

European Ships of Discovery

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Abstract

The ships and boats of the 15th and early 16th century European voyages were the space shuttles of their time, and yet we don't know much about them because most have been destroyed by looters and treasure hunters. This paper will focus on a particular type, the caravel, and presents an overview of the early European watercraft that crossed the Atlantic and sailed along the American coasts during the first decades of the 16th century.

Key words: *caravel, 16th Century, Europe, ships, looting*

Introduction

The earliest Iberian voyages into the Atlantic were carried out in the existing ships. Soon however the need to adapt the existing watercraft to the sailing conditions of the open sea triggered a process of evolution that is poorly understood, but that reflects the existing cultural, scientific and economic conditions in the Iberian kingdoms. This is an interesting process of technological evolution that is in its earliest states of investigation.

The main ships of the European expansion were sailing ships, mainly caravels, *naus*, and galleons. Rowing ships were also used in the European factories abroad, sometimes shipped in the holds of sailing ships, and sometimes built in Africa and Asia, in the beginning according to European standards, but very soon incorporating local features as they

were understood as advantageous. This paper deals with caravels, a versatile and small ship type that is still poorly understood.

Caravels

Caravels are among the least understood of all historical vessels. Mentioned in hundreds, perhaps thousands of books, these ships are associated with the Iberian exploration of the Atlantic in the 15th century, and are considered the space shuttles of their time, allowing the Portuguese and Spanish explorers to sail down the African coast, and open the maritime routes to the Caribbean, the west coast of Africa, and the Indian and Pacific Oceans. A few authors have dedicated lengthy works to this ship type, such as Quirino da Fonseca (1934 and 1935), Pimentel Barata (1972), Tengarrinha Pires (1980, 1985, 1986, 1988 and 1990), Malcolm Elbl (1985), Francisco Contente Domingues (1989), or George Schwarz (2008).

Their agility is legendary, and more than 150 years after the first mid-15th century references to the new exploration caravels, they are mentioned in an account of a 1597 expedition to the Azores under the Earl of Essex as fast and highly maneuverable: *Whilest we thus stayed about the Rocke, ye carvalls of Lyshbourne and of the parts thereabouts would daylie come swarminge about us like butterflies soe neare us as that we might cast a stone into some of them, and yet could we never catch any one of them, soe warie and nimble they are* (Gorges, 1604, transcribed by Richard Barker, 2007).

These vessels probably originated in the Mediterranean. The Portuguese and the Spanish probably changed and adapted this type of vessels to the navigation along the coast of Africa. Venetian merchant and chronicler

Alvise da Ca' da Mosto wrote in the late 15th century: '*...essendo le caravelle di Portogallo i migliori navilii che vadino sopra il mare di vele, ed essendo quelli bene in punto d'ogni cosa che gli fa di bisogno...*' (Ramusio, 1600). Ca' da Mosto mentions eyes painted on the bow of these caravels, something characteristic in the Mediterranean since long. He says, about the inhabitants of the African coast: '*...e pensavano che gli occhi che si fanno a prova alli navilii fussero veramente occhi, che 'l navilio per quelli vedesse dove gli andava per mare*' (Ramusio, 1600).

This technology spread to northern Europe and the expression 'carvel-built' still refers to watercraft built with flush laid planks, nailed to pre-erected frames, a structural improvement that originated in the Mediterranean and spread along the Atlantic coast of Europe and into the Baltic, during the late 15th and early 16th centuries.

Although much has been said and written about caravels, these vessels have never been thoroughly described in historical sources, their representations are few and impressionistic, and no ship identified as a caravel has been archaeologically excavated. Replicas have been built with mixed results, never based on solid supporting information. This paper is a tentative summary of what is known about these ships, both from documental sources, written and iconographic, and from the archaeological record.

Pictures of caravels labelled as such are rare but clear enough to allow historians, already in the 19th century, to have a fair picture of what they may have looked like. Portuguese historians Quirino da Fonseca (1934) and Tengarrinha Pires (1980) inventoried the most important representations of caravels in existence. Pimentel Barata (1989) published an interesting drawing of a caravel, depicted as the signature of a caravel master from the 15th century named João de Lião, dated to

1488 according to the author. This drawing was first published by Avelino Teixeira da Mota (1971, Fig. 4) who noticed that this is the earliest drawing of a caravel, designated as such, and one of the earliest dated representations of a stern panel, which is clearly defined (Fig. 1).

