 rowers' benches and a length on deck from ca. 16.5–33.0 m, the largest of which was only slightly smaller than a Venetian light galley (Zorzi da Modon, fols. 27v–28v, 37v–39; Anderson 1925, pp. 145–147; Chiggiato 1987, p. lxix). By the sixteenth century, *fuste* were more regular in size as they had 18–23 benches. An anonymous shipwright writing after 1546 noted that a *fusta* of 20 benches was almost the same size as a light galley, carried ordnance in contrast to a *bregantin* or *fregata*, and had a draft of 0.87 m once armed (Pre' Teodoro, fols. 14–15, 35v; Tucci 1963/4, pp. 282–283; Picheroni della Mirandola, fol. 7). The Venetian *fusta* in Lago di Garda measures 30 × 3 m, a length-to-beam coefficient of 10:1 that mirrors that estimated for wreck TK05-AB. Manned by rowers and crossbowmen, the Venetian *fusta* also carried crew items, two grapnel anchors, and ballast (D'Agostino et al. 1997, pp. 147–153). The presence of ballast on the Lago di Garda *fusta* suggests a vessel with one deck and a hold. Ballast and guns made galleys heavier and lowered their acceleration rate. However, increased weight offered extra inertia to maintain momentum over time. The Lago di Garda *fusta* had its master frame located virtually at mid-length, a change made in Venetian galleys at the beginning of the sixteenth century to counter-balance the weight of guns mounted at the bow and improve the hydrodynamics of the hull.

Contemporary illustrations represent various Venetian and Ottoman galleys with a single gun along the central gangway, at times complemented by smaller guns to either side or along the bow quarters. The oft reproduced woodcut that Erhard Reuwich von Utrecht made for his 1486 edition of Bernard von Breydenbach's *Peregrinatio* shows a Venetian galley armed with a mounted bow gun bound to a stock (Ivins 1919, pp. 215–221; Guilmartin 1974, pp. 296, 298–299, with reconstruction; Alertz 1995, p. 152; Bondioli et al. 1995, p. 177; Tonini 2002/3, pp. 125–127). A Venetian illustration of the battle of Zonchio in 1499 shows Turkish galleys armed with what appears to be a swivel gun at the bow (Guilmartin 1974, p. 86; 1994, pp. 144–145). A plate from the fifteenth or sixteenth century in Venice's Museo Civico Correr depicts a small galley propelled by 15 oars per side and armed with a large centreline gun and three smaller guns to either side mounted on the forward yoke of the galley's rowing frame (Ray Martin 2001, pp. 137–138, Fig. 126). The rowed Ottoman "admiral's ship" depicted in a seventeenth-century Cicogna manuscript (cod. 1971), known as the *Memorie Turche* and now in the Museo Civico Correr, has a single centreline bow gun with a flared muzzle and five smaller swivel guns on the bow quarter; no guns appear amidships or at the stern. Rodger has argued that the early sixteenth-century decision to arm galleys with a heavy bow gun produced a "naval crisis" in the Mediterranean. The gun's firepower made it more dangerous than simply another missile weapon and gave the galley tactical advantages over large sailing vessels like carracks (Rodger 1996, p. 303; Glete 2000, pp. 27–28, 36; Rodger 2003, p. 245). Even when effective tactics for broadside gunnery were developed by the mid-seventeenth century, galleys never abandoned the arrangement of guns on the bow.

Smaller galleys such as *fuste* or *galiote* were at a disadvantage in any direct fight with a full-sized galley (Guilmartin 1974, p. 47). Therefore, these vessels typically attacked land positions, transported troops, supported amphibious assaults, served as patrol vessels, ambushed unarmed vessels, and raided coastal settlements. Tactically, *fuste* sat low in the water, were rowed near enemy positions on land or in port, and pointed their bows to aim their guns. After firing, their rowers backed water to escape return fire. Smaller swivel guns mounted on both sides prevented boarding and provided cover fire during a landing or retreat. To be effective in those manoeuvres while carrying guns and anchors, small galleys required special strengthening of the hull, skilled handling, and effective trimming with ballast.

Among possible candidates for ownership of the vessel, Venetians seem the least likely. Iconographic and manuscript sources indicate that Venetian galleys were usually outfitted with grapnel anchors like those on the Lago di Garda *fusta* and that, by 1500, Venice preferred to equip galleys with a bow gun cast from bronze (Guilmartin 1974, pp. 173–174; 1994, p. 146; Beltrame 2007, pp. 420–421). The limited corpus of vessel depictions from the late fifteenth and sixteenth centuries does include examples of larger Venetian and Ottoman galleys carrying two-armed fluked anchors. Such an anchor seems intended on the *kadırga* off Tenedos in Piri Reis from 1526 and an Italian engraving of the *paşa bastardası* of Ali Pasha from 1571, and it is shown on the Ottoman "göke" and the Venetian galleass in Kâtip Çelebi's *Tuhfet-ül Kibar fi Esfar-ı Bihar* from 1656 (Uzunçarşılı 1948, plate 39 [no. 79]; Ökte 1988, v. 1, p. 218; Güteryüz 2004, pp. 33 [upper], 42, plate VII-C [upper]). Furthermore, artists often portrayed galleys from the side, a perspective that obstructed the view of any anchors stowed on deck. Representations of Ottoman vessels without visible anchors include rough woodcuts for the 1496 edition of Guillaume Caoursin's account of the siege of Rhodes, depictions in the "Şecatname" and "Şehname-I Nadiri" manuscripts, and depictions in Nikolaes Witsen from the late seventeenth century. The galleys of unknown ethnicity, which the knowledgeable Pieter Bruegel the Elder drew for engravings

from ca. 1561–1562, also lack anchors (Brockman 1969, pp. 68, 77; Roberts-Jones and Roberts-Jones 1997, 280–293; Orenstein 2001, p. 215, no. 93, p. 216, no. 94; Güleriyüz 2004, pp. 33 [lower], 37, plates I–C, II–C, V–B, VIII–C).

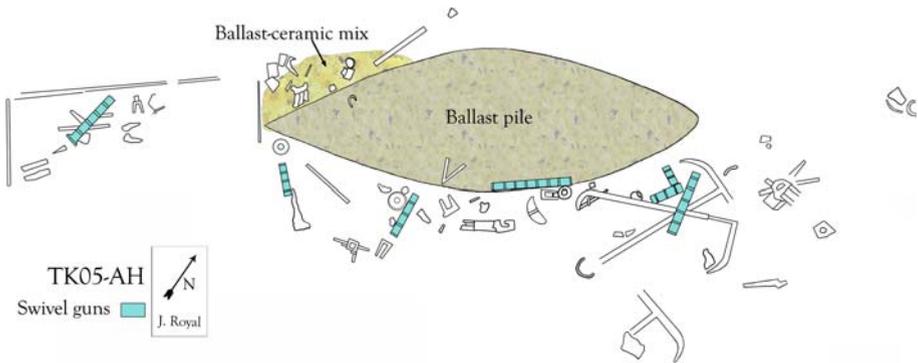
An Ottoman or Rhodian provenience seems more likely. Soucek's seminal research on Turkish terminology for vessels emphasised Ottoman dependence for nomenclature on the West and Ottoman emphasis for naval defence on oared vessels: the *kalita* (from the Italian *galiota*), the *kadırğa* (from the Byzantine Greek *katergos*), and the *başarda*, a term taken directly from Italian (Soucek 1975, pp. 234–238; Ökte 1988, v. 1, p. 219; Soucek 1996, pp. 13–20). Although *fuste* were not well suited for direct naval engagement, their versatility made them a common choice for Ottoman fleets (Ágoston 2005a, pp. 48–49). The minimal draft of *fuste* proved suitable for coastal and river operations. As early as 1433, a Burgundian traveller reported Ottoman *fuste* on the Danube armed with guns, and, in the Hungarian campaigns of the mid-fifteenth century, the Ottomans used around 100 *fuste* on the lower Danube (Parry 1960, p. 1061; Heywood 2002, pp. 6, 8–9). The vessels went as far upriver as Belgrade, where, in 1456, they participated in amphibious assaults.

