

CONTRIBUTION TO THE ARCHITECTURAL STUDY OF *RIA DE AVEIRO A*, A MID-15TH-CENTURY PORTUGUESE SHIPWRECK

FRANCISCO J. S. ALVES

INTRODUCTION

The remains of *Ria de Aveiro A* shipwreck were casually discovered in 1992 by Carlos Neves Graça, a local resident, in the vicinity of the «Englishman's beach» (*Praia dos Ingleses*), which is at the end of the Mira channel of Aveiro Lagoon (Figs. 2.1 and 2.2). In the next year the wreck remains were formally identified during an extreme low tide of 0.3m (Fig. 2.3), when they were visible at the surface. Between 1996 and 1999 those remains were all excavated (Fig. 2.4), recorded and carefully collected under the direction of the A., and promptly dated by radiocarbon as being from the mid-15th century (ICEN-1105/1116/1117/1118).



Fig. 2.1. The Aveiro lagoon in the Iberian Peninsula map
Source: Deutsches Archäologisches Institut (original map)



Fig. 2.2. Archaeological site of the *Ria de Aveiro A* shipwreck
Source: Aveiro Harbour Administration



Fig. 2.3. View of the ship remains in an extreme low tide of 0.3m, in 1993
Source: Francisco Alves; CNANS



Fig. 2.4. Underwater view of the remains (the heel in the foreground) completely uncovered and recorded, just before their archaeological dismantling in 1999
Source: Guilherme Garcia

In 1999 all the structural remains of the ship were transported to the conservation laboratory of the *Centro Nacional de Arqueologia Náutica e Subaquática* (CNANS) in Lisbon, created in 1997 as a part of the *Instituto Português de Arqueologia* (IPA) of the Ministry of Culture¹; in 2001 two very comprehensive papers about the research developed until then were published²; and in 2003 the structural wooden remains of *Ria de Aveiro* A shipwreck underwent the classical conservation treatment with poly-ethylene-glycol (PEG) which was concluded in less than a decade. Nevertheless, today those remains are still lying in the original PEG solution, with the implicit risk of degradation³.

The area of the finds (Fig. 2.5) had its major axis oriented 22° Nmg, and was spread along 10.4m, from the stern extremity to the north till the terminal hull planking elements to the south. This preserved part of the hull is composed by 23 transversal elements (frames, peak-floors and futtocks) and 31 planks, some of them incomplete, and preserved *in situ* in a maximum width of c. 2.5m.

¹ António Guterres, recently elected Secretary-General by the General Assembly of the United Nations Organization, was the Prime-Minister at that time. IPA and CNANS were created in 1997 as part of the Portuguese Ministry of Culture. However, with the IPA extinction in 2007, CNANS saw his institutional profile being diminished.

² ALVES *et al.*, 2001a; ALVES *et al.*, 2001b.

³ See *infra*: Addendum.

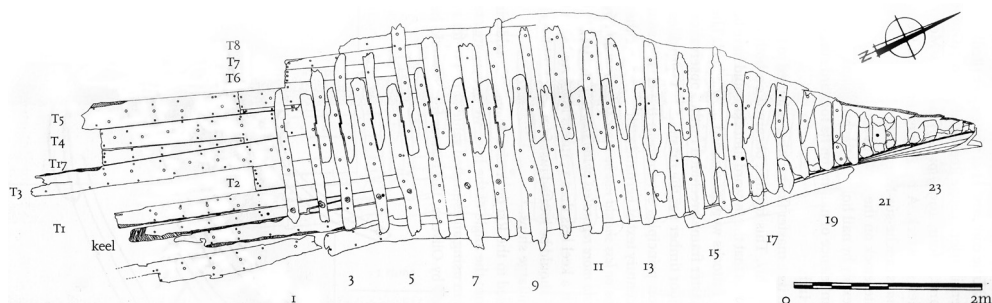


Fig. 2.5. RAVA. Plan of the architectural remains
Source: ALVES *et al.*, 2001: 327

Those elements corresponded to a little more than the aft half of a hull bottom of a ship, lying *in situ* with a lateral starboard side inclination of c. 15°, and a longitudinal stern inclination of c. 3° to 6°. For this reason, the starboard hull planking was buried deeper in the sediment, and much better preserved here than in the portside — the same happened longitudinally, with the *couce de popa* (the heel) (Fig. 2.6) more buried than the fore planking, which raised at the surface of the sediment. This *couce* could not be more similar to the one represented in the classical manuscript by João Baptista Lavanha, *Livro Primeiro da Arcuitectura Naval*⁴ (Fig. 2.7), of the early 17th century.