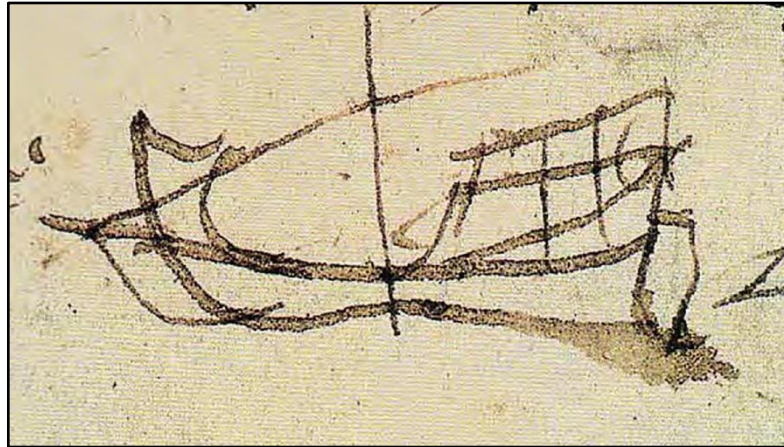


Fig. 1: Signature of a certain João de Lião, master of caravels, dated to 1488, on a document pertaining to the supply of hardtack to a caravel departing to Africa. (Arquivo Nacional da Torre do Tombo, CC II-I-781, in Mota 1971)

Documental Evidence

Before 1500 we can only guess what the word ‘caravel’ means. All we have to work with are a few textual references: medieval boats named *carávos*, two 12th century Italian references to a type of boat called *Caravellum*, one 13th century reference to *caravelas* in the chart of the Portuguese village of Gaia, one 14th century reference in Spain, and the 15th century caravels of the Discoveries.

Auguste Jal and Corominas explored the origins of the words *cáravo* and *qârib*, both referring to small boats, sometimes coracles. As to the word *caravellum*, there is no way to tell what kind of boat the 1159 Genoese *caravellum coopertum* was. These boat type appears in two Genoese 12th century documents, the first mentioned is decked (*coopertum*)

serving a *navis* (1159), and the second (1190) is small, belonging to a *caravelator*, presumably working as a harbor tender (Ciciliot, 2005). Furio Ciciliot points out the fact that in the 12th century the word *caravelum*, referring to a small boat, is masculine, and does not become feminine until it is assimilated to a larger vessel: *navis sive caravellae* (Ciciliot, 2005).

Historian Malcolm Elbl mentions a 1226 reference to a Portuguese caravel taken by English ships on a return trip from Gasconne (Elbl, 1985). He cites the French translation Francisque Michel's *Histoire du commerce et de la navigacion à de Bordeaux* (Michel, 186). Michel mentions only 'un navire portugais, appelé le Cardinal' and indicates the *Rotuli Litterarum Patentium* (Rot. Litt. Pat., 10 Hen. III, m. 5) and the *Rotuli Litterarum Clausarum* (Rot. Litt. Claus., 10 Hen. III, m. 27 et 14; t. II p. 89, col. 2; et p. 119, col. 1) as her sources. The *Rot. Litt. Pat.*, mention a '*navem que vocatur la cardinale*' (1971, p. 36), and the *Rot. Litt. Claus. Membrane 14*, mentions an unrelated incident pertaining to wine trade with Bayonne (1916, 5). I could not access *Membrane 27* of Henry's 10th year, and I am not sure that all of Henry's rolls are published.

The caravels referred to in the Chart of Gaia (1255) seem to be fishing vessels, of which we know nothing. Square rigged vessels were rare in the Mediterranean between the early 6th century and the mid-13th century, and most references to caravels mention lateen sails (Bellabarba, 1999).

Some authors have proposed that caravels were mentioned in Alfonso X's *Libro de las Leyes* or *Siete Partidas*, as it is better known, written between 1254 and 1265. Most authors, however, agree that the passage in question – Partida Segunda, Titulo XXIV, Ley VII – mentions *haloques*, and not *caravelas*.