The Ottomans employed a combination of 280 galleys and *fuste* at Negroponte in 1470 and gathered 120 galleys and 260 *fuste*, *barças*, and other vessels for the fleet that attacked Kaffa in 1475. Marin Sanudo the younger claimed that the Ottoman fleet in 1496 had 50 *fuste* among its 207 warships (Heywood 2002, p. 8, n. 29; Ágoston 2005a, pp. 18, 48–49). *Fuste* and *galiote* remained useful in Ottoman campaigns of the sixteenth century. In the winter of 1500–1501, Sultan Bayezid II ordered the preparation of 450 such vessels for his fleet, in 1501 Kemal Reís sailed to the Aegean with a fleet of 30 *fuste* that caused Venice to warn its convoys of possible attack, during the early spring of that same year Kemal's fleet at Pera consisted of 8 *galiote* and 13 *fuste*, in 1503 the Turkish fleets at Galata and Gallipoli had significant numbers of smaller oared warships, and in 1504 the fleet of the corsair Kara Durmuş consisted of 22 *fuste*, 1 *bregantin*, and 1 *galiota* (Brummett 1994, pp. 89–121).

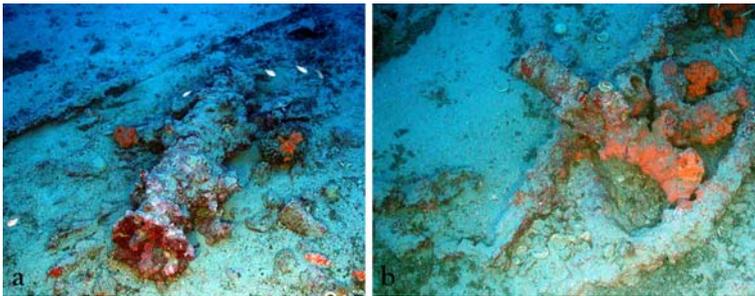
Ottoman corsairs likewise preferred the *fusta* because its size and speed made it effective for surprise raids or attacks, and, once armed with iron or bronze guns, Ottoman *fuste* even skirmished effectively with Christian light galleys (Tenenti 1960, pp. 243, 273; Vatin 1994, pp. 81–83, 97–102). To increase pressure on the Knights of St. John, Turkish regulars and Turkish corsairs operated in the channel between Rhodes and Turkey. Any naval force that used smaller oared galleys like *fuste* in their fleets required supply bases nearby. In 1503, Turkish *fuste*, perhaps belonging to corsairs, attacked fortresses on Rhodes, but the Knights drove the raiders off and recovered guns from the *fuste* abandoned on beaches. Again in 1508, the Rhodian fleet seized 8 *fuste* operated by Turkish corsairs (Brummett 1993, pp. 524–525, 532; Vatin 1994, pp. 94–96). The sunken vessel near Bozburun more likely belonged to the Ottomans, the Knights of St. John, or raiding corsairs on either side than to the Venetians. Those forces used *fuste*, had bases in the area, and clashed in the straits (Royal 2008b).

## Wreck TK05-AH

A second wreck that lies near wreck TK05-AB is over  $10 \times 4$  m, oriented NE-SW, and features an ovoid ballast pile of ca.  $6.0 \times 2.5$  m (Fig. 4; Royal 2006, pp. 201–206; Royal and McManamon 2010). Three anchors are visible; two have a rounded cruciform shape and one a more crescent shape. All three anchors have flukes that appear to be palm-shaped. Two rings protruding from the sand may indicate additional buried anchors. Ordnance includes the remains of four or five small wrought-iron guns; their lengths of



**Fig. 4** Preliminary plan of site TK05-AH



**Fig. 5** Wrought-iron gun found in the stern (a) and two of the anchors located at the bow (b) from site TK05-AH

ca. 1.5–2.0 m and barrel diameters of ca. 10 cm suggest that they were swivel guns (Fig. 5). Although there has been a shifting of ordnance during and after deposition, it appears that swivel guns were mounted at the bow, the stern, and along the gunwales amidships. Ceramics on the site include storage jars, tiles, and numerous sherds within the ballast pile. Given the number of exposed timbers and amount of overburden, there is a high probability of significant hull remains buried here. The three visible anchors have their crowns lying forward. Iconographic examples show an anchor secured on a round ship with the crown toward the bow, a grapple anchor on a Flanders galley fixed in the same direction in an illustration from the manuscript *Arte de far vasselli*, a trio of anchors hung at an angle with the crown slightly forward, and a grapple anchor tied off from the bowsprit of a *nave* (carrack) in an illustration from the manuscript of Zorzi da Modon. The majority of depictions, however, have anchors catted with the crown toward the stern (Ray Martin 2001, pp. 62–63, Fig. 37, p. 86, Fig. 66, p. 36, Fig. 14, p. 89, Fig. 70).

The number of anchors, extensive scatter of pottery, shape of the ballast mound, and low length-to-beam coefficient of the site suggest that this was a small coasting merchantman about 15–20 m in length and ca. 65–90 tons. The Culip VI coaster (ca. 16–17 m long) displaced around 56 tons, while the Contarina I coaster (ca. 20–21 m long) displaced around 94 tons (Castro et al. 2008, 352). As for the previous wreck, the wrought-iron swivel guns place the operational period of this vessel generally between 1450 and 1600. Less flamboyant than the era's larger, long-distance trading vessels, the coaster offered

several advantages on the Mediterranean (Pryor 1994; Balard 1994; Steffy 1994, pp. 13–14, 85–93; Castro et al. 2008). They were ideal for practical navigation, where masters kept their vessels within sight of land and later exploited portolan charts of the coast to assist their reckoning. Coasters carried a range of products picked up on frequent calls at ports along the way. The Arab geographer al-Bakri described an eleventh-century merchantman making 45 stops between Mahdia (Tunisia) and Alexandria (Egypt) (Balard 1994, p. 133). Coasters helped to contain start-up and operational costs because they required less material to build and smaller crews to man. Technological developments leading to a system of whole moulding are already apparent in elements of the hull of the ninth-century Bozburun wreck and the eleventh-century Serçe Limani wreck (Hocker and McManamon 2006, pp. 1–3, 7–9). Those developments imply reliance on frame-based construction and methods to pre-determine the shape of the central portion of the hull. Coasters offered entrepreneurs the possibility of rapid turnover in trade, especially when carrying a limited variety of cargoes. They could be loaded or unloaded quickly and exploit their lateen rigs to sail quickly and manoeuvre effectively. Tacking was still a complicated and somewhat labour intensive activity, but lateen-rigged coasters were not as limited by the prevailing winds or sailing season.

Regional trading occurred along all of the Mediterranean coasts, where the Catalans and Arabs circulated in the Western basin, the Genoese sailed west to southern France and south to Sardegna, southern Italy, and Sicily, and the Venetians exploited their domination of the Adriatic. Coasting was especially vital to the Eastern Mediterranean's economy. Land routes through the Anatolian mountains proved more dangerous and expensive than coastal routes. The Ottomans inherited Greek traditions in that region. Many cities and villages along the Anatolian coast had their own shipyards to build small coasting merchantmen. Those vessels moved Ottoman goods throughout the Aegean from the Balkans to Anatolia and then out into the wider Mediterranean. Similarly, the Italian city-states who established trading colonies in the region built their own coasting vessels. The Venetians had a shipyard on Crete at Candia, and the Genoese had a shipyard on Chios and another at Kaffa in the Crimea.

As early as the eleventh century, the Serçe Limani wreck indicates that small merchantmen armed themselves with edged weapons against pirate attacks (Bass in Bass 2006, pp. 115–116). By the late fifteenth century, piracy had become a severe threat to such merchantmen. Furthermore, as the rivalry between Venice and Genoa eased, that between Western Christian powers and the Ottomans and Barbary regencies intensified. Trading over shorter distances and with less stowage capacity, coasters initially found safety in numbers and sailed in convoys. The complement of wrought-iron swivel guns on wreck TK05-AH represents the gunpowder successor to the edged weapons on the wreck at Serçe Limani. Although not designed as ship-killing weapons, the welded swivel guns on this vessel supplied some means of defence. Higher quality bronze guns were reserved for warships, and owners of merchantmen probably limited costs by purchasing older wrought-iron guns. Iberian vessels wrecked in the Americas in the sixteenth century consistently have an eclectic mix of wrought-iron guns, some of which were very old at the time of sinking.

