

Horse and cargo handling on Medieval Mediterranean ships

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The history of ships and boats is filled out through three forms of evidence: archaeological discoveries, textual sources, and a corpus of artistic images. Art from Venice and Ravenna in north-east Italy and the Topkapı Museum in Istanbul, Turkey, offers keys to understanding several questions of Medieval ship-loading practices in the Mediterranean, including cargo loading, and where the war-horse entered his Crusader's ship.

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Introduction

Archaeological discoveries, textual sources, and a corpus of artistic images offer evidence for the history of ships and boats. Iconographic material clarifies certain issues and instigates further questions. It is an invaluable source, particularly for the Medieval Period, for which so few ships and boats have as yet been excavated and recorded adequately, and for the details not available in other sources. For example, rigging and sails are features generally not well preserved in the archaeological record but are detailed in maritime art. Although they have their limitations, artistic portrayals of ships and boats are, in fact, the nearest we have to photographs of ancient watercraft (Martin, 2001: 4). Mosaic and manuscript images from Venice and Ravenna in north-east Italy and the Topkapı Museum in Istanbul illustrate and illuminate several aspects of Medieval ship-loading practices in the Mediterranean, including how mounted knights disembarked from their horse transports.

General loading practices

The back-breaking task of handling cargo is most easily accomplished by mooring the ship at a wharf, setting a gangway from dock to ship, or, for heavier loads, utilizing a harbour crane or pulleys rigged from the ship's mast and spars. Not all harbours were deep enough for large ships to reach dock, nor did all inhabited coastal regions

have specially built wharves or jetties; these became more common from the beginning of the 12th century. A range of loading practices are alluded to in one scene of the 11th-century northern European Bayeux Tapestry: 'one boat being beached, another coming to anchor in the shallows, and others fastened to a mooring post' (McGrail, 1997: 52). Tidal patterns and shallow sandy coasts occurring in northern Europe, and the corresponding designs of relatively flat-bottomed hulls with low dead-rise like the cog, facilitated another approach: a ship was grounded at low tide, the cargo was unloaded and stowed, and the ship was floated off at high tide.^[1]

Grounding was uncommon in Mediterranean waters, as there is virtually no tide, though smaller vessels could be hauled ashore on suitable beaches, or unloaded in shallow water. *Pirî Reis*, a 16th-century Turkish mariner, geographer, and cartographer, described the eastern coasts of the Mediterranean fairly accurately in *Kitab-ı Bahriye*, a work completed in 1521: there are, he says, some sandy beaches, numerous small harbours and safe anchorages, as well as dangerous shoals, rocky coasts, and strong prevailing winds (Historical Research Foundation, 1988). In general, the coasts south of Beirut have few islands and inlets, and thus few natural harbours, while the coasts north of Gibraltar through Turkey have deep bays, steep headlands and many islands, creating numerous natural harbours (Muckelroy, 1980: 162). A great deal of loading and unloading would have occurred while