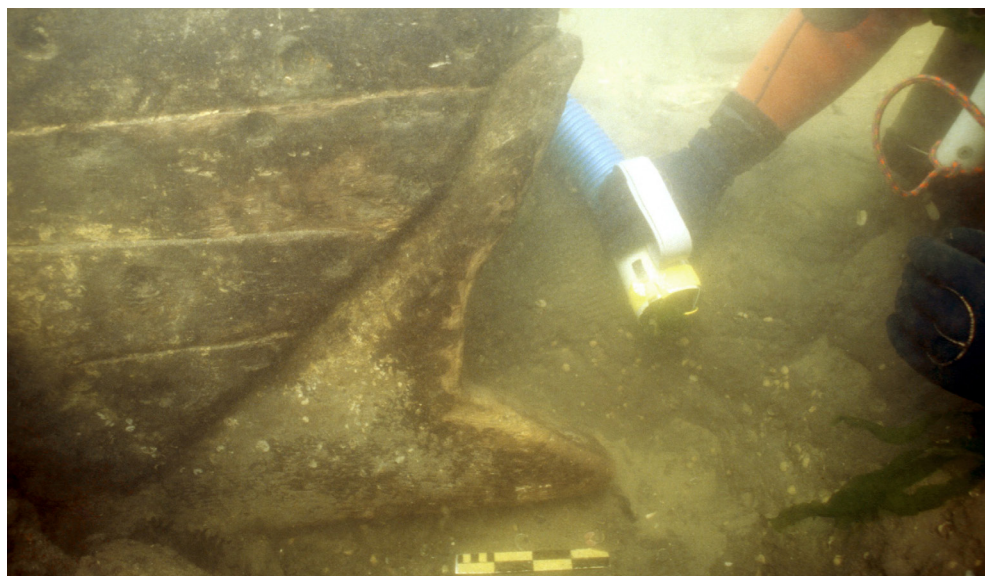


Fig. 2.6. Underwater view of the terminal part of the heel of RAVA
Source: Francisco Alves

⁴ BARATA, 1996: 62v-63.

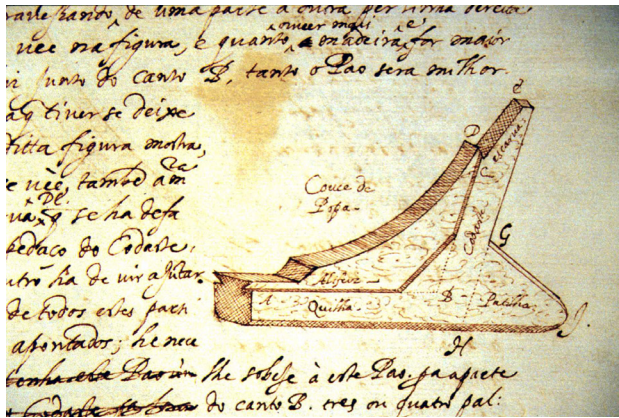


Fig. 2.7. Heel (with its stern-knee) drawn by Lavanha in his treaty of the early 17th century
Source: BARATA, 1996: 45, fig. 10 e fig. 63

This kind of heel (*couce de popa*) is present in Portugal in two other instances: a) the 1985/1986 dredges in the Varadouro area of the estuary of river Cávado, close to Esposende⁵ (Fig. 2.8), when the first *couce* of this kind was found in Portugal — their two main pieces, the heel (*couce*) and the stern knee (*coral*), although disassembled, had survived; their radiocarbon dating points to the 16th century/1st half of the 17th century (Beta-143087); b) the *Corpo Santo* shipwreck, discovered in 1996 during excavation works in the Lisbon riverside (Fig. 2.9), and dated from the 14th century by radiocarbon (Sac-1361), which had a shape very similar to the *Aveiro A* one.



Fig. 2.8. Heel and stern-knee of Varadouro shipwreck (river Cávado estuary, Esposende), 16th century/1st half of 17th century
Source: Ivone Magalhães

⁵ This «couce» was the first discovery of this kind occurred in Portugal. The A. thanks Ivone Magalhães and José Salgueiro, a local witness, for the information they kindly provided.



Fig. 2.9. Heel of *Corpo Santo* shipwreck, 14th century
Source: Francisco Alves

A significant part of the *Aveiro A* keel has survived in a length of 9.15m, a little less than the full length of the planking (c. 10.4m). It was a composite piece, made of segments linked through vertical plain scarfs, reinforced by transversal iron nails of square section (Fig. 2.10), a system also illustrated by Lavanha. The last aft element of the keel integrated the heel. A small segment of the keelson had also survived (Fig. 2.11). This one was originally fixed to the axial top of the frames (Fig. 2.12), which were fixed to the keel by similar iron nails, inserted vertically into the frames 1-9, and obliquely into the frames 10 to 18, in grooves carved in their fore faces, and into the frames 19-21 in their aft faces. The whole was assembled by thick iron bolts — of circular section vertically inserted from the top of the keelson into the base of the keel with their extremities hammered over iron washers, reason why they were called *anielados*.

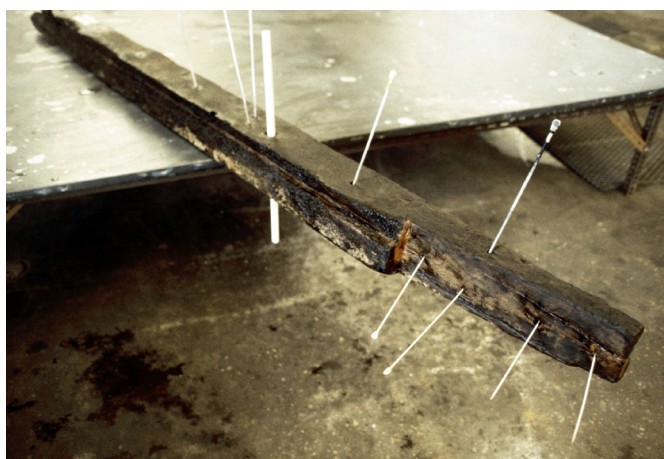


Fig. 2.10. Segment from the keel of *Ria de Aveiro A* with vertical scarfs in their extremities
Source: Francisco Alves



Fig. 2.11. A segment of the keelson of *Ria de Aveiro A* where the rectangular sloping carving for the deck post sliding can be seen