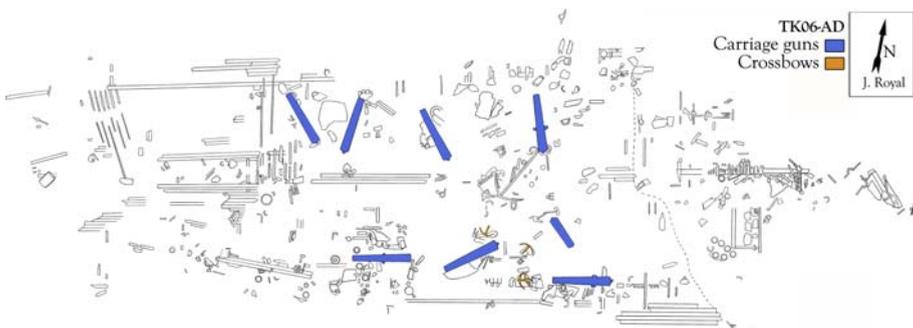
The owners of the vessel in the Rhodian Straits judged that they needed at least 4–5 wrought-iron swivel guns to ward off boarding attempts or hold off attacking vessels long enough to flee. The Cattewater wreck, an armed merchantman dated to the early sixteenth century, carried three wrought-iron swivel guns mounted in wooden stocks. The best preserved of the three was 1.25 m long and had an outside diameter at the muzzle of ca. 7 cm (Redknap 1984, pp. 39, 49–63; 1997). The guns are similar to those found on wreck

TK05-AH; however, at anywhere from 186 to 282 tons burden, the Cattewater wreck was much larger. If the three guns found on the Cattewater vessel were its total armament it was either relatively under-gunned, or the Turkish wreck needed a heavier complement because Mediterranean merchantmen faced greater dangers in an area plagued by piracy and conflict. In that sense, the smaller oared warship a few hundred meters distant constitutes a representative part of the broader reality that led Mediterranean merchants to arm their small round ships with wrought-iron swivel guns. On the basis of present evidence, it is not possible to say who owned the vessel or why it sank. The Ottomans, the Italians, and the Knights on Rhodes all used such vessels in this region. A sudden storm seems the likely cause of sinking: the crew never cast their anchors. Moreover, an enemy vessel would want to capture this one. If by chance another vessel did sink this one, it is further proof that the coaster was poorly outfitted for battle.

### Wreck TK06-AD

In 2006, a large wreck site was discovered near the promontory protecting the small bay of Gerbekse (Royal 2008a, pp. 93–95; Royal and McManamon 2010). The site consists of an extensive mound housing numerous artefacts: tableware, storage jars, cooking items, crossbows, iron guns, and one anchor (Fig. 6). The anchor has a square shank, V-shaped arms, and spade-shaped flukes with a sharp protruding bill. Many of the deep plates or shallow bowls scattered around the site are intact and, in some cases, stacked. The bows of the crossbows seem fashioned from metal, and one has its foot stirrup (Fig. 7). There are four guns on each side of the vessel; they lie transverse to the line of the hull on the starboard side and parallel to the line of the hull on the port side. Their regular taper from breech to muzzle indicates that they were cast from iron rather than welded (Fig. 8). However, the guns do differ among themselves, particularly in the discernable number of barrel mouldings. In contrast to the other two wrecks, there is no distinct pile of ballast stones but rather what appears to be a deposit of shingle.

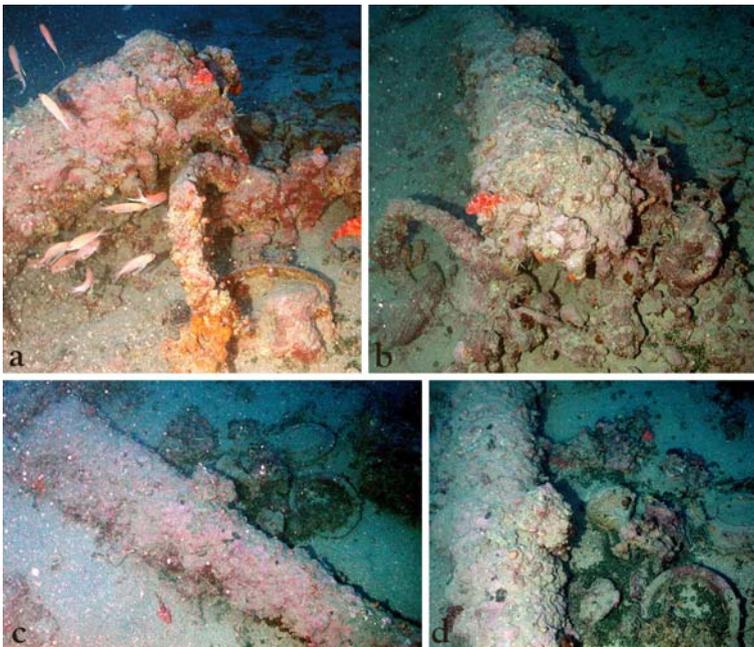
Extensive hull remains are visible above and below the thin covering of sediment, and include the keel, portions of flat and Y-shaped frames, the rudder, and planking. The relatively well-preserved timber remains allow an estimate of the vessel's overall shape and dimensions. Substantial frame remains point to a sturdily built vessel, and the gudgeons indicate a straight rudder attached to a flat transom with external sternpost. The Y-shaped frames atop substantial deadwood at the stern are characteristic of a high transom



**Fig. 6** Preliminary plan of site TK06-AD



**Fig. 7** Crossbows located on the port side near midships on site TK06-AD



**Fig. 8** Starboard gun in sector 3 of site TK06-AD: (a) base of gun and top of anchor, looking E, (b) looking N along gun. Port gun in sector 6 of site TK06-AD: (c) view from above looking S, (d) looking E

structure. The site is approximately 25–30 m long and 8–9 m wide. As the stern is fairly well defined, one need only add length at the bow, minimally 5 m, to account for the vessel's length. Adding a similar 1 m to account for beam, the vessel is estimated to have been ca. 30–35 m in length and 9–10 m in beam. Hence, the vessel has the typical or

perhaps slightly elongated length-to-beam coefficient of a merchantman (3.0–3.9:1). The limited number of guns and their placement for a broadside suggest a vessel with a single deck and a raised, narrow stern. Based on the evidence, this vessel had a displacement around 200–300 tons and was propelled by sails. Eight carriage guns on a single deck allowed the vessel to defend itself when necessary and still lade cargo in quantity. The bowls with a decorative groove at their rims and the pitchers (*ibrik*) have an Ottoman provenience. Although some of the bowls and pitchers could be crew's equipment, their high number and scattering indicate that others were goods obtained in trade. The vessel is therefore an armed merchantman. The site's dimensions, scatter of tableware items, eight cast-iron carriage guns, crossbows, type of anchor, and type of ballast suggest an English merchantman from ca. 1560–1590.

### Vessel Type and Strategic Considerations

The dating of the TK06-AD wreck is broadly supported by the one anchor, as the angle of the arms corresponds to a type manufactured in England around mid-century (Royal and McManamon 2010). The complement of weapons further refines the dating. The presence of cast-iron carriage guns indicates a date in the second half of the sixteenth century. By the mid-fifteenth century, European powers had widely introduced cast-bronze guns (McNeill 1982, pp. 86–87). The Ottomans early favoured such guns and hired competent manufacturers, often from the West (Parry 1960, pp. 1063–1064; Heywood 1980, pp. 12–18; Barker 1983, pp. 70–72; Glete 2000, p. 21; Ágoston 2005a, pp. 46–48, 65–66). For example, Ottoman *darbzens* of cast bronze figured among the most common artillery used: between 1517 and 1519 the Imperial Cannon Foundry (Tophâne-i Âmire) in Istanbul cast 575 *darbzens* out of 673 total guns. Similarly, of the 1,027 pieces cast at the Imperial Foundry from 1522–26, 625 were small *darbzens* (375 lbs) and 355 were large *darbzens* (1000 lbs) (Parry 1960, pp. 1061–1063; Heywood 1980, pp. 214–215). As early as 1488, the Ottomans used *darbzens* as ordnance; 12 large and 20 small *darbzens* were typically placed on *barças*, and they were also used to arm *kadirgas*, *kalitas*, and *iğribars* (coasters) (Bostan 2000, pp. 741–742; Ágoston 2005a, pp. 52–53, 85). In Western Europe, the leading manufacturers of cast-bronze artillery were located in France, Germany, the Low Countries, and Italy. The Venetians, excellent founders of cast-bronze ordnance, produced a variety of small- and medium-sized guns for use on vessels. Spain also established new foundries but suffered from a lack of skilled labour (Mallett and Hale 1984, pp. 81–84, 395–399). When the Spanish Netherlands revolted in 1566 and Italian producers could not meet Spanish demands for bronze guns, Spain found her strategic position weakened. The quantity and quality of cast-bronze guns produced by her internal foundries contributed to that weakness (Cipolla 1965/85, pp. 30–36).