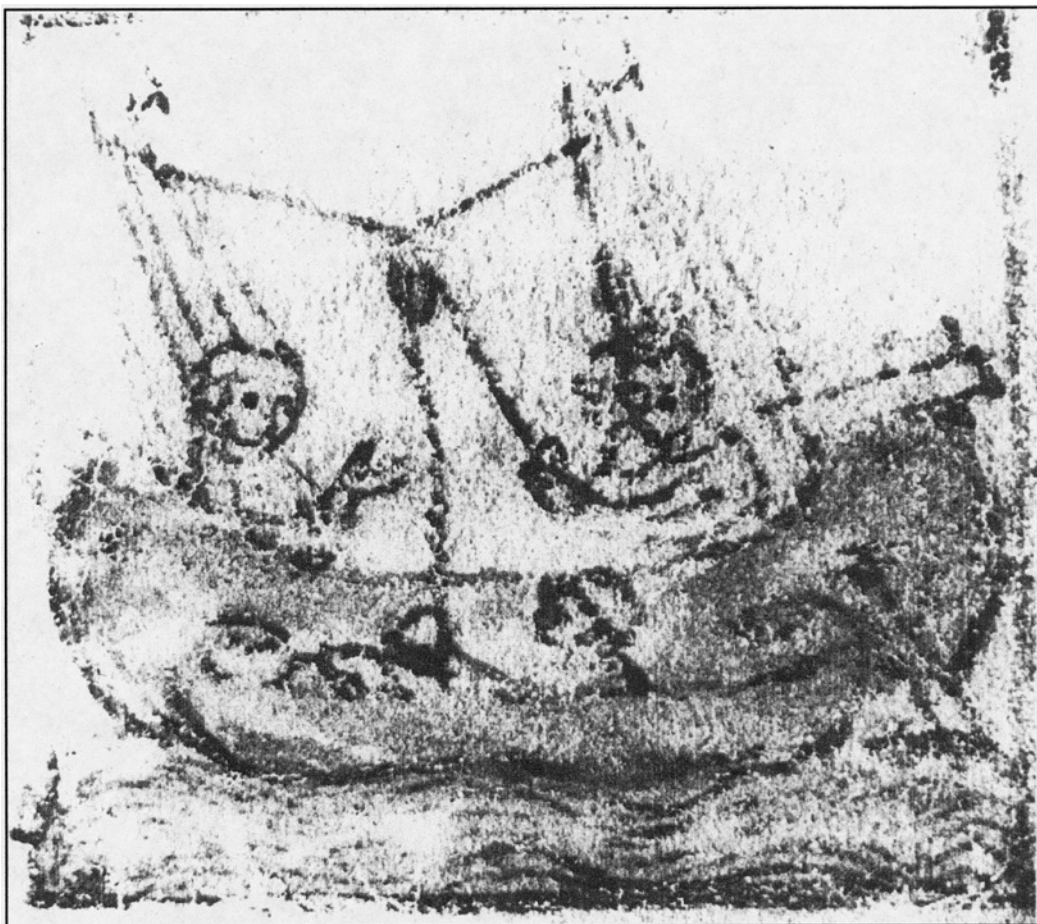


Figure 1. Loading a ship from a lighter, from the early 14th-century Venetian manuscript *Chronologia Magna*. (Courtesy Marciana National Library, Venice.)

anchored offshore or in small harbours, wherever wharves were unavailable.

How were heavy cargo and supplies loaded aboard a ship at anchor? An interesting case is illustrated in *Chronologia Magna*, the 14th-century chronicle of world history by Paulinus Venetus. Mariners on a medium-sized round-ship have utilized both masts and a pulley to rig a temporary lifting device and haul cargo aboard from a lighter (Fig. 1). Cargo would have scraped along the curved hull if loaded in such a manner, but this is clearly the way in which it was done.

Venice, the powerful mercantile city-state built upon a lagoon, utilized yet another approach suited to its environment. Specially designed, flat-bottomed vessels, called *cammelli* (camels), cradled and buoyed up large ships, thus reducing their draft and enabling them to cross the shallow lagoons to the city's quay. *Cammelli* are first mentioned in Venetian documents in 1340.^[2] The type was modified and improved in the 17th

century through influences from Holland and Russia, where similar vessels were used (Bonolis, 1847: 213).

Wales, intrinsic to the skeleton construction common for larger Mediterranean vessels, would give the side of the hull some protection from abrasion when at a dock. Some Medieval ships could open a section of the bulwark to facilitate dockside loading. In a 12th-century Venetian ship mosaic (Fig. 2), a wide section of the bulwark is apparently missing amidships. This is not an isolated example in ship iconography. A 14th-century French manuscript, *Roman de Troie*, contains two (Folios 26^v & 38^r; Martin, 2001: figs 41 & 44). Andrea da Firenze illustrated this feature as well, in a fresco of Pisa, Italy (Nebbia, 1932: fig. 17).

The fortuitous preservation of a section of the port bulwark of the Medieval ship, dating to c. 1300 and excavated at Contarina, offers archaeological evidence for the same feature,



Figure 2. Stevedore's bulwark opening on a three-masted lateener, from the 12th-century mosaic in San Pietro Chapel, San Marco, Venice. (Photo: author. Courtesy Procurator of San Marco, Venice.)

which was incorrectly interpreted by the excavators as proof that the vessel was rowed ([Relazione della Commissione elatta della R. Deputazione Veneta di Storia Patria, 1901: 29–34](#)). In fact, its design relates to dockside loading of the ship. According to the excavation report, the moulded dimensions of the futtocks, labelled A and B in [Figure 3](#), increased at their upper ends so as to accommodate a vertical slot running through them in a fore–aft direction just inboard of the outer face. In this thickened section of the futtocks at and above what is believed to be deck level, both A and B have a 4×2 cm groove, or rabbet, cut into opposing faces ([Fig. 3](#), right). All the futtocks between A and B appear to have been shorter than the level of the rabbets, while those aft of A and forward of B were taller. Movable bulwark panels, formed with thick planks as long as the interval between A and B, could be set within these slots, but removed or slid aside to lower the side for loading and unloading at a wharf.