It seems that caravels are not mentioned in Portuguese documents during the 14th century. There is a reference to caravels in 1307. Malcom Elbl (1985) places it in Biscay, Spain, and cites Quirino da Fonseca. Quirino cites Auguste Jal, and places the caravels in northern Europe (1978), and Jal (1848) is silent about the place and cites Pierre Carpentier (1766), who does not place these caravels anywhere, and gives a source for it I could not find: *Charta an. circ. 1307*.

From the mid-15th century onwards chroniclers mention caravels engaged in the exploration of the Atlantic, and later carrying Columbus into the New World. There are some documents describing caravels, the best known pertaining to the caravels *Niña* and *India*, used by Columbus in his fourth trip (Smith, 1993), or the *caravelões* de Arguim published by Alexandre Monteiro (Monteiro et al., 2011). Carlos Etayo transcribed a 1450 contract for the construction of a caravel for a Catalan *mariner* named Gracia Amat with one central and two side rudders, and a length to beam ratio around 4/1 (Etayo, 1971). Jacques Paviot and Erich Rieth published a paper relating the construction by Portuguese shipwrights of two caravels in Brussels, in 1438 and 1439, for the Duke of Burgundy, Philippe *le Bon* (Paviot and Rieth, 1989).

Bibliographic research in Italy, where caravels probably originated, is scarce. Lucien Bash refers to 24 caravels sent by the Republic of Venice in 1490, with 24 men each, and 30 caravels in 1499 with capacities between 100 and 400 *botte* (Bash, 2000). A *botta* was close to half a Portuguese tonel, if we are to trust a 1519 document mentioned by Lane (1964): '*Per lettere di Sibilia delli 9 ditto erano avvisi, come a di 6 era venuta una caravella di portata de 60 tonelle, videlicet 120 botte, a qual era stata a scoprire le Indie (Mexico)...*' (Fulin, 1881).

Although Portuguese and Spanish historians combed the most important European archives more than one century ago (Domingues, 2004), almost nothing is known about caravels. Around 1600 we have the first lists of timbers for the construction of a caravel in the Lisbon National Library manuscript known as *Livro náutico* (Anonymous, c.1590), dated to the 1590s, and two cryptic *regimentos* by Manoel Fernandez, dated to 1616 and illustrated, but difficult to understand because the drawings are not always represented in the same vertical and horizontal scales (Fernandez, 1616).

Iconography is scarce and doesn't shed light on the most important questions. For instance, they do not tell us whether the early Portuguese 15th century caravels had a stern panel and a central rudder. Around 1500, when we have the first images and descriptions, caravels seem to be small ships of 15 to 50 tons, built with flush-laid planking, rigged with one, two, or three masts, all mounting lateen sails. Sometimes they appear with a foremast rigged with a square sail (Fig. 2). Generally, the mainmast is placed on the center of the keel, and the second and third masts are stepped abaft it, with a small stern castle and no forecastle, a stern panel and a central rudder.

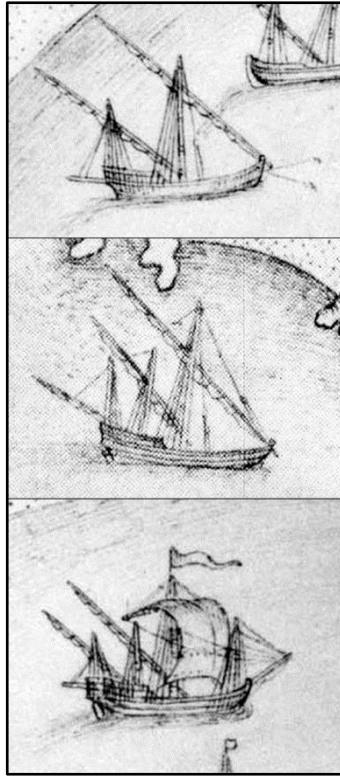


Fig. 2: Presumed representations of caravels in the Livro da fortalezas of Duarte d'Armas, circa 1509. (Armas 1509/1997)

Central rudders first appear in Denmark, in the 12th century (Hocker and Dokkedal, 2001). The earliest explicit reference to a central rudder is probably Gracia Amat's contract, in the middle of the 15th century. Stern panels appear in the iconographical record after 1475, and at least in the in 15th century iconographical record, central rudders seem to be characteristic of square-rigged ships.