Though more reliable in operation and less subject to corrosion, bronze guns were also expensive to manufacture. Already in the mid-fifteenth century, European founders had attempted to cast-iron guns but with no success. A breakthrough came in 1543 during England's preparation for war with France. When Henry VIII could no longer afford bronze guns produced in the Low Countries, he supported domestic founding based upon extensive reserves of iron ore. The cast-iron guns that the English manufactured, for reasons that are still not altogether clear, were relatively reliable, though initially heavier than equivalent bronze guns. Until the end of the sixteenth century, the English held a virtual monopoly on the mass production of trustworthy cast-iron guns (McNeill 1982, pp. 86–87; Glete 2000, p. 23). England's technological success soon led to economic success. English gun founders produced for growing internal demand in support of trade

and privateering, as well as export to fellow Protestant powers. Only by the 1620s and only with Dutch collaboration did Swedish iron founders begin to produce guns on a scale to rival England (Cipolla 1965/85, pp. 36–64; Guilmartin 1974, p. 175; 1994, pp. 149–150; Cipolla 1980, pp. 286–287; Glete 2000, p. 23; Black 2002, p. 175). When English merchantmen resumed trading in the Levant in the last decades of the sixteenth century, they were often armed with cast-iron guns.

In ship technology and iron founding, the Mediterranean lagged behind northern Europe. Spain had trouble casting good iron guns, only produced useful guns in the 1620s, and never manufactured them on the scale that England and later Sweden achieved (Wignall 1975, p. 253; Mott 2003, p. 117). It was not until the seventeenth century that the Venetians acquired the skills for casting iron guns. The Ottomans shared in the earliest transfer of technologies for manufacturing guns. Though scholars long emphasised that the Ottomans favoured guns of larger calibre, they actually manufactured and used many light-weight and medium-weight guns (Ágoston 2005a, pp. 64–88, 184–186, 195–198; Ágoston 2005b, p. 120). However, those guns were either welded from iron or cast from bronze. When first developing a navy, the Ottomans employed renegade Western experts for shipbuilding in the yards and arms production in the foundries. Weapon technologies moved from West to East as the Ottomans paid trained workers to defy the papal ban on dealing with “the infidel” (Ágoston 2005a, pp. 91–92; 2005b, pp. 113–114; Aydüz 2006, pp. 11–13). The Ottomans tapped iron reserves in Bulgaria and purchased small amounts from the West; however, most of the raw materials that they purchased, especially tin and scrap metals, were used to make cast-bronze guns (Imber 1980, p. 234; Heywood 1980, pp. 211–212; Ágoston 2005a, pp. 167–178; Aydüz 2006, pp. 15–17). English methods for casting iron did not reach the Ottomans until the seventeenth century, and, when they did, the Ottomans used them only to produce small iron guns. The slow diffusion of the technology for casting iron reflects conscious English policy to maintain that secret and the strategic advantage it afforded. The government of Elizabeth I eventually banned the sale of cast-iron guns to England’s enemies, but, by the end of the sixteenth century, some had been illegally sold to Spain, the Barbary regencies of North Africa, Russia, and the Ottomans (Stone 1949, p. 45; Cipolla 1965/85, pp. 43–46; Wignall 1975, p. 252). Owning the guns, however, was a far cry from producing the guns, for which one needed the proper grade of ore and the proper techniques for founding.

Although cast-iron guns became lighter and shorter over time and always had economic advantages, the process required years to perfect (Guilmartin 1988, pp. 133–134). Well into the sixteenth century, most European and Mediterranean naval powers continued to equip their vessels with wrought-iron and cast-bronze guns. Even the English fleet late in the reign of Henry VIII had far more wrought-iron pieces in the inventories: the Anthony Rolls of 1546 and a manuscript account of 1548 list over 1,700 wrought-iron pieces out of a total of 2,008 guns (Kenyon 1983, pp. 63–65; Caruana 1994, pp. 6, 17–21). The vast majority of cast guns registered in the rolls were made from “brass”, and, as late as September of 1595, less than 20% of English naval guns (188 of 977) were cast from iron (Parker 1996, p. 294, n. 17; Black 2002, p. 175). Archaeological analysis of the performance of guns during the Armada skirmishes in the English Channel confirms these tendencies. Whereas England could count on some quality cast-iron guns, the Spanish did not trust them. Cast-iron guns from Spanish foundries, if they were not heavy, blew up during testing, and, if they were heavy, proved unwieldy for shipboard use. The Spaniards continued to rely on cast-bronze guns but generally obtained their high quality exemplars from foreign producers. Bronze guns cast in Lisbon under the direction of an Italian founder from 1587–1588 proved of low quality. A bronze *media culebrina* recovered from

*El Gran Grifón* has its bore well off centre, and an Italian bronze *sacre* recovered from *Juliana* has a hole blown out of its barrel. Few quality guns, many inferior guns, inconsistent bores, ineffective shot, and clumsy two-wheeled carriages have all been adduced as factors contributing to Spanish difficulties in the naval skirmishes (Wignall 1975; Martin 1975, pp. 173–181, 203–224; Parker 1996, pp. 280–286; Rodger 1996, pp. 310–311; Martin 2001, pp. 384–389; Black 2002, pp. 183–186). Even cast-iron anchors on Spanish Armada vessels show signs of breaking under stress (Glover 1998, pp. 61–62).

Archaeological evidence from non-Armada wrecks reflects the scarcity of cast-iron ordnance until the late sixteenth century and its principal manufacture in England till then. A few English guns are presently the best parallels for the starboard guns on site TK06-AD: a cast-iron gun found at Western Ledge reef off Bermuda and manufactured in England in 1577, a cast-iron gun recovered from the Alderney wreck of 1592 and manufactured in England, and a cast-iron minion found near *Sea Venture* (wrecked 1609) and manufactured in England by Richard Phillips (Wingwood 1982, pp. 335, Fig. 2, 339; Watts 1993, pp. 115–118; Davenport and Burns 1995, pp. 30–40; Bound 1997, p. 86; 1998b, pp. 64–83; Alderney Elizabethan wreck 2008). The archaeologists studying the assemblage from the *Mauritius* (1609) have labelled one cast-iron minion as comparable to the gun of Phillips (L'Hour et al. 1990, pp. 70–72). The Cayo Nuevo site off Mexico yielded one large cast-bronze gun and five cast-iron guns. The latest information on the site offers an apparent date for the bronze gun of 1552, indicates that two of the cast-iron guns had the same etched identification mark, and suggests that the site includes two wrecks, one that may be Spanish from the sixteenth century and another from the eighteenth century (Smith 1988, pp. 87–88; Luna Erreguerena 1995, p. 276).

The guns on the port side of the wreck are similar to those on the starboard side in all of their features except for the greater number of mouldings along their barrels. It is possible that the port guns are slightly older. An iron demi-culverin that probably dates to the end of the reign of Henry VIII was cast with many hoops in the manner of a wrought-iron gun. For greater security, early founders of iron guns may have added numerous mouldings. On the other hand, in the years between 1571 and 1579 when the English shifted from using serpentine powder to corned powder, founders added to cast-iron guns a second reinforce and further mouldings. Were that the explanation, the guns on the port side would be slightly younger than their starboard counterparts (Caruana 1994, pp. 3, 26, 34–37). A mix of guns was common to vessels of the period and might benefit a vessel's owner, who could save by purchasing both older and more recently manufactured guns.