Source: Francisco Alves

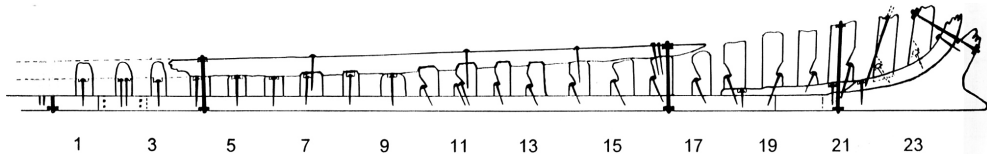


Fig. 2.12. RAVA. Axial section of the preserved structure of *Ria de Aveiro A* with its iron nailing system

Source: M. Aleluia, rev. Francisco Alves

The preserved framing of the ship was composed by 23 basic elements, among which were the hull frames and terminal peak-floors; the latter were fixed to the curved face of the stern knee (*couce*), with nails following the above described method. All of them were better preserved on the starboard side because they had been buried deeper, reason why most of their first futtocks were in better condition, on this side. The fore frames and futtocks were connected through a triple reinforcement, composed by the classical male-female mortise, typical of the millenary carpentry (called in English «in dovetail» shape, in French «en queue d'aronde», and in Portuguese «em rabo de minhoto», designation due to its trapezoid shape) — a system here symmetrically reinforced by pairs of iron nails of square section, and wooden pegs of circular section (Fig. 2.13).

It was also verified that the position of the different segments of the framing system followed the «Atlantic model»⁶ in which the futtocks are always connected with the sides of the frames that face the respective forward or aft extremity of the ship — with the exception of the master-frame, which always has a pair of symmetrical futtocks in each side (Fig. 2.14).



Fig. 2.13. Typical frame-futtock connection, through dovetail mortise and double fastening, with iron nails and wooden pegs
Source: Francisco Alves

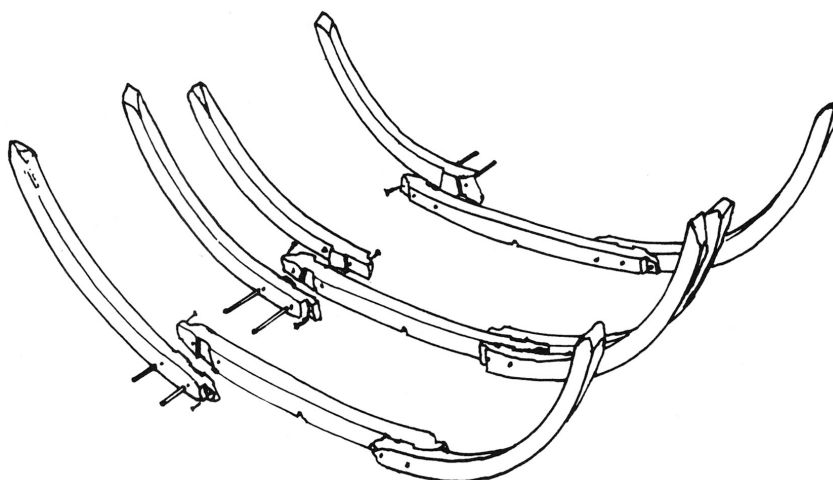


Fig. 2.14. The so-called Atlantic scheme of the master-frame and its adjacent frames
Source: T. Oertling

⁶ OERTLING, 2001.

The ship cargo included walnuts and chestnuts, presumably stored in small barrels, from which several staves and half-round wicker hoops (Fig. 2.15) survived. However, the cargo was mostly composed of ceramic pieces of a well-known common ware, typical of the Aveiro region (Fig. 2.16). From this kind of cargo — apparently dominant — the recovered part constitutes the largest, most diversified and best preserved collection of ceramics of this type, from the Portuguese Late Medieval and Renaissance times, with a national and international very well-known diffusion, especially at European and transatlantic level, which is now archaeologically attested⁷.



Fig. 2.15. Wooden barrel stave and fragments of wicker hoops
Source: Francisco Alves



Fig. 2.16. Typical common earthenware production from the Aveiro region
Source: Francisco Alves

⁷ The preliminary research on the ceramics recovered inside and outside the ship hull, from the stern part of the shipwreck till the skeg base, was led by the A. After the archaeological dismantling of the ship hull in 1999, the dispersed but compacted area of the cargo, spread around the original hull location, was carefully excavated by Patrícia Carvalho and José Bettencourt, members of CNANS at that time (ALVES *et al.*, 1998; CARVALHO & BETTENCOURT, 2012).

Finally, it was possible to prove archaeologically that the ship was lost in the sequence of a fire occurred on board, attested not only by the melting, re-cooking and cooling of numerous ceramic vases retrieved, completely deformed but intact, and sometimes welded to other ones (Fig. 2.17), but also by traces of fire in the inner faces of several preserved hull planks of the starboard side, corresponding to the cellar (Fig. 2.18).



Fig. 2.17. Two bowls deformed and welded in consequence of a fire in the cargo hold
Source: Francisco Alves



Fig. 2.18. Fragment of a starboard side hull plank burnt on its internal face
Source: Francisco Alves

1. THE *RIA DE AVEIRO* A SHIPWRECK: FEATURES AND ORIGINS

The first three frames partially preserved in the fore side of the remains, emerging from the sediment, in their portside rupture extremities (originally located axially) presented horizontal plan surfaces, clearly obtained by intentional lowering (Figs. 2.19 and 2.20).