Where did the warhorse enter and exit his Crusader's ship?

Chroniclers' reports of Crusades after the 12th century describe knights in full armour and

mounted on their steeds disembarking large ships through 'horse ports'. What was the design of such ports, and where were they positioned in the hull? Nautical archaeologists have yet to locate and excavate any of the specially designed horse transports mentioned by the chroniclers, and the design and construction of transports must have varied in place and time, but the following textual and pictorial evidence offer insights concerning the location and design of horse ports on both the sailing *nave* round-ship and the oared transport types used by the Crusaders.

Chronological evidence for horse transports

In the Latin West, texts mention that *salandria* (*chelandie*, *chelandre*, *chelandri*, *calandie*), *ippagoghi* (*ippeggi*, *hippagmi*) *uscarii* (*uscieri*, *usiache*, *usciera*, *uschere*, *oxirii*, *uissiers*, *nave uselleria*, *nave uscheria*, *nave usseria*, *uissiers*, *huissiers*), *arsilii*, *taride*, *dromones*, *busses*, and the generic *nefs* transported horses; later ships became larger and more specialized ([Bonolis, 1847: 198–215](#); [Pryor, 1982a: 17, 21, 24](#)).

As early as 762, Theophanes reports on the Byzantine emperor Constantine V's fleet of *chelandia*, relatively small, oared warships, carrying a dozen horses each. Leo the Deacon reports