If the crossbows comprised part of the vessel's armament, they help date the wreck to ca. 1560–90. Whether firearms are eventually located on the site, the presence of crossbows remains significant. Crossbows proved particularly effective in the Mediterranean naval encounters of the thirteenth and fourteenth centuries and continued in use for centuries thereafter (Rose 1999, p. 566). Crossbows required less training, expertise, and physical strength to master than did longbows. From the late fourteenth into the fifteenth century, crossbows manufactured from tempered steel, called arbalests, had increased penetrating power. However, making crossbows from steel proved more expensive, and crossbows always suffered from a slower rate of fire than their long cousins (Hall 1997, pp. 16–20). Already in 1404, a naval clash near Modon between the Genoese and Venetians featured a novel combination of crossbows and gunpowder weapons (Lane 1973a, pp. 199–200; Rose 2002, pp. 40, 47–48, 110–111, 125–126). By the mid-fifteenth century, individual firearms began to appear regularly on ships. Arquebuses and muskets slowly supplanted crossbows as the preferred weapon for soldiers in armies and marines on warships, especially when discharged from a strong defensive position (Guilmartin 1974,

p. 140; DeVries 1998, pp. 390–391, 395; Black 2002, pp. 69–72). The Cavoli wreck, dated ca. 1425–50, supplies early archaeological evidence for this transition. The vessel carried eight wrought-iron carriage guns, several smaller swivel guns, shot, crossbows, swords, and musket balls (Martin-Bueno 1992, 1998). Historical evidence indicates that Venice used some arquebusiers on her war galleys after 1460 and that the soldiers and marines who fought in the Second Turkish War (1499–1503) used an early form of flintlock musket called the *schioppo* (Lane 1973a, p. 338; Pepper 1993, pp. 49, 52, 55; Rose 2002, p. 114). Governments favoured the arquebus as it was fairly simple to operate, required minimal training, did not exhaust their budgets, and delivered effective impact force (Black 2002, pp. 37–38, 70).

The overall pattern suggests that, over the course of the late fifteenth and sixteenth centuries, governments gradually phased out crossbows, but the process was hardly linear. The use of crossbows on warships illustrates the erratic character of that process. After 1460, the Venetians began replacing their crossbows, and in 1518 the Council of Ten decreed the substitution of matchlock firearms for crossbows on galleys. Nonetheless, almost a century later, the Venetian Senate complained about a continuing resort to bows and arrows, by then deemed “useless and superfluous” (Lane 1973a, p. 365; Hale 1975/85, pp. 13–14; Black 2002, pp. 37–38, 70). Although Spain took the lead in replacing crossbowmen with arquebusiers and, by 1530, crossbows were rarer on Spanish vessels, they are still encountered in regulations for standard armament on Spanish ships in the 1550s (Guilmartin 1974, pp. 148, 256). There are several Iberian wrecks from the sixteenth century on which archaeologists found crossbows. The Molasses Reef wreck from ca. 1510–30 carried 2 wrought-iron carriage guns, 1 smaller welded piece, 17 swivel guns, as well as 3 arquebuses, crossbows, edged weapons, and grenades (Keith et al. 1984, p. 55; Keith and Simmons 1985, p. 418; Keith 1988, pp. 60–63, 68; Simmons 1988, p. 25; Smith 1993, pp. 158–160). The St. John’s Bahamas wreck, which has a *terminus post quem* of 1554, carried 3 wrought-iron carriage guns, 7 swivel guns, 9 crossbows, pole arms, and swords (Malcolm 1997, p. 352). Crossbows were discovered on the 1554 Padre Island wrecks, together with wrought-iron guns and swords (Keith 1988, pp. 53–56; Smith 1988, p. 89; Smith 1993, pp. 162–163). The mid-sixteenth century Emanuel Point wreck located off the Florida coast had lead shot for arquebuses and copper bolt heads for crossbows (Smith 2001, p. 298).

As missile weapons for their marines, the Ottomans long favoured composite recurved bows (Lane 1973a, p. 372). Nonetheless, even the Ottomans eventually began to experiment with the arquebus as an alternative. In a raid on Malta in 1552, the Turks used the bow guns on their galleys and the arquebuses of their marines to drive back the Christian defenders and permit the landing of troops. However, the recurved bow had strong roots in a society of noble warriors on horseback, and Western depictions of the Battle of Lepanto in 1571 give prominence to Turkish archers and swordsmen (Tonini 2002/3, pp. 130–133). Only after the Ottoman defeat at Lepanto were all Ottoman *sipahi*, the elite cavalry especially loyal to the bow, required to arm themselves with arquebuses (Guilmartin 1974, pp. 81, 149–157; McNeill 1982, p. 98; Hall and DeVries 1990, p. 506; Ágoston 2005a, pp. 53–54, 57–58). The Ottomans henceforth preferred firearms for their marines (Lane 1973a, pp. 371–372; Imber 1980, pp. 264–265).

English armies had long used crossbows and longbows, applying them for different tactical purposes. The transition to firearms also occurred in England over the course of the sixteenth century. By mid-century, though adopting the arquebus meant higher costs for the government, soldiers and generals alike appreciated the arquebus’s ability to pierce armour at close range. Moreover, quality yew for longbows was proving more difficult to

import (Phillips 1999, pp. 580, 589, 591). Toward century's end, the debate became public. Unofficially from 1571 and officially in 1585, English soldiers served in the Low Countries and, while there, noted the superior armament and organisation of the Spanish regiments (*tercios*). The soldiers brought this knowledge home to England. Shortly thereafter, strategists lobbied for a shift from the bow and halberd to the arquebus and pike. In the debate over the wisdom of such a change, politicians wrote pamphlets to support the retention of bows or the integration of firearms (Esper 1965; McNeill 1982, pp. 91–95; Borman 1997; Phillips 1999). In 1590 Sir Roger Williams argued for firearms, and he referred to the crossbow as a weapon used in “our ancient wars” (Esper 1965, p. 385). Similarly in 1594, Humfrey Barwick supported firearms by snobbishly likening English fondness for their longbows to Irish fondness for their darts. Both were veterans of the wars in the Low Countries. Even the most dedicated opponents of longbows argued for a tactically effective mix of missile weapons (Rahn Phillips 1994, pp. 577, 582).

Archaeological evidence confirms a shift in strategy for military ships as well. The English carrack *Mary Rose* had by 1540 significantly increased its complement of heavy guns. When *Mary Rose* sank in 1545, it had 39 wrought-iron and cast-bronze carriage guns, 52 wrought-iron swivel guns, 50 handguns, 250 yew longbows, 300 staff weapons such as pikes and halberds, and almost 500 darts for hurling from the fighting tops (Rule 1997, pp. 265–266; Hildred 2005, pp. 147–172). The entire English fleet of 1545 had only 27 cast-iron guns, yet all vessels in that fleet were supplied with longbows. By contrast, the vessel that sank at Alderney in military service around 1592 had no crossbows or longbows but did carry from 6 to 8 cast-iron guns, 45 muskets of matchlock and wheel-lock type, incendiary grenades, and edged weapons. At least one of the heavy matchlock muskets was for use on board, given that it has a pintle on the underside of its stock (Guilmartin 1974, pp. 146–149; Davenport and Burns 1995, pp. 34–35; Bound 1997, p. 25; 1998b, pp. 68–77, Fig. 14).

The hull characteristics also support the probable English origins of the vessel. Ottoman sailing vessels of the sixteenth century did not usually have a high flat transom. The only Ottoman vessel from the period examined by archaeologists, the possible military transport at Yassıada, had a curved rudder. Iconographic evidence for Ottoman vessels of this period is mixed. Some Ottoman vessels are depicted with flat transoms and a straight rudder often set an angle to follow the post, and others, particularly galleys, are shown with a curved rudder. Curved rudders are shown on Ottoman galleys in the “Şehname-I Selim Han”, “Şehname-I Nadiri” manuscripts (Güleryüz 2004, plates V-B, VI-C, VIII-C). Furthermore, the reconstruction of a galley with 36 benches, the galleys in Katip Çelebi's book (1656), and a *şebek* in the “Şehname-I Selim Han” manuscript also depict rudders with a discernable curve (Güleryüz 2004, plates III-B, IV-A, X-C). Contemporary iconographic evidence for Ottoman vessels featuring straight rudders is less common. The clearest examples are the galley in Bruegel (ca. 1561–1562) that Güleryüz labels a *kalita* and on which he notes “an early flat poop” (Orenstein 2001, p. 216, no. 94; Güleryüz 2004, plate I-C) and the galleys from Witsen (Güleryüz 2004, p. 37). Other depictions and reconstructions of *şebeks* with straight rudders appear to be French or North African vessels, or they date to the eighteenth century (Güleryüz 2004, pp. 52, 54, plate X-B). Moreover, Ottoman terminology for vessels indicates that they concentrated on oared warships to the detriment of sailed merchantmen.