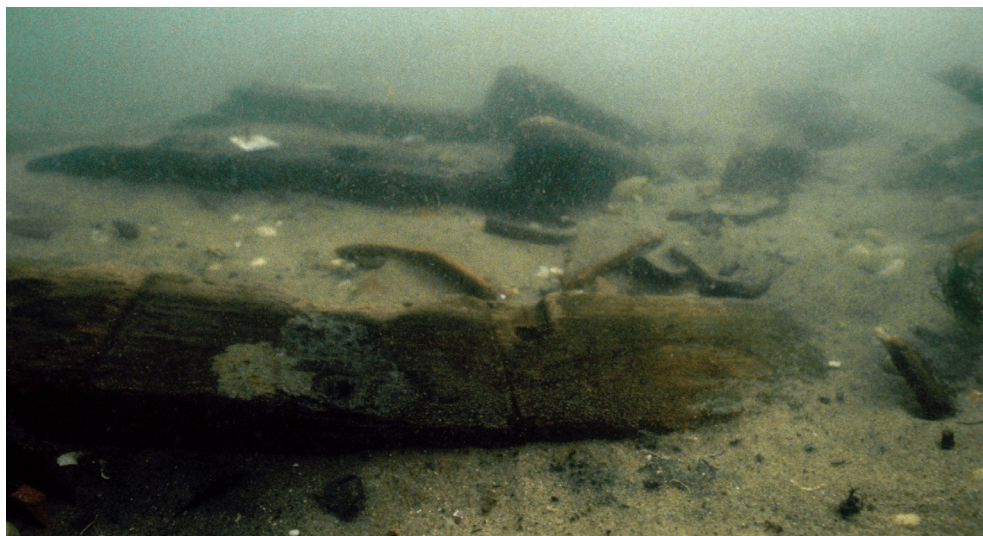


Fig. 2.19. Subaquatic aft-fore view of the first three starboard side frames partially preserved in the fore part of the remains (1 to 3)
Source: Francisco Alves

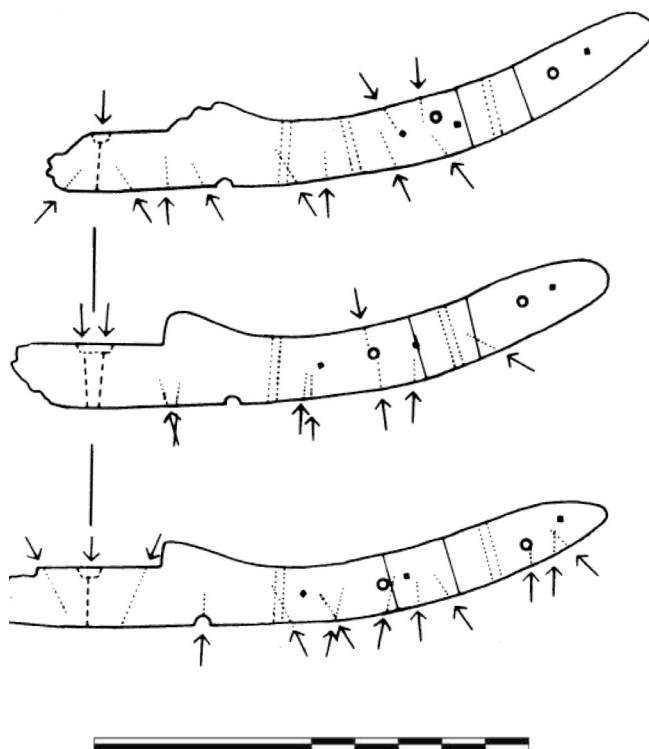


Fig. 2.20. Drawing of the axial-transversal sections of the first three partially preserved frames
Source: M. Aleluia

Those lowered horizontal surfaces were immediately contiguous, in their starboard side, to abrupt vertical protuberances (*buttresses*) that progressively reached, in that direction, the original vertical thickness of the frames. In fact, originally, they were the axial parts of the three first partially preserved fore-frames. Those lowered spaces between the original symmetrical buttresses served to host the enlarged part of the keelson (the mast step, *carlinga* in Portuguese) in whose hole (*pia*) the mast foot was inserted. This system is very well documented in the inside of the hull of the *Contarina 1* shipwreck of the Italian Po delta, dated from the 13th century, recovered during an excavation in 1898⁸ (Figs. 2.21 and 2.22).