As it often happens, the word *caravel* designated a wide range of watercraft, even in the 16th century: *caravelas latinas*, *caravelas de Alfama*, *caravelas redondas*, *caravelas de armada*, and *caravelões*. In some cases, we have a fair idea about the main differences between them, and in other cases circumstantial evidence allows some provisory hypothesis. Below are presented short description of what each type may have looked like.

Caravelas latinas

As already mentioned, during the 14th century they are not mentioned in Portuguese documents. In the mid-15th century caravels appear as *lateeners* with a capacity around 50 *tonéis* and crews between 20 and 25 men. It looks like small caravels with 2 or 3 masts with lateen sails endured for over one century without much change. But we don't know what characteristics defined a caravel, or what separated a caravel from the other lateeners of their time.

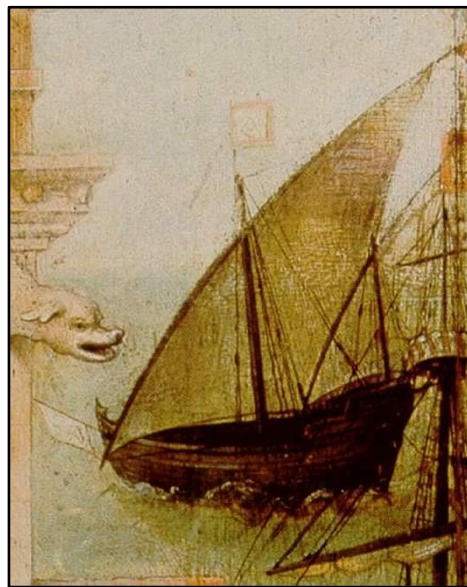


Fig. 3: Representation of a caravel in the Retábulo de Santa Aute, dated to c. 1517. (Photo: author)

Quirino da Fonseca mentions Braancamp Freire describing 54 *caravelas* leaving Lisbon in 1488 and 1489, with capacities varying between 15 and 50 *tonéis* (Fonseca, 1935).

This range of capacities is compatible with other accounts, some written much later. In 1571, in *A vida e feitos de el-rei D. Manuel*, D. Jerónimo Osório, describes caravels as rather small vessels. These caravels don't have tops (*cestos de gávea*), nor their yards make right angles with their masts, but hang, inclined, secured under the masthead, and the base of the sail is triangular and almost touches the bulwarks. The yards, which

are fastened to the ship's bulwarks, are as thick as topmasts in their lower part and have smaller sections upwards (Fonseca 1935).

Sometimes these small two- and three-masted lateeners are referred as typically Portuguese, but José Luis Casado Soto found references to 125 caravels in the *Registro General del Sello* in the *Archivo General de Simancas* between 1476 and 1496, and they seem to come from all over the Iberian Peninsula. His figures show that 45% of the caravels registered were from Andalusia, 21% from the Cantabrian region; 19% from Portugal, 12% from the Mediterranean, and 3% from France, England and the North Sea (Soto, 1991).

There is no mention of any possible difference between them. Were Cantabrian and Andalusian caravels much different from each other? How different were they from the Portuguese ones? Or how did the Portuguese ones differ from each other?

We have a long way to go before we can say that we understand this ship type. Iconography can provide some clues if we are to trust the illustrations in the Atlas of Georg Braun (1541-1622), published between 1572 and 1617 (Fig. 4). The quality of the illustrations in Braun's Atlas is known, including the figures in local dresses. It is not uncommon for painters and illustrators to register in the mapmaker's guilds and work on map illustrations when they find an opportunity (Binding, 2003 and Unger, 2010). The ship illustrations in Braun's Atlas seem to be reliable as well, and vary from city to city. Although no systematic study of the Atlas' ships has been done yet, the caravels represented in several Portuguese and Spanish cities, in Iberia or around the world, seem plausible and accurate, and consistent with the descriptions below.