Various states in the Western Mediterranean and Northern European did construct round ships with a flat transom. They included carracks, caravels, pinnaces, “great ships”, and early galleons, all of which appear in sixteenth-century depictions of Spanish, Portuguese, Italian, Dutch, French, and English vessels. Archaeologically, the shape of gudgeons found on several Iberian wrecks confirms that sixteenth-century Iberian merchant

vessels in the New World often had flat transoms (Oertling 2001, pp. 234, 236). However, as Iberian wrecks in the Americas and Armada wrecks in Europe prove, Spain did not have a reliable source of cast-iron guns. The TK06-AD vessel likewise does not appear to be a warship. Most sailed warships of similar size tended to have more, and a greater variety of, ordnance than the eight carriage guns found on this site. Some sixteenth-century English warships carried many more weapons. In 1545, *Mary Rose*, a 700-ton carrack, received 91 pieces of ordnance, predominantly swivel guns, and, in 1548, *Falcon*, an 80-ton pinnace, received 4 cast-bronze sakers and 22 swivel guns of several types (2 quarter slings, 2 double bases and 18 single bases) (Kenyon 1983, pp. 64–65; Guilmartin 1994, pp. 147–149; Caruana 1994, pp. 10–15, 20–21; Rule and Dobbs 1995; Hildred 2005). Records for the English navy between 1558 and 1603 show that even smaller pinnaces of 40–70 tons usually had 8–16 guns, while galleons of 350–750 tons had 30–60 guns (Nelson 2001, pp. 102–105). Thus, the relatively few guns and the mix of gun types indicate that the vessel in the Rhodian Straits was not a warship but an armed merchantman.

At the beginning of the sixteenth century, a new type of merchantman armed with guns first appeared in substantial numbers in association with the trade between north western Europe and the Mediterranean. Before the 1650s, most states did not equip their naval vessels with cast-iron guns; however, merchant vessels preferred cast-iron guns because they were less expensive to acquire and effectively warded off enemy attack. As a merchantman did not require a large gunnery crew to continuously fire its guns, there was little risk of overheating them (Glete 1993, v. 1, pp. 51–55; 2000, pp. 23–24, 31). The Alderney wreck of 1592, a channel merchantman serving as a transport in English naval operations, had a minimum eight cast-iron carriage guns mounted for a broadside (Bound 1997; Alderney Elizabethan wreck 2008). By the late sixteenth century, vessels from northern Europe armed with cast-iron guns became important cargo carriers and pirates in the Mediterranean as well.

When arming the crew of a merchantman, crossbows perhaps cost less than longbows or arquebuses. Crew members were not trained marines capable of effectively firing a longbow, but they were capable of firing a crossbow in an emergency (Rose 2002, p. 128, testament of Duke Charles of Orleans). For example, Venetian galleys traditionally carried extra bows and later arquebuses for use by the rowers (Hale 1975/85, p. 13). Whether defending the vessel with cast-iron guns or crossbows, the merchantman's crew sought to volley and run, not to engage in prolonged battle. Moreover, a mix of weapons gave the crew flexibility in responding to circumstances. Eventually, the arquebus's superior impact at short range won out over the longbow, which required more extensive training and consistent practice. In the second half of the sixteenth century, even the simpler crossbow, with its other bowed cousins, fell out of favour. During this period of declining popularity and demand, crossbows were likely cheaper to obtain.

Evidence gathered to date indicates that this wreck was an English merchant vessel in the 200–300 ton range, probably closer to the upper end. Armed merchant vessels of the day typically displaced 200–300 tons whereas armed warships displaced 500–600 tons (Black 2002, p. 167). The basic size and shape of the remains implies a sailed vessel, the timbering implies strength, and the hull breadth implies carrying capacity plus speed. The limited number of artefacts useful for preparing food, e.g., a single brazier, and the limited number of guns and personal weapons indicate a small crew capable of handling a merchant vessel of these dimensions. The common types of Ottoman ceramics scattered across the site suggest that the vessel carried some of those items as trade goods. During the late sixteenth century, English merchantmen attained growing influence all the way to the Levant, made possible in part by the security that cast-iron guns provided. When seeking to

surprise and capture vessels, English privateers made minimal use of their guns, as much to intimidate as to inflict damage. Against the Spanish Armada in 1588, the English demonstrated the effectiveness of a new style of fighting at sea utilising armed merchantmen (McNeill 1982, pp. 100–102; Parker 1996, p. 273; Rodger 1996, p. 307).

The working hypothesis of an English merchant vessel of the Elizabethan era explains the absence of a large mound of ballast stones typical of the wreck assemblage of most other sixteenth-century merchantmen, particularly armed Iberian vessels in Europe and the Americas. In fact, a ballast mound of sizable stones comprises the central portion of those sites and provides the surest clue that a vessel has wrecked. For example, the Iberian vessel at Highborn Cay from the first half of the sixteenth century left a conspicuous mound of ballast stones, some larger than 50 cm in size (Smith et al. 1985, pp. 69–71), the Iberian vessel at Emanuel Point likely from 1559 also had a mass of stones (Smith 2001, pp. 295–296), and the Iberian vessel at Molasses Reef carried a large pile of stones estimated to weigh over 36 metric tons (Keith et al. 1984, pp. 46, 48–51, Figs. 3, 4, 6; Oertling 1989, p. 241). The long search in Blasket Sound, Ireland, for the wreck of the Armada vessel, *Santa Maria de la Rosa*, only ended with the finding of the vessel's ballast stones (Martin 1975, pp. 57–97). Some sixteenth-century vessels combined stones and gravel. The ballast in the hold of the Genoese *nave*, *Lomellina*, consisted of gravel and pebbles (Guérout 1997, p. 244; Guérout and Rieth 1998, pp. 40–41). The Cattewater wreck had ballast comprised of stones and large quantities of gravel, but it is still not known whether the vessel was Iberian or English (Mortlock and Redknap 1978, pp. 199–200; Redknap 1984, pp. 83–88; 1997, p. 91). For some time prior to 1600 and continuing well beyond, the English preferred to employ for ballast the shingle they dug from beaches. In the Tudor and Elizabethan eras, many English merchantmen were ballasted with gravel as it was cheap and compacted well. Moreover, on long voyages vessels so ballasted could be beached and scrubbed out more easily in order to improve sanitary conditions and prevent disease (Adams 1985, pp. 279–284; Nelson 2001, pp. 51–52, 101, 115). The English *Sea Venture* that sank in 1609 had shingle as its primary ballast material, and the likely English wreck at Alderney lacked a large pile of ballast, though a reconstruction of the vessel indicates that it would need heavy ballast (Bound 1998b, p. 81; Roberts 1998, pp. 35–36). The low mound where the ballast would logically be found on the Turkish site is conspicuous for its lack of sizable stones; however, areas amidships have what appear to be deposits of pebble-size rocks consistent with shingle.

The vessel apparently sank in the Rhodian Straits after a struggle by the crew to save it. A single large anchor amidships likely means that the crew recognised danger and cast their other service anchors. In 1602, an English ship of 200–300 tons typically carried four anchors (Curryer 1999, pp. 48–49). Given that one fluke is detached, the only anchor found on the TK06-AD site may have been a spare, or even broken and stowed. The positions of the guns, on the port side parallel to the line of the hull and on the starboard side transverse to that line, may also provide clues to an extended sinking process. The crew may have been caught unaware by an enemy vessel to starboard and was deploying guns to fend off attack. While they ran out the guns, their adversary sank their vessel. However, this seems unlikely behaviour for any prudent master operating in the waters of the Eastern Mediterranean, frequented as it was by enemy vessels, corsairs, and pirates. In such dangerous waters, crews would not leave themselves vulnerable by having their guns unprepared for immediate action at all times. Tudor and Elizabethan vessels may well have secured their guns outboard and manoeuvred the vessel to aim them effectively (Konstam 1988, pp. 19–20; Rodger 1996, pp. 311–314). Moreover, the absence of most anchors undercuts a theory of surprise attack and rapid sinking. More likely, the crew noted that a storm was about to break, cast most

anchors, and started to clear guns lashed outboard so that they could secure their ports. They only partially completed their task, on the port side, before the vessel sank.