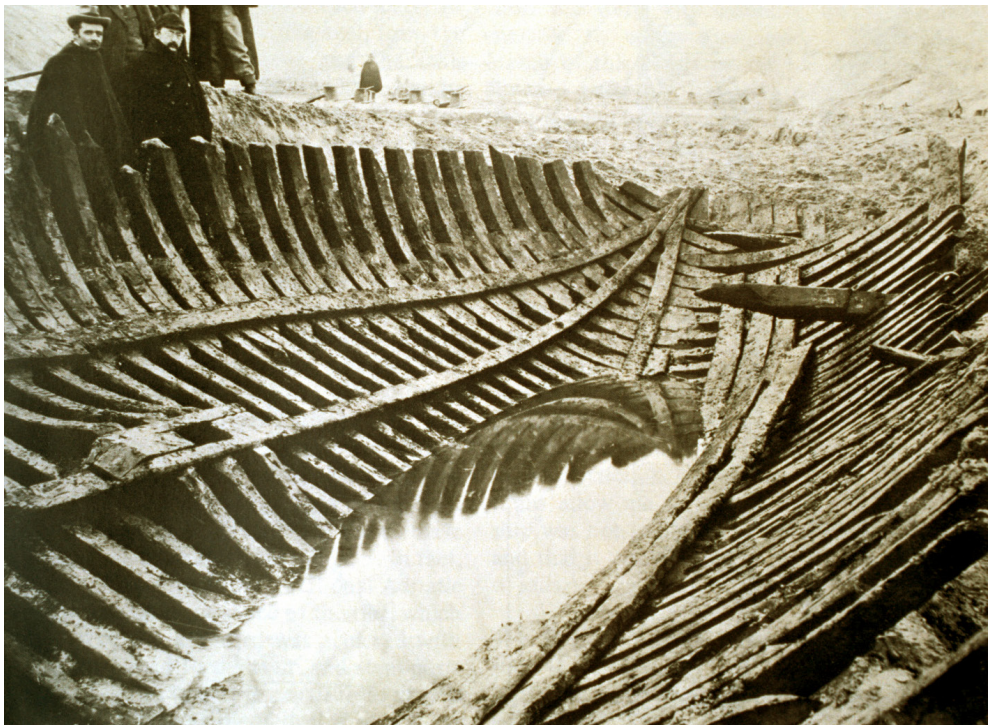


Fig. 2.21. View of the hull bottom of the *Contarina 1* shipwreck in the River Po delta in 1898
Source: BONINO, 1978: 13, Fig. 3

⁸ BONINO, 1978.

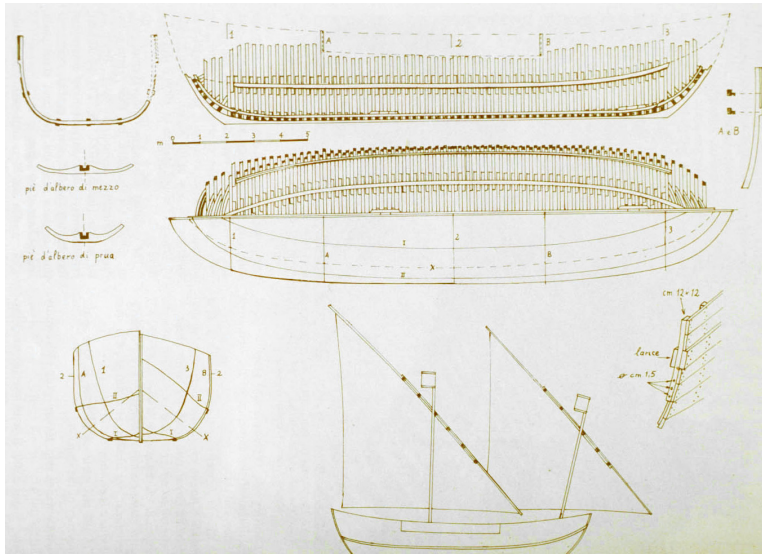


Fig. 2.22. Drawings and graphic reconstruction of the *Contarina 1*
Source: BONINO, 1978: 14, Fig. 4

As it can be observed, the internal axial structure of *Contarina 1* presents notorious similarities with the equivalent preserved part of *Ria de Aveiro A*, although this one was not so well preserved — that part of the keelson in the three fore-frames being only attested in negative by their keelson encasement spaces. This is well documented by the drawings of the transversal sections of those three partial frames of *Ria de Aveiro A* (Fig. 2.20), and especially in their detailed plan (Fig. 2.23) which also proves that the first of those partially preserved frames (the lower one of Fig. 2.20 and the number 1 of Fig. 2.23) corresponded to the master-frame.

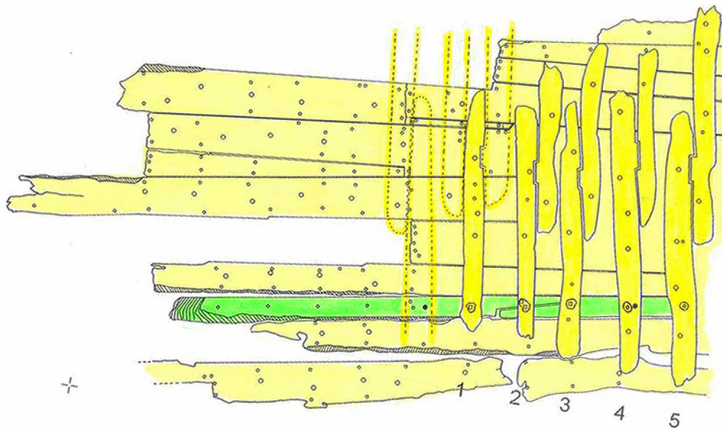


Fig. 2.23. Detailed plan of the extreme fore part of the architectural remains
Source: Francisco Alves

In fact, this first fore frame, partially preserved, was the only one, among all the frames, that originally had on each side (fore and aft) two symmetric futtocks (fixed in their aft and fore faces) — whose presence in negative was attested by the holes of the iron nails that fixed the subjacent outer planking to the base of those frames. Those holes are clearly visible on the drawing. This detail of architectural symmetry of this pair of futtocks of the master frame, as already referred, is common to all known ships of the Iberian-Atlantic ship building tradition⁹. It must be also referred that the missing frame (the fore — first preserved frame) — equally attested in negative by the respective iron nails holes (Fig. 2.23) — should be, in all, identical to the frames numbers 2 and 3, originally existing in their exact symmetry. Therefore, they would together constitute the original bed of the ships keelson, as we can observe in *Contarina 1*, in which this axial part of the ship structure was completely preserved.