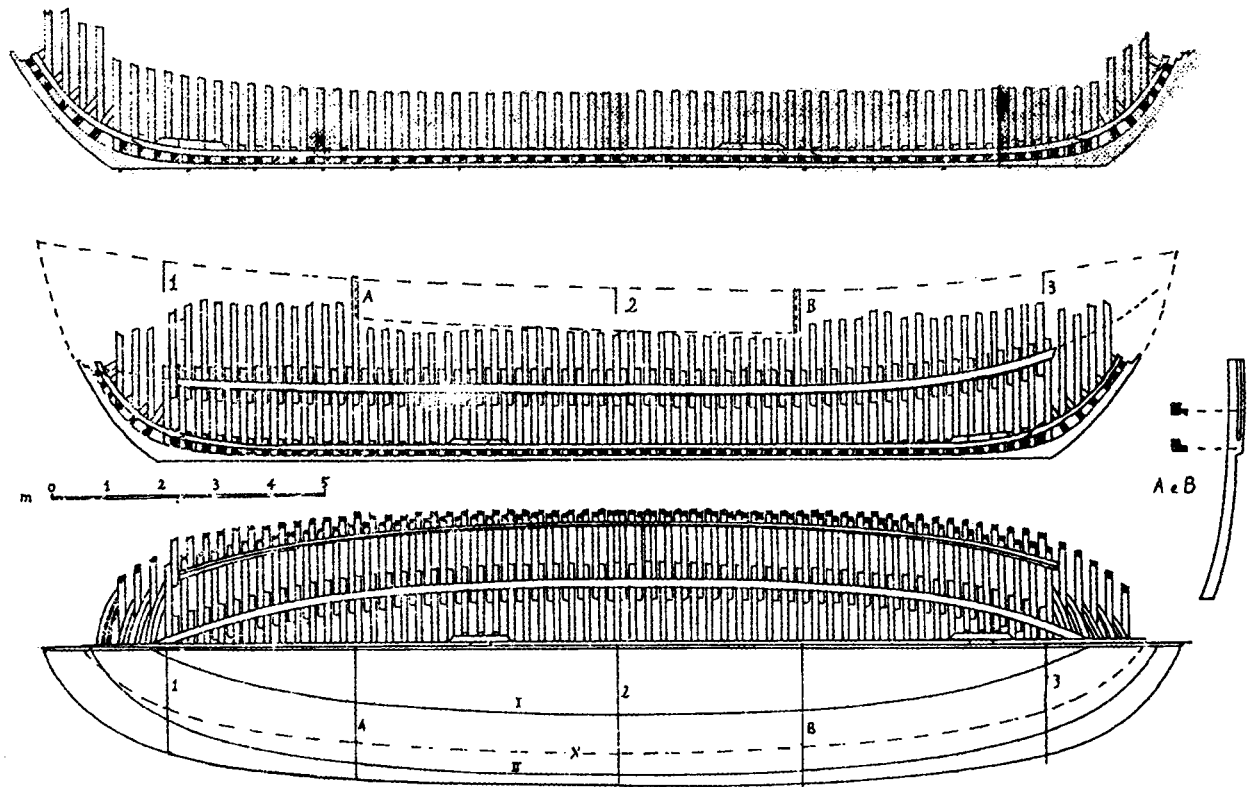


Figure 3. The Contarina I ship (c. 1300) in port profile. Between the extra thick and taller futtocks A and B, a section of the bulwark could be opened to facilitate loading. A detail of the grooves cut into futtocks A and B is illustrated on the right. (After *Relazione della Commissione elatta della R. Deputazione Veneta di Storia Patria*, 1901: table III. Courtesy Museum of Naval History, Venice.)

on another massive Byzantine fleet of Nicephorus Phocas, which surprised the Muslims in 960 by the naval tactic of landing mounted troops:

When the time came for landing, he [Nicephorus Phocas] demonstrated practically the experience he had of military affairs. For carrying ramps on the transport ships, and bringing these close to the shore, he landed the army under arms and on horseback from the sea to the shore. (Pryor, 1982a: 9–10).

In northern Europe, William of Normandy's transports built in preparation for his conquest of England in 1066 are depicted on the Bayeux Tapestry. Here, the horses either jumped the low gunwale into the shallows of a sandy shore (Bass, 1972: 184), or unloaded via a ramp, run from the gunwales to the beach (Pryor, 1982a: 10).

Bonolis, who studied Italian textual evidence, relates that 9th-century and subsequent Venetian texts describe *ippagoghi*, *ipegi*, and *hippagmi*, as well as the *usiache* and *usie* as horse transports. *Ippagoghi* were 86 *piede* (29.928 m) long, 38 *piede* (13.224 m) in beam, 29 *piede* (10.092 m) high, and, according to Bonolis, very likely two-decked

ships. These were built in large numbers as part of the Venetian fleet made between 1201 and 1202, prepared to carry 4500 horses and Crusaders to Palestine. Regarding the *ippagoghi*, Bonolis states:

Cho che particolarmente li distingueva dale altre navi era una porta a fior di aqua, sita all'estremita di poppa, per la quale si facevano entrare ed uscir i cavalli. Compiuto il carico, si chiudeva quest'uscio, e lo si calafatava, poiche in allora la parte inferiore trovavasi pressoche sotta la linea d'immersione (1847: 198–199).

That which distinguished them from other ships was a door at water level, situated at the extremity of the stern, through which the horses entered and exited the vessel. After completing loading, the door was closed and caulked, to prevent the lower part, below the waterline, from leaking.

According to Bonolis, the 9th-century *usiache* and *usie* also had the horse port *a fior d'acqua*, which can be translated to 'at the waterline' or 'at water level'; his description of these ships specifically states that the lower part of the port could be under water, and so must be caulked. Bonolis

also mentions the existence of a similar horse transport, the *palandra*, in 864–881, and *nave uselleria*, *nave uscheria*, and *nave usseria* in the 14th century, but provides no further details (Bonolis, 1847: 199, 200, 215).

In 1169, William of Tyre's specially built Byzantine horse transports were 'fitted with large openings in the stern for greater convenience in loading and unloading the animals and they also had bridges by means of which both men and horses might be more easily embarked and landed' (Pryor, 1982a: 18).

In their accounts of Crusades (1248–1254), both Villehardouin and Joinville indicate that horse ports on their particular transports were at the side of the ships (probably at the quarters). Joinville details the departure of St Louis and his men on *neis*, sailed round-ships:

We went aboard our ship at the port of Marseilles in the month of August (1248). On the day we embarked the door on the port side of the ship was opened, so that all the horses we wanted to take with us oversea could be put into the hold. As soon as they were inside, the door was closed and carefully caulked, as is done with a cask before plunging it into the water, because, once the ship is on the high seas, that door is completely submerged (Joinville, trans. Shaw, 1970: 196).