### Mediterranean Maritime History and the Shipwreck Finds

Before the end of the fifteenth century, Mediterranean round ships had not attained sufficient manoeuvrability under sail to use guns effectively. Late in that century, the Venetians introduced an armed sailing vessel, the *barza*, but the galley retained its perennial status as the principal naval weapon (Lane 1934, pp. 47–50, 60; 1973b, pp. 147, 149; Concina 1990, pp. 46–49, 60–62; Glete 2000, pp. 22, 27). Competition to control trade routes, as well as the defence and maintenance of ports and logistical bases, led to conflicts on land and sea (Dotson 1995, pp. 217–222). The various states bordering the Mediterranean gradually expanded their maritime commitments and contracted with private entrepreneurs. After the Turkish victories at Zonchio in 1470 (Lane 1973a, pp. 358–359; Pepper 1993, pp. 40–42) and Negroponte from 1499 to 1503 (Lane 1973a, pp. 359–361; 1973b, 150–167; Inalcik 1989, pp. 347–352; Pepper 1993, pp. 43–55; DeVries 1998, p. 393; Glete 2000, pp. 93–95), the latter aided by use of shipboard guns, the Ottomans focused their attention on Rhodes, base of operations for the Knights of St. John. Even a group as ideological as the Knights was not devoid of pragmatism. At times they cooperated with Ottoman factions, at others they raided in ways that upset their more powerful Venetian and Ottoman neighbours (Inalcik 1989, pp. 331–332; Brummett 1994, pp. 101–102, 109–111). At all times, the Knights acted to defend their vulnerable position on Rhodes (Brummett 1993; Vatin 1994, pp. 137–143).

The Ottomans generally employed their navy in amphibious assaults against enemy bases and not in fleet actions against enemy ships (Guilmartin 1974, pp. 53–56, 187–188, 217; Pryor 1988, pp. 180–182; Glete 1993, v. 1, p. 115). Early in the sixteenth century, when sultans such as Bayezid II (1481–1512) and Selim I (1512–20) set Turkey on a conscious program of naval development, the Ottomans had several reasons to expand. They looked to acquire commercial opportunities and valuable territories along the Levantine coast, and they wanted to assure the safe flow of tax revenues from any new territories (Hess 1970, pp. 1901–1905, 1912; Guilmartin 1974, pp. 109–110; Brummett 1994, pp. 9–10, 17–18; Rose 1999, pp. 577–578). Under the leadership of Selim I, the Ottomans greatly expanded their naval forces and arsenals. The Ottomans had sufficient natural resources and skilled labour; if anything, they suffered from a lack of skilled seamen (Imber 1980, pp. 220–221, 227–247; Brummett 1994, pp. 89–94; Bostan 2000, p. 736). Under the leadership of Sultan Süleyman the Magnificent (1520–66), the Ottomans finally expelled the Knights from Rhodes in 1523. The Ottomans wished to punish Christian Rhodes for sanctioned attacks on their vessels, and they needed logistical support for their campaigns against Mamluk Egypt and Safavid Persia.

Throughout the sixteenth century, the Ottomans and the Venetians conducted mirroring activities along the same routes: participation in the lucrative trade of the Levant and transport of pilgrims to their respective holy sites. In those limited waters and under differing assumptions about the nature of their relationship, tensions were inevitable (Libby 1978). Small armed vessels, propelled by oars and sails, operated from fortified bases to police those waters and protect merchantmen from attack. Pirates likewise preferred smaller oared galleys. “The closer the raiders’ bases were to their targets, the more effective their raids were likely to be, both in the narrowly tactical sense and in terms of cost effectiveness. Preying *galiots* and *fustas*, working close to home, could continue to

operate from such bases even in the winter, and the fortified port gave the raider convenient refuge from enemy warships” (Guilmartin 1974, p. 97). The small galley at site TK05-AB may have engaged in just such raiding activities or served to protect shipping from predatory raids. It surely reflects tensions in that strategic region. Bases on islands such as Rhodes were used to harass enemy merchantmen and led to numerous, small-scale conflicts in the Rhodian Straits. The constant presence of pirates heightened official tensions in the Eastern Mediterranean, and their impact was enhanced when legitimised as corsairs or part of the region’s naval forces. Whether operating from Rhodes or later from Malta, the Knights at times shielded the activity of bandits operating against the Turks or supposedly friendly powers. After Spanish attacks on the Moorish regencies of North Africa, the Ottomans responded in kind when they licensed private corsairs in the East and coordinated efforts with the Moors in Barbary ports in the West (Tenenti 1960, pp. 235–243, 285–287; Braudel 1972, v. 2, pp. 865–891; Fontenay 1988). The small armed merchantman at site TK05-AH provides archaeological evidence for the ways in which vessels had to mount swivel guns in order to protect themselves from capture. A coasting merchantman operating in the Straits of Rhodes, even on short hauls between ports, only felt safe in that environment with a complement of antipersonnel weapons.

France, England, and Holland gradually moved to compete with Venice in the Levant (Rapp 1975). Increasing population in the West and an inability to meet demand for food meant that merchants operating bulk carriers had an opportunity to trade grain in the Mediterranean (Braudel 1972, v. 1, pp. 570–606; Fontenay 1993; Wallerstein and Tabak 2000, pp. 120–125). The French were the first to gain capitulations from the Ottomans and made serious inroads into Levantine trade, but they were hampered by wars with the Habsburgs, civil wars, and traditionalism in shipbuilding (Hauser 1933, pp. 260, 266–267; Davis 1970, pp. 193–203; Aydüz 2006, p. 8). England’s involvement in Mediterranean commerce, by contrast, grew significantly in the second half of the sixteenth century. Already in the Tudor period, English merchants found in various Mediterranean ports a willing market, particularly for their woven woolen cloth called kersey. English vessels returned home with wine from Crete, Chios, and Anatolia, spices from Ottoman markets, and alum from Foça (Phokaia). This English trade continued until the middle of the century when wars, raiding at sea, and difficulties closer to home ended it for a time (Ramsey 1953, pp. 178–179; Willan 1955, pp. 399–401; Braudel 1972, v. 1, pp. 612–621; Andrews 1984, pp. 6–8, 87–88; Nelson 2001, p. 50).

Beginning in the late 1560s and 1570s, the English renewed their efforts to trade in the Mediterranean. Export records show that, by 1565, England exported cloth more than any other commodity, while import records show a variety of products entering the kingdom. Among these imports, items like dried fruits and spices came from the eastern Mediterranean or even further east; however, the English initially obtained most of those goods indirectly through Italian middlemen (Tenenti 1967, pp. 59–61; Willan 1955, pp. 407–410). Similarly, until 1571, the English had slightly increased the total tonnage of their rather modest merchant fleet. Thereafter, however, the size and number of their larger merchant vessels (over 100 tons) increased significantly and the direction of trade shifted away from Antwerp (Andrews 1984, pp. 22–30, 362–363). English merchants received important support from their government. The crown encouraged the use of England’s natural resources and cultivation of new plants in order to lessen dependence on foreign suppliers. England particularly advanced in metallurgy and manufactured marketable guns. The crown likewise subsidised shipbuilding and supported new monopoly companies engaged in overseas ventures to obtain supplies that England lacked. In the 10 years after 1571, the merchant fleet of vessels over 100 tons doubled in size as shipwrights met

imperatives to build vessels of capacity and seaworthiness. Though the bulk of English trade continued to flow to the areas of Western Europe between Germany and Spain, England demonstrated greater flexibility in exploiting ocean routes (Stone 1949, pp. 43–44, 50–54; Braudel 1972, v. 1, pp. 621–624; Brenner 1972, pp. 366–374).