It is worth to note also that Father Fernando Oliveira, author of the oldest and most famous Portuguese treaty of naval architecture, *O Livro da fabrica das naos*, of 1580, clearly states that the master frame of a ship must always be placed at 1/8th fore amidships. Consequently, counting for a length in Portuguese classical *rumos* of naval architecture (1 *rumo* measuring c. 1.54m), *Ria de Aveiro A* shipwreck could only have a keel of 8 *rumos* (12.32m), since the measures of 7 or 9 *rumos* were either insufficient or excessive in length to be compatible to the dimension of the preserved part of *Ria de Aveiro A* shipwreck.

Another detail — of important architectural meaning — was the presence (on different designated on the plan by the numbers 5, 12 and 15) of the Latin numerals «V», «XII» e «XV» engraved by excision (Figs. 2.24a, 2.24b and 2.24c)¹⁰, whose specific architectural meaning was initially not clear, independently of their obvious generic significance in the architectural sequence (Fig. 2.25).



Figs. 2.24a to 2.24c. Latin numeric marks (V, XII and XV) engraved by excision in the preserved frames 5, 12 and 15, as indicators of position in the architectural sequence

Source: Francisco Alves

⁹ The exceptions would be ships with more than one master-frame.

¹⁰ Identical numeration on *Cais do Sodré* shipwreck, and on the wreck of the Portuguese Indiaman *Nossa Senhora dos Mártires*, was incised, instead of excised as seen in *Ria de Aveiro A*.

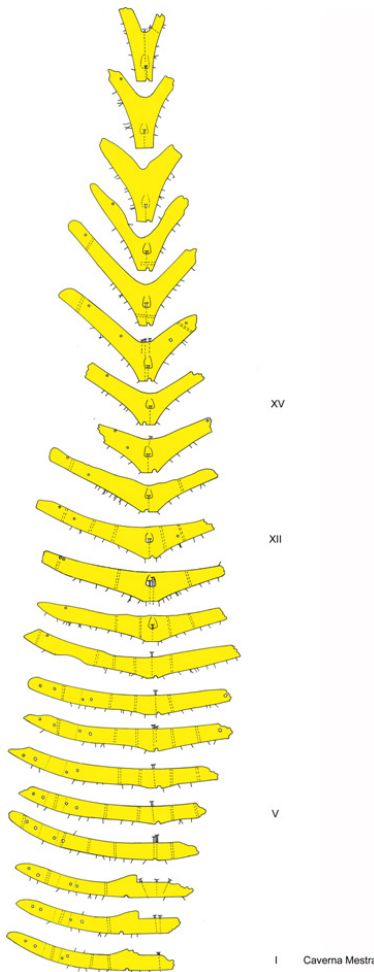


Fig. 2.25. Architectural sequence of the preserved frames, represented by the respective transversal sections
Source: Francisco Alves

This kind of shipyard's criterion of identification was already archaeologically attested in the *Culip VI* shipwreck, at the Catalonia coast, dated from the end of the 13th century¹¹. In Portugal it has also been recorded in the *Cais do Sodré* shipwreck¹², from the late 15th to mid-16th century, and in the presumable Indiaman *Nossa Senhora dos Mártires*, wrecked in 1606 in the Tagus bar¹³.

All those details, testimony of a well-known architectural conception of Late Middle-Ages Mediterranean origin, allow an hypothesis about the constructive genesis of the *Ria de Aveiro A* ship. Indeed, its relative modest dimensions and the rough shape of its framing timbers allow us to admit that the ship could have been built in a modest

¹¹ NIETO & RAURICH, 1998.

¹² RODRIGUES *et al.*, 2001.

¹³ ALVES, 1998; CASTRO, 2001.

local shipyard of the Atlantic or the Mediterranean Iberian coasts. This hypothetical origin also allows us to admit that the building of this ship could be based on a tradition perhaps even earlier than the mid-15th century.

Finally, it seems acceptable to admit¹⁴ that *Ria de Aveiro A* constitutes so far the closest and most coeval example of what would be a caravel of the *Quattrocento* Portuguese Atlantic explorations.

* * *

This was the state of the question until 2015. However, in this year, the A. was invited to give two lectures on nautical archaeology and naval architecture of Portuguese tradition in a seminar organized by the University of Cadiz¹⁵, where he presented five shipwrecks found in Portugal (*Corpo Santo*, *Ria de Aveiro A*, *Cais do Sodré*, *Nossa Senhora dos Mártires* and in the Oranjemund coast of Namibia¹⁶), with a brief reference to the works of Fernando Oliveira and João Baptista Lavanha. Along with the preparation of those themes, when revising the graphic documentation of *Ria de Aveiro A* shipwreck, and facing the diversity of scales published, the A. decided to draw a scale based on the real dimensions of the remains and place it all along the shipwreck plan (Fig. 2.26).

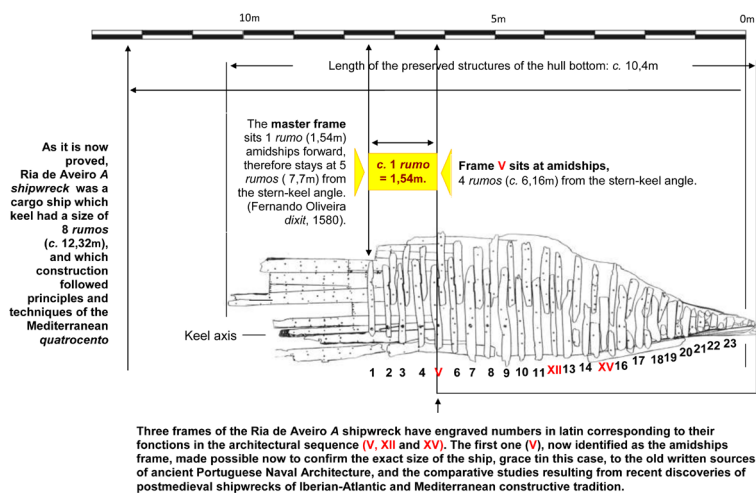


Fig. 2.26. *Ria de Aveiro A* shipwreck plan, reviewed and annotated by the A. (for Cadiz seminar, 2015)

Source: Francisco Alves

¹⁴ Despite the obvious reserve about the effective shipyard origin of most of ancient shipwrecks found everywhere.