Villehardouin, describing the *uissiers* (apparently sailed ships) in the first siege of Constantinople (1203), relates:

The trumpets sounded. Each transport was attached by a tow-rope to a galley, so as to reach the other side more easily . . . The knights disembarked from the transports; they leapt into the sea up to their waists, fully armed, with helmets laced and lances in hand. In like manner our good archers, sergeants, and cross-bowmen, each in his company, landed as soon as their ship touched ground . . . The sailors now began to open the doors at the side of the transports and lead out the horses. The knights mounted quickly, while the divisions began to draw up in due order (Villehardouin, trans. Shaw, 1970: 66).

However, Robert of Clari's version of this assault on Byzantium in 1203 indicates that mounted knights landed from their *huissiers*:

As soon as they had made land, the knights issued forth from the transports on their horses, for the transports were made in such a way that there was a door that could be opened and a bridge thrust out by which the knights could come out on land all mounted (Pryor, 1982a: 22).

We have no way of knowing which account is correct, or whether both are right. As Pryor has pointed out, different situations require differing tactics, and it is possible that Robert of Clari's division met with circumstances that prompted them to unload the knights mounted (Pryor, 1982a: 22).

The *Annals of Cologne* also report that knights at times mounted their horses aboard:

For each usserius, there was a landing ramp so that if there should be need, the knights, armed and having mounted their horses on board ship, could easily and without danger of injury disembark via those ramps as if already drawn up in ranks to give battle (Pryor, 1995: 115).

An anonymous Muslim manuscript of 1365 describes large, three-decked Crusader ships called *qarqura* (plural, *qarqir*) that also had side ports, the ideal position for loading at a dock, broadside (Pryor, 1990: 108).

In 1614, Pantero Pantera called horse ships *palandarias*, describing them as having a draught of about four *piede*, a capacity of 20 horses, and a door in the poop that could easily be opened to let on the animals.^[3]

Discussion

Horse ports have been the focus of some interesting discussions in the past. Scholars seem to concur that the sills of the horse ports must have been just above the waterline when the ship was fully laden in port (Pryor, 1990: 255). Other issues, including their location in the hull, have been subject to debate; yet, certainly, transport design varied to meet the logistical demands of the particular expedition planned (Pryor, 1982a: 24). Some were rowed, while others relied on sail and, as a result, the manner in which the ships were unloaded would depend on their construction and the conditions.

Submerged port sill?

Joinville's description of the horse port being 'submerged' has caused present-day scholarly debate. In response to Fourquin's note on Pryor's earlier article in *Mariner's Mirror*, the latter countered, 'Joinville was not a seaman, he was a belted knight who 'saw things from the heights of the aftercastle' (Richon). When he said that the ports were submerged at sea, what he meant was that they were hit by following seas and perhaps

submerged somewhat when the ship heeled' (Pryor, 1982b: 390). Apparently, some scholars have concluded that Jal did not recognize Joinville's description as unreliable and thus that his work, *Archéologie Navale*, has perpetuated the 'error' of the port being beneath the waterline. This argument seems reasonable, yet Bonolis, in analysing the Venetian textual evidence, described the lower part of horse ports of both the *ippagoghi* and *usiache* types as below the waterline. Unfortunately, he failed to specify whence he derived this information.

Should all descriptions of submerged ports be dismissed simply as 'unreliable'? Did Bonolis, too, merely draw his opinion from Jal's work without any supplemental Venetian information, or were Joinville, Bonolis, and Jal in fact correct about some horse ports being submerged? Further textual research or the fortuitous discovery of an actual transport in an archaeological context may resolve the question.

Location and number of horse ports

As mentioned above, a Muslim manuscript of 1365 described the Crusader ships *quarqir* with 'side' ports; likewise, both Villehardouin and Joinville's 13th-century descriptions. A few iconographic examples exist, showing what might be interpreted as ports in the side of the hull.^[4] However, many of the texts that specify the position of the horse port in the hull identify it as at the stern, which could mean either the extremity of the ship or, more generally, the aft area including the port and starboard quarters; this area could also be described as the 'side'. In other words, much evidence points to a stern or quarters location for the horse port of most transport types.

Fourquin (1982: 389) stated that the ports were almost always on the axis of the ship. Pryor has shown that there were even varied arrangements for stern ports. Single ports were described in a 13th-century text and illustrated in a 16th-century manuscript illumination in the Topkapı Museum (Fig. 4). In other cases, two stern ports had three posts, including the main sternpost, between them (Pryor, 1990: 255–256). Another variation may have the port at deck level instead of near the waterline.