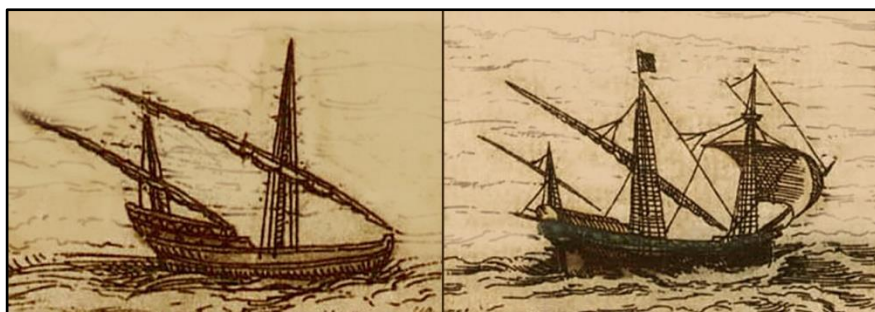


Fig. 4: Caravels: presumably Portuguese at São Jorge da Mina (leaf) and presumably Spanish at Santander (right). (After the 1572 edition of Braun and Hogengberg's atlas)

Caravelas de Alfama

Paulo Monteiro found this reference in a Spanish late 16th century document: '*(...) Tambien se quedan despalmando dos caravelas pequenas destas que aqui llaman de Alfama que las pide el Almirante para llevar consigo...*' (Monteiro pers. comm. 2009).

Were at least some of the Spanish caravels larger than the Portuguese ones? José Luis Casado Soto mentions a witness account of Columbus' second voyage, Pedro Mártir de Anglería, who claims that Columbus took 17 vessels: 3 large cargo ships with tops, 12 caravels, and 2 large caravels, *with masts large enough to support tops*. Nothing is said about their rigging arrangements. Were these typically different from those of the Portuguese caravels?

Caravelas redondas

Navarrete calls *caravelas redondas* 'castellanas'. They have three masts, the foremast mounting a square sail and the main and mizzen masts mounting lateen sails. Quirino da Fonseca cites him: "*caravels were divided into Portuguese and Castilian, the first exclusively lateen-rigged, could sail cinco ou seis quartas (56° to 67°) into the wind, facilitating the Portuguese routes to the African gold mines. Castilian caravels used in their seas with square sails, or better, with a square sail on the foremast.*"

Quirino also refers to a 1512 letter from D. Fernando to Pedrarias Davilla in Panama: '*Yo vos mando que ... se hagan luego tres o cuatro carabelas, al modo de Andalucía, las dos, e las otras dos, pequeñas, latinas, como las de Portugal...*' (Fonseca 1935).

In Columbus' *Diario de a bordo*, transcribed by friar Bartolomé de las Casas, the entry for August 9, 1492, famously mentions the explorer decision to change the rigging of his caravel *Pinta*: '*y adobaran muy bien la Pinta con mucho trabajo e diligencias del Almirante, de Martin Alonso y de los demás; (...) Hicieran la Pinta redonda, porque era latina;*'(Colón, 1991).

In the 14th century Mediterranean it was common to rig two-masted cargo vessels with a square sail on the foremast and a lateen sail on the mizzen. Sergio Bellabarba called this rigging arrangement *quadra-latina* and proposed two possible roots for the development of three-masted, ship-rigged vessels, one from the two-masted lateeners and one from the one-masted square-rigged cogs, both common merchant ships in the mid-14th century Mediterranean (Bellabarba, 1999). According to Bellabarba's plausible theory, both ship types at some point may have adopted a *quadra-latina* rigging arrangement, the two-masted lateeners by changing to a square mainsail, the cogs by adding a lateen-rigged mizzen mast. The earliest representation of a ship-rigged three-masted vessel dates to 1409 and appears in a Catalanian document. It shows a *cocca* with a *quadra-latina* rigging arrangement to which a foremast was added, mounting a square sail (Mott, 1997). *Caravelas redondas* seem to have evolved in a similar way. It looks like they were two-masted lateeners – which show the mainmast always stepped on the middle of the keel – with a third mast, a foremast stepped far forward. This type of vessel is

represented in Braun and Hogenberg's *Civitates orbis terrarium*, especially in Spanish harbors. (Fig. 5)