Trade, the *corso*, and piracy dominated the last quarter of the sixteenth century in the Mediterranean, and England assumed a leading role in trade and piracy (Tenenti 1967, pp. 67–71). In the decade beginning in 1570, private enterprise, not strategic motives, led the English to increase their trade in the Levant. English dealings with Ottoman merchants rapidly increased, and, around 1575, the two governments exchanged agreements allowing their vessels safe conduct. The merchantman at site TK06-AD may testify to that strengthening commercial nexus. Several factors favoured English-Ottoman trade. In 1578 the Ottomans renewed their war with Persia, which created demand for lead, tin, silver, and munitions. Heightened tensions between the English and Spanish, who had battled the Ottomans for most of the century, gave the English added cause to pursue trade with the Ottomans for its economic advantages and strategic bonuses. Negotiations between Queen Elizabeth I and Sultan Murad III from 1579 to 1580 yielded the legal capitulations, and English vessels loaded with manufactured goods and strategic materials sailed for Ottoman ports. The agreement with the Ottomans gave English merchants a reduction in duties from the 5–10% that all other states paid to a favourable 3%. Elizabeth next granted a royal charter of seven years to the Levant Company, formed by a group of English merchants on September 11, 1581. When the Company received a second charter in 1592, it absorbed the merchants of the Venice Company. After Murad III died in 1595, the English negotiated a renewal of capitulations with Mehmet III. From the 1580s until the 1620s, the Levant Company proved the most profitable of England's overseas ventures. Its ships carried approximately 6% of England's export of cloth and, by 1602, accounted for the same percentage of imports (Foster 1933, pp. 68–78; Stone 1949, pp. 50–51; Willan 1955, pp. 405–407; Parry 1960, p. 1063; Braudel 1972, v. 1, pp. 625–629; Andrews 1984, pp. 87–100; Bulut 2001, p. 58; Ayduz 2006, pp. 8–9). English ships dominated trade in the Levant until the Dutch became serious competitors after they too had obtained trade capitulations from the Ottomans in 1612. Dutch merchants initially followed the English lead and focused their efforts on controlling the cotton trade with Cyprus. Nonetheless, in the early seventeenth century, the Dutch and the French still played a lesser role than the English throughout the Mediterranean (Andrews 1984, pp. 97–99; Israel 1986, pp. 161–165; 1989, pp. 6–7, 53–60; Bulut 2001, pp. 112–120, 161–162; 2002, pp. 200–206).

In the 1580s, the Levant Company annually operated approximately 20 vessels over 100 tons, it still employed 15 vessels and around 1,000 men by 1595, and in 1600 the fleet rose to 30 merchantmen totalling 5,240 tons (Stone 1949, p. 53; Scammel 1972, p. 399). The merchantmen that England favoured were typically galleons of 150–300 tons, though there were some larger ones of 450–500 tons (Andrews 1984, p. 99). By the second half of the sixteenth century, England's vessels had gained a distinctive reputation as fast and manoeuvrable, of low freeboard, and given to fight with heavy guns along the sides as well as at the bow and stern (Scammel 1972, pp. 387–388; Parker 1996, pp. 270–272; Rodger 1996, pp. 301, 305–307, 315–317). By the time of the Spanish Armada, English galleons were less deep in the hold and slightly longer than their Spanish counterparts, having a length-to-breadth coefficient around 3.77:1–4.25:1. English shipwrights sacrificed a modicum of space for speed, and the English used their small galleons to harass Venetian shipping in the Mediterranean (Rahn Phillips 1994, pp. 104–106).

The wreck at site TK06-AD reflects several characteristics of English shipbuilding of the later sixteenth century. The tonnage, length to breadth ratio, braced hull, gravel ballast,

and broadside guns all fit the English pattern, and the absence of bow guns distinguished an Elizabethan merchantman from a warship. Some maritime historians argue that galleons had two decks with guns, while the vessel off the Turkish coast had only one. Other evidence suggests that masters into the seventeenth century objected to the new two- and three-decked galleons because those vessels were clumsy and slow when tacking, an important consideration if attacked. A few records of such attacks survive. In 1586, as England's hostilities with Spain intensified, 5 vessels of the Levant Company skirmished with a Spanish squadron of 11 light galleys ("gallies") and 2 smaller galleys ("frigats"). A Company merchantman fought off raiding vessels of the Knights of Malta in 1628 using its broadside and stern guns, the latter a traditional element of defence for merchantmen but missing on the wreck off Turkey (Foster 1933, pp. 73–74; Rodger 1996, pp. 309, 314–315). There is also no evidence to date of a beakhead on the wreck. It would be premature, therefore, to describe the vessel as a specific type (*bertone* or galleon).

The cargo, or lack thereof, at site TK06-AD, is consistent with an English hypothesis as well. If the vessel is English and carrying typical Ottoman table ware as cargo, it is homeward bound. The Levant Company obtained from Ottoman ports a wide variety of goods, most of which would perish rather quickly after sinking: silk, cotton, clothing, carpets, currants, spices, gall for ink and dyes, and alum for dyeing and fulling cloth. If the cargo included wine, the site has yielded no evidence of its containers, likely to have been barrels. The primary cargoes imported from the Levant were silk from Persia and cotton grown locally, which were laded at various ports in Cyprus, Syria, and Western Anatolia, including Izmir. By the 1590s, England also imported from the ports of the Barbary regencies in North Africa raw sugar for its newly built refineries (Stone 1949, p. 47; Willan 1955, pp. 407–409; Andrews 1984, p. 93). Hence, the lack of evidence for any cargo except table wares at site TK06-AD is consistent with a merchantman laded with goods that did not survive long after sinking.

For protection, English merchantmen sailed in convoys or in pairs. In 1583, John Newberry sent a letter from Aleppo in Syria, in which he claimed that vessels voyaging from England to the Eastern Mediterranean faced so little danger that they could travel in pairs as safely as they once had from London to Antwerp (Newberry 1583). English vessels defended by cast-iron guns even risked solo voyages because they could out-sail and out-gun Venetian and Ottoman galleys. The remains of the vessel off Turkey suggest confidence in a complement of eight cast-iron carriage guns. Sailing in pairs or alone enabled England to have numerous vessels active in the Mediterranean and take an increasing share of port-to-port trade (Andrews 1984, p. 97). Over the long term, Venice eventually lost much of her privileged trade in the Levant to the English, and later the Dutch and French. When trading ventures failed, such vessels could resort to piracy as compensation. Acts of piracy by English vessels in the Mediterranean angered the Ottomans and engendered feverish diplomatic activity to preserve England's favourable trade status (Andrews 1972, pp. 513–519, 523–524; 1984, pp. 92, 97–98; Goffman 1990, pp. 66–67; Glete 2000, pp. 31–32, 108).

As good as English vessels and crews were, they were still subject to all the risks of the day, including hostile vessels, damaged rudders, lost anchors, fouling, leaks, dependable sailing only in favourable winds, and inability to predict changes in the weather. Between 1625 and 1628, England averaged the loss of ca. 130 vessels a year, a number that comprised around a third of all English vessels over 100 tons (Scammel 1972, pp. 402–404; Andrews 1984, pp. 23–24). The vessel now lying at site TK06-AD may be one of England's losses. The trio of Renaissance shipwrecks testifies to the broader realities of seafaring activities in the Mediterranean. Arming all vessels with suitable guns became

a priority for the powers in the region. The wrought-iron guns on the wrecks at sites TK05-AB and TK05-AH and the cast-iron guns and crossbows on the wreck at site TK06-AD reflect a gradual transition to gunpowder weaponry. With hindsight, we know that the largest of the three vessels, a sailed merchantman built with a flat transom and armed with cast-iron carriage guns for a broadside, eventually came to dominate at sea. In the end, as secure as all of the guns might make crews feel, they provided no immunity from the mortal threat posed by the sea and the wind. The crews of the two smaller vessels did not have time to cast their anchors before they sank. Even casting virtually all anchors, as the crew of the large merchantman apparently did, provided no guarantee of survival. All three vessels, which to us seem a small oared *fusta*, a small armed coaster, and a larger armed merchantman of English characteristics, sank to the depths of the Rhodian Straits, where they still lie today, shrouded in sand and shrouding the full details of their respective histories.

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