Possibly, one compelling reason to position such a large port astern was the danger when landing in hostile territory. While horsemen were being landed, a stern location offered covering fire from the sterncastle. On a vessel that was rowed or had sweeps to manoeuvre astern, it was feasible to seek out an undefended or weak spot to land, setting anchors to keep the bow offshore, and then putting stern to shore so that the knights could disembark on a beach. Lacking the manoeuvrability of an oared galley, a pure sailing vessel must have loaded and unloaded horses by lighter, or at a wharf, a difficult action to carry out in an enemy's harbour. However, horses were transported by sea for other than military campaigns (Pryor, 1982a: 23). The deeper drafted, beamier, sailing ship could carry more horses and, with a side or quarters location of the horse port, could readily unload at a wharf.

Ravenna ship mosaics depicting 13th-century horse transports

Four Medieval ship mosaics originally decorating the floor of the church of San Giovanni Evangelista in Ravenna illustrate episodes from the Fourth Crusade, including the taking of Zara and Constantinople between 1202 and 1204 (Martin, 2001: figs 18–21). These contemporary mosaics laid c. 1224 depict a two-masted lateen-rigged Crusader transport. Two images show the ships' masts utilized to form siege platforms for scaling the city walls. Three of these ship mosaics are fragmentary, while the ship in Figure 5 is complete. All four show the masts, lateen sails, hull bottom, and several rows of strakes, delineated in a simple yet fairly realistic manner considering the limitations of the mosaic medium. Wherever preserved, the crow's nest is shown aft of the masts, a practical position not interfering with the tacking of a lateener. The mizzen (*di mezzo*)^[5] mast is set vertically amidships, while the taller foremast (*di proda*) rakes forward. The mosaics do not show any oars, and the full shape of the ships reveals that, although from the subject of the mosaic clearly associated with war, these bulky transports relied on sail power and could also have been used for commercial purposes.

A trumpeter in the mizzen crow's-nest in Figure 5 calls other ships to signal the beginning of their

Figure 4. Stern horse port, showing detail from a manuscript illumination, Landing of Turkish forces at Famagusta, 1571. (Courtesy Topkapı Palace Museum, Istanbul.)



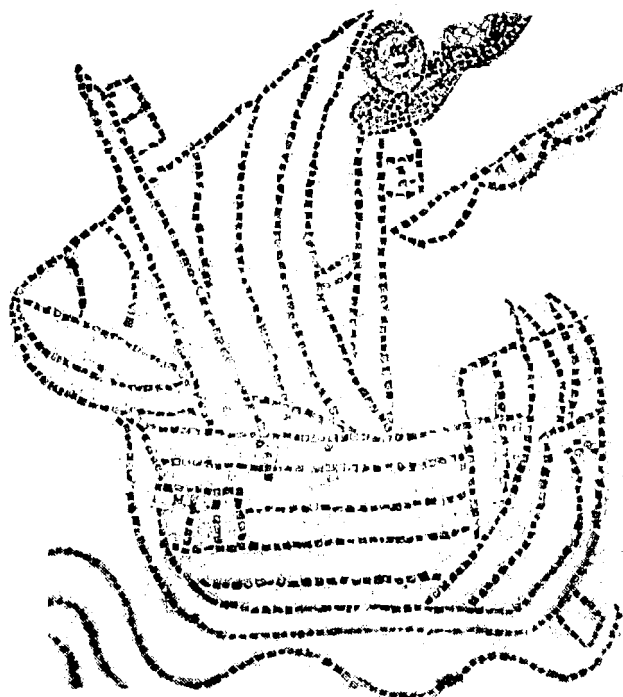


Figure 5. Crusader transport ship, originally part of floor mosaic (1224), now displayed on wall, San Giovanni Evangelista, Ravenna. (Photo: author.)

voyage to the Holy Land. According to a maritime code written in 1255, half a century after these mosaics were created, two trumpeters were required to accompany all Venetian ships larger than 400 *milliaris* (188 dead-weight tons) going beyond the Adriatic (Predelli & Sacerdoti, 1903: 93; Lane, 1973: 248). In his accomplished reconstruction of the transport type represented in these mosaics, Bonino calculates that the length of these ships was approximately 33.2 m, their beam 9.6 m, and their rate of travel, 5 knots. The proportions are inferred from

... the distance between the two decks, the height of the ports, the position of the foremast (*arbor de prora*) with respect to the structure of the prow, probably protruding cross beams, ... the shape of the raised quarter-deck (*paradises*) and of its ends, which rise above the railing-like wings (*ali*), in order to build a stand on which the yards could rest, and the yards (Bonino, 1978: 9).