¹⁵ The seminar *The origin and development of Naval Architecture* (September, 7-11) was organized in collaboration with other important provincial institutions, under the coordination of Javier Nieto, ancient director of ARQVA (Cartagena) and CASC (Girona), a colleague and friend since 1982 (Europe Council UCH-Course of Neuchâtel and Marseille). This meeting has been an opportunity to listen to some invited reputed friends (Patrice Pomey, Cemal Pulak, and Francisco Fernández González).

¹⁶ ALVES, 2009a; ALVES, 2011; ALVES, 2013.

Only then, after having traced at 6.16m the half-keel mid-vertical line, the A. realized that it was situated exactly over the frame that had the numeral «V» engraved (Fig. 2.24a.); for the first time, he understood that this numeral corresponded to the exact amidships frame. This observation was also coincident with another one, subsequently confirmed by Eric Rieth¹⁷ — in 2003 he had remarked that in the plywood model at 1:1 scale (called 2D¹⁸), the bottom arch of the ship hull was rising exactly at the frame 5 (Figs. 2.27 and 2.28).

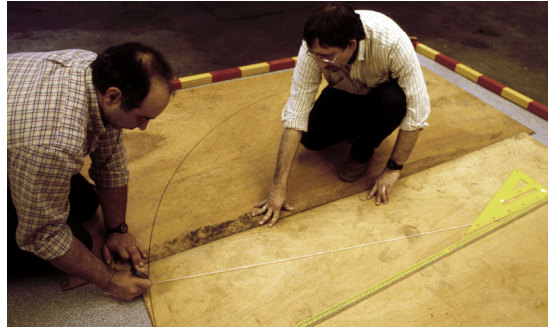


Fig. 2.27. Eric Rieth and Paulo Rodrigues testing the curvature of the first frames of *Ría de Aveiro A* shipwreck, with the help of a mould of the master-frame, in the plywood model at 1:1 scale, said «in 2D»
Source: Francisco Alves



Fig. 2.28. View of the 2D and 3D models of the preserved framing at the CNANS facilities in 2004
Source: Francisco Alves

¹⁷ Information transmitted to the A. by E. Rieth, during the elaboration of the present text.

¹⁸ Two models at 1:1 scale of the basic structure of *Ría de Aveiro A* shipwreck were conceived by the A. and were executed under his supervision in CNANS facilities in 2003-2004 (Fig. 2.28.). The 2D model remained exposed there until 2010, when CNANS moved from Belém to Loures (See *infra: Addendum*). In this model all the frames were made of plywood, regardless of its thickness which did not correspond to the original longitudinal thickness of each frame. The frames and peak-floors were also cut out from a plywood sheet where the drawings (in 125 micron transparent Mylar DuPont sheet) of the transversal sections of those parts had been previously transferred to. Then, all the frames and futtocks were inserted in a «U» section wood keel, through transversal grooves, corresponding exactly to the transversal axis of the feet of each frame. The 3D model was made of medium density polyurethane sheets with the exact thickness of each group of frames and futtocks, and the four faces of each frame were sculpted accurately and finally painted dark brown to suggest old wood.

It was thus unveiled the significance of the first of the three engraved numeral marks; and one of the other two (the «XII» or the «XV») would certainly correspond to the aft loof frame of the ship; the only thing missing was to find what the remaining mark means.

This simple conclusion was the first positive contribution of the Seminar held at Cadiz.

* * *

The second contribution of this Seminar resulted from a fortuitous conversation between the A. and Cemal Pulak, which gave place to two important questions:

- One, formulated by the A., pointed to the resemblance between the internal axial and transversal hull structures of *Ria de Aveiro A* and *Contarina 1* shipwrecks, especially in the keelson zone;
- the other one, by Cemal Pulak, stressed the radical structural, architectural and functional difference between the aft terminal parts of both ships, *Contarina 1* being a round stern ship (Fig. 2.22), using the multi-millennial lateral rudder, while *Ria de Aveiro A* had its stern «like a cog», he concluded¹⁹.

This remark of Cemal Pulak was not only absolutely justified but also extremely rich of significance, due to the implicit suggestion of reconsidering the genealogy of the stern structure of the caravel of the Portuguese *Quattrocento* — this referring to the fundamental question of the transition in Portugal from the use of a round stern, associated with a lateral rudder — or even with an incipient axial one, as McGrail admitted²⁰ — to the generalized use of an axial rudder fixed to an axial stern. This was, in any case, a fundamental nautical innovation at architectural, structural and functional levels, and particularly decisive to oceanic and transoceanic navigation, especially due to the intense maritime traffic between the northern and southern Europe regions during the

¹⁹ In fact, Filipe Castro (2012: 28) already had said: «Das cogas, os navios portugueses do século XVI parecem ter herdado os couces (hooks) [...]» («the Portuguese ships of the 16th century seem to have inherited the hooks from the cogs [...]). Interestingly enough, this author did not mention the well-known archaeological finds that include preserved heels («couces»), from *Corpo Santo* (ALVES *et al.*, 2001a) and *Ria de Aveiro A*, respectively from the 14th and 15th centuries, but also from *Varadouro*, from the 16th/1st half of the 17th century, still unpublished but exhibited in the Municipal Museum of Esposende.