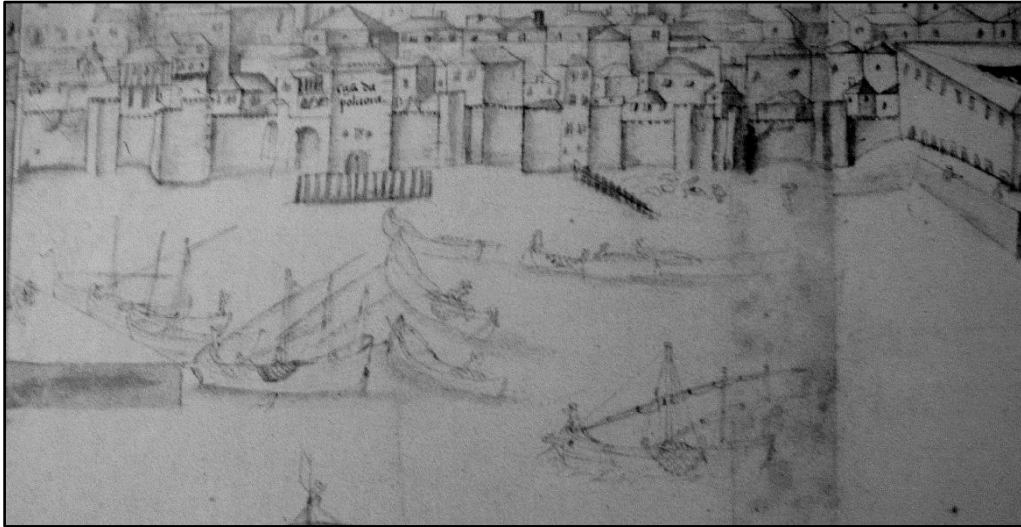


Fig. 5. Lateeners in Lisbon, c. 1530 (detail from the Leiden view of Lisbon, COLLBN J.29-15-7831-110-30)

Two documents dated to 1498 (before Columbus' fourth voyage) contain the inventories of the rigging of two caravels, *Santa Clara*, or *Niña* (60 *toneles* – probably not the *Niña* of the first voyage – and *Santa Cruz*, or *India*, built in Hispaniola during the second voyage with the remains of the ships lost in the hurricane that swept La Isabela in 1495.

Both these caravels had four masts, and both had square sails on the fore and main masts, and lateen sails on the mizzen and bonaventure. Additionally *Santa Cruz* had a bowsprit and a spritsail; and *Santa Clara* has '*dos botalos vno del trinquete y otro de la cont[ra]*' (Smith, 1993).

Gaspar Correia states that Vasco da Gama sailed to India in 1502 with '*cinco caravelas latinas, que mandou muito bem concertar*' and '*iam com velas redondas armadas, para com elas navegarem quando cumprisse*'. He does not mention how many masts these ships had, and the representations we have date to around 1565, more than half a century later.

Large cargo ships – *naus* or *naos*, *caracche*, or *hulks*, as they were known in the Atlantic, Mediterranean, and Baltic – tend to have three masts and square sails on the bowsprit, fore, and main masts, and a lateen sail on the mizzen mast.

When a fourth mast appears, in the late 15th century, square sails are always present, either on the fore and main masts, or only on the foremast. The first type of rigging is common on larger vessels, such as galleons, developed around 1500, or on the Spanish *caravelas redondas*, such as the *Santa Clara* and the *Santa Cruz*. The second type, with square sails only on the foremast, is typical of the Portuguese *caravelas de armada*.

Caravelas de armada

It is curious to notice that in the 1550s Fernando Oliveira is skeptical about the qualities of the *caravelas de armada*. In his *Arte da guerra no mar* he states: '*A mim me pareceu sempre, que caravelas de armada, não eram tão boas como são gabadas, por serem um género de navios misturado e neutro, e as partes que tomam de cada um dos outros géneros serem as piores*' (Oliveira, 1555).