In Figure 5, the mosaicist defined what appears to be a relatively flat-bottomed hull by two lines to indicate the keel and both stem and stern posts. The bow area is simply rendered with horizontal lines indicating strakes running into the stem. A

rectangular feature is defined at the bow adjoining the stem: three vertical lines just aft of the stem run between the line delineating the bottom of the third strake and a short horizontal line in the fourth strake. The stern is more complex and challenging to interpret but seems to illustrate a stern horse port. Flanking an inward-curving sternpost, two large timbers rise above the stern-castle planking and curve slightly inboard. These posts are clearly structural; their lower ends appear to be butted against the after end of the keel from where they sweep, tine-like, upwards and inboard. Two lines drawn in perspective roughly perpendicular to these timbers define the width of the transom stern. The lower horizontal element, just above the top of the sternpost, may represent the *trigante* (tragent) specified for some two-decked round-ships in Crusader contracts, such as that between St Louis and Genoa in 1246 (Pryor, 1984: 278).

Bonino (1978: 12, 9) has interpreted the three vertical and two horizontal lines forming the rectangular feature at the bow as a horse port and the uprights at the stern as supports for the yard when lowered. Yet, the bow seems an unlikely position for cutting a door in the hull. Pryor has suggested that the lines at the bow portray an open deck area beneath the bulwark (Pryor, 1984: 277). The lines at the bow perhaps indicate a small port at a lower deck level but above the waterline for easy forward stowage of spars, long planks or other bulky matter.

Although the bow and other positions for a horse port cannot be ruled out, archival and iconographic evidence from various periods corroborate a stern location (sometimes at the quarters) as the most common. This is supported by logistical as well as structural considerations. A reasonable interpretation for the large upright timbers at the stern in Figure 5 is that they functioned as the outer jambs of a horse port.

Interpretation of other iconographic evidence for horse ports

Numerous Medieval and Renaissance representations show two inward-curving, tine-like features at the upper part of the stern, similar to those in Figure 5, which may be illustrating continuations of structural posts framing horse ports.^[6] Bonino (1978: 9) has suggested that these may form a prop for the yards when not under sail, and this is

illustrated in the 12th-century Venetian mosaics of round-ships in San Clemente Chapel, St Mark's Cathedral (Martin, 2001: figs 10 & 12). Pryor (1984.3: 276) agreed, but sees a secondary function to provide a platform from which the steering oars were slung over the side. Ennio Concina, an expert on Venetian architectural history, has suggested that they may also have been used to facilitate closing the port (pers. comm.).

Figure 4, a detail from a 16th-century manuscript illumination depicting the siege of Famagusta, Cyprus, in 1571, illustrates stern horse ports. A horse is emerging from the stern port of the ship on the left. In this case, the horse is not in full armour, and his knight is not yet mounted. Note 'the shape of the raised quarter-deck (*paradises*) and of its ends, which rise above the railing-like wings' (*ali*) (Bonino, 1978: 9). 'Wing-like' is certainly an appropriate way to describe the ends of the quarter-decks in this manuscript illumination.

Documented archival evidence for 13th-century taride horse ports

The Sicilian Archives, destroyed in World War II, had contained the Angevin documents, Count Charles I of Anjou's letters dating from 1270 to 1300, in which he specified details for the construction of some *taride* at Brindisi. In a letter dated 1 May 1278, the count wrote:

In each *taride* ...there should be one port at the stern of the *tarida* for embarkation and landing of men and horses; which port should be eight and a half *palmi* high and five and a half *palmi* wide. That port should be able to be closed with two very strong doors and those doors should have false beams so that where the *tarida* is weak because of the large openings of the ports, it should be strong because of the beams. And that port at the stern of the *tarida* should [have] a good strong swinging door. Item, at the stern in the space where it is usual to stow things, the deck beams should be doubled and six quite strong ones should be built in made of good oak or ash or elm; which beams are *syonte* as the Provençals say. Item, it should be rounded at the stern so as to allow a horse to be able to embark and land saddled and armed.^[7]

From this document, and others similarly worded, it is clear that *taride* horse transports from the times of Count Charles I included horse ports as part of a specially constructed stern, specifically designed to embark and land horsemen. He even had *taride* built with two horse ports (Pryor, 1990:

255); perhaps these had a greater horse capacity. According to the specifications in this letter, the port of this transport was approximately 1.44 m wide and 2.23 m high; Pryor has estimated that this was just high enough for a mounted knight to fit through, assuming that he had the mobility in his armour to lean forward over his horse's neck (1982: 106). Furthermore, Count Charles specified that the port door was to be fortified by two 'false beams'. Postulating that the doors on the *nave* round-ship in Figure 5 would be larger than those on Count Charles' oared *taride*, it seems that the upright elements at the stern are similarly functioning framing timbers.

The stern ports described by Count Charles closed with an inner and outer door, both of which swung open vertically. In the Angevin documents, in the case of the hull ports, the word *boccaporta*^[8] meant flanges, 'internal coamings around the hull ports, against which the port doors were locked to provide a watertight fit' (Pryor, 1990: 260). The inner door was hinged at the top and locked by a bar on the inside. The outer door was probably also hinged, but at the bottom.

Conclusion

It should be remembered that at least two transport ship types existed: large, sailed *nave* round-ship transports and oared transports. It seems reasonable to conclude that the horses could disembark, armed and mounted from some transport ships but not all, and that some horse ports were positioned lower in the hull. Large *nave* with horse ports were nailed shut, sealed, and caulked. It may be hard to believe that the ports were actually below the waterline, as is explicitly stated by Joinville, Bonolis, and Jal, but surely, the ports were caulked for good reason. However, caulking may not have been necessary on oared transports designed with the horse port well above the waterline, discharging from a weather deck. Robert of Clari testifies that saddled, armed horses embarked and landed through horse ports, and Count Charles' description, too, makes it clear that on his ships, the horse port swung open at the stern and was large enough for both horse and rider, mounted and fully armed, to disembark. Count Charles recognized that such a large opening created a structural weakness that needed to be fortified by larger deck beams and the addition of strong timbers.

Representational material is valuable to the study of ship and boat history, as these examples have shown. A 12th-century ship mosaic illustrates an enigmatic bulwark feature discovered on an excavated ship lost *c.* 1300, Contarina I (Fig. 2 and detail, Fig. 3). Without considering the representational evidence, it is difficult to understand the archaeological discovery. Likewise, documentary evidence alone is insufficient. The archival evidence concerning the structure and location of the horse port may be clarified by studying images such as Figures 4 and 5. The nautical archaeologist must integrate all forms of evidence, archaeological discoveries, textual descriptions, and artistic images, to further the history of ships and boats.

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Notes

- [1] Tipping (1994: 3–11) provides an excellent discussion on various stowage problems for different cargoes and on converting the cog's rig for lifting and stowing.
- [2] By Galvanco Fiamma, as recorded by Doge Marco Foscarini in his catalogue (Bonolis, 1847: 213).
- [3] Imber (1980), in reference to Pantera's book, *L'Armata Navale*.
- [4] For example, a Hispano-Hebrew manuscript illumination of Jonah and the whale (Bodleian Library manuscript, 1476, MS Kennicott 1, fol. 305).
- [5] On two-masted lateen-rigged ships, Venetians called the principal mast *di proda* and the mast placed aft *di mezzo*, because it was in the middle of the ship; from this, the forward sail came to be called the foresail, while the second, the mizen, though it could correctly be called the aftermast. But with the existence of three-masted ships, the terminology becomes confusing, as the aftermost mast is still called the mizzen, so what should the central mast be called? For lack of a better term, it is referred to as the central mast (Bellabarba, 1988: 237).
- [6] Martin, 2001, figs 10, 12; Nebbia, 1932: fig. 26; Pryor, 1982a: fig. 1K; 1992: fig. 22; see also Pryor's reconstructions, the *taride*, 1982a: fig. 2, and the three-decked round-ship, 1984: fig. 7.
- [7] Sicily Reg. August 1 [1268, A] fols. 112r and 153r-v as translated by Pryor, 1982, no. 2: 115. In 13th-century Naples, the *palmi* measured 0.262 m.
- [8] Other documents use the term '*battiporta*'.

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