Later, in his *Livro da fábrica das naus*, Oliveira states: '*Aqui me lembra e quero o dizer, antes que me esqueça, que nunca me pareceu bem, fazer da caravela navio redondo, diga cada um o que quiser, que tudo será afeiçoado*' and '*porque, mudando-se a forma da vela, cumpre mudar-se a fábrica do fundo, a qual já não pode ser mudada*' (Oliveira, c. 1580).

In the middle of the 16th century these caravels were purposely built with a forecastle and four masts, rigged with square sails on the foremast and lateen on the remaining three, and later would be as large as 180 *tonéis*.

As mentioned above, there are two *regimentos* for the construction of these caravels in Manoel Fernandez treatise (1616), and they both have two decks. We have their main dimensions:

- *Folios 16 and 107*: The caravel with 11 *rumos* (17m) of keel has 23.2m of length overall, a max beam of 6.42m, a depth of hold of 4.1 m, and a flat amidships of 2.05m.
- *Folio 24 (and 108?)*: The caravel with 12 *rumos* (18.5m) of keel, has 25.5m of length overall, a max beam of 7.19m, a depth oh hold 4.40m, and a flat amidships of 2.31m.

These *caravelas de armada* have length to beam ratios of 3.61 and 3.55 respectively, values that are compatible with the extensive iconography, often with reliable, albeit impressionistic, characteristics.

Caravelões

It seems that the smaller caravels were sometimes referred to as *caravelões* (Pico, 1955). Alexandre Monteiro transcribed two early 16th century documents relating to *caravelões de Arguim* that describe 3-masted vessels with bowsprits, square sails on the fore and main masts, and a lateen sail on the mizzen (Monteiro et al., 2011). Both *caravelões* have hatch covers, so there is no doubt about the fact that they were decked, as it should be expected in ships that are engaged in oceanic trips. One of these *caravelões* had a crew (*companha*) of nine: pilot, six sailors, and two apprentices. This information gives us a hint of the ship's dimension, if we are to believe Fernando Oliveira, who one generation later, in the mid-16th century, states that crews should be calculated as follows:

- Up to 10 *tonéis*: 2 sailors, 1 apprentice;
- 10 to 20 *tonéis*: 3 sailors, 1 apprentice;
- 20 to 30 *tonéis*: 4 sailors, 2 apprentices;

- Above 30 *tonéis*: add 1 sailor / 4 *tonéis* and 1 apprentice / 3 sailors. According to Oliveira, both the master and the pilot must be counted as sailors, thus suggesting a ship with a capacity around 42 *tonéis* (Oliveira, 1555).

One of these documents (1508) is particularly interesting because it refers a bowsprit, fore and mainmasts, and a bonaventure mast with its yard. Although there is no mention of a mizzen mast and yard, there is one mizzen sail, and one mizzen halyard (*ostaga*). It is not clear whether this is a mistake, or there were *caravelões* with 4 masts (Fig. 2).

Conclusion

The sample of shipwrecks of probable Iberian origin is small and the preservation is often poor. Moreover, it is impossible to say for sure that these archaeological remains are even remotely related to caravels. The size, shape, structure, construction sequence, and rigging of the Iberian caravels of the 15th and 16th centuries are far from well-understood. In spite of the many excellent historical publications available for almost one century in certain cases, we have more doubts than certainties when it comes to reconstruct these mysterious ships. Most data on caravels and other small vessels dates to the end of the 16th and beginning of the 17th centuries, more than a century after the first voyages into the Atlantic. A small sample of measurements from contracts and technical texts suggests that all caravels, even the Portuguese *caravelas de armada*, were small vessels, that they all relied primarily on lateen rigs, and that by the 16th century they all had stern panels and central rudders, no forecastle, one to four masts with a minimum of two lateen rigged masts, a low sterncastle, and no topmasts. For the Iberian Peninsula all caravels had length to beam ratios between 3 and 4, tonnages between 50 and 150 *toneles*, corresponding to lengths overall between 15m and 25m.

The archaeological record suggests that vessels of this size had similar basic construction features and scantlings. In other words, that there was an 'Iberian way' of designing and building small ocean-going vessels, of which some were possibly caravels. However, only the full publication of a much larger sample of shipwrecks will help shed light on this subject.

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