²⁰ «Several town seals of the thirteenth and fourteen centuries (for example Elbing, 1242, Wismar, 1256, Poole, 1325) show vessels with centreline rudders; these may best be described as ships as they are clearly decked and no longer open boats. Median rudders are also depicted on the Tournai fonts at Winchester (Fig. 8.18.) and Zedelgem, Bruges, Belgian (FENWICK, 1978: Fig. 8.12b), which are conventionally dated to the late twelfth century. Nevertheless, early fourteenth-century seals of de Faversham (FENWICK, 1978: Fig. 8.32c) and Winchelsea (FENWICK, 1978: Fig. 8, 25, 4) show evidently fair-sized vessels with side rudders which, if not an anachronism, may indicate that during the twelfth/fourteenth century both side and median rudders were used. It may be that, at first, median rudders were used on the curved hull form of vessel (hulc), depicted on the late twelfth-century font and on the cog, rather than the post-Viking development of the Norse tradition (keel)» (MCGRAIL, 1998: 251).

Middle Ages, as well as with Cantabria, Galicia, Portugal, the Al-Andalus, and of course with all Mediterranean areas²¹.

* * *

At this point, the A. must evoke here, at first hand, the interest dedicated by his good friend and master, late Octávio Lixa Filgueiras (1922-1996)²², to the representation in low relief of an old sailing ship on the southern tower of the Cathedral of Oporto (Fig. 2.29), which he identified as a cog, in a short but extremely interesting paper, where he assembled some relevant quotations concerning the relation between cogs and Portugal²³ — a subject that is here brought to the present.



Fig. 2.29. Cog sculpted on the southern tower of the Oporto Cathedral

Source: <<http://cidadesurpreendente.blogspot.pt/2010/12/nave-esculpida-numa-torre-da-se-do.html>>
[Access on 07/08/2016]

The cog has its archaeo-museologic paradigm in a shipwreck discovered in 1962, during dredges in the estuary of the river Weser, which was baptized as «Bremen cog»²⁴. The remain has been exposed since 2000, as an extraordinary masterpiece, in the Deutsches Schiffahrtsmuseum of Bremerhaven (Fig. 2.30), after many years of impregnation by immersion in a water solution of poly-ethylene-glycol (PEG) and structural remounting²⁵.

²¹ PICARD, 1997a, 1997b.

²² ALVES, 2009a.

²³ FILGUEIRAS, 1982, 1983.

²⁴ ELLMERS, 1994.

²⁵ In 1982 the A. in company of Rui Parreira had the opportunity to catch a glimpse of the «Bremen cog», immersed in its dark bath of PEG solution, during an unforgettable study visit to 43 German archaeological institutions, as guests of the Deutsches Archäologisches Institut.



Fig. 2.30. «Bremen cog» displayed in the Deutsches Schiffahrtsmuseum of Bremerhaven
Source: <<http://bertan.gipuzkoakultura.net/ac/accesibilidad.php>>. [Access on 16/08/2016]

In a very brief characterization of its structure, the cog is a flat plank bottom and a clinker hull ship (Fig. 2.31), therefore differing from ships of Viking tradition, in which the planking is structured on the basis of a «classical» keel with quadrangular section. The flat bottom planking is composed with symmetrical planks laterally jointed, the axial one being thicker than the others, and in a certain sense representing a «proto-keel»; from the turn of the bilges on the planks are «bitten» in both sides by the upper ones, as can be seen in the sections of the cogs of Bremen, Kollerup, Kolding and Vejby (Fig. 2.32). As the «Bremen cog» shows, the cogs also had strong transversal beams that consolidated the hull by penetrating it transversally down to the external surface. They also have characteristic strong bars or posts, fore²⁶ and aft, here constituting the terminal part of a heel with a terminal angular skeg, serving for the protection of the rudders base, and also corresponding to the extremity of the keel, sculpted in the heel.

²⁶ ESPARTEIRO, 1974: 25.

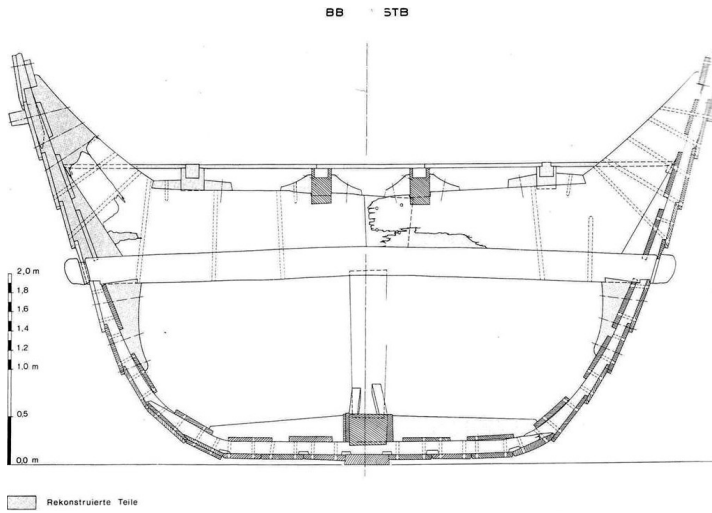


Fig. 2.31. Central section of the «Bremen cog»

Source: CRUMLIN-PEDERSEN, 2000: 232, Fig. 3 ff. LAHN, 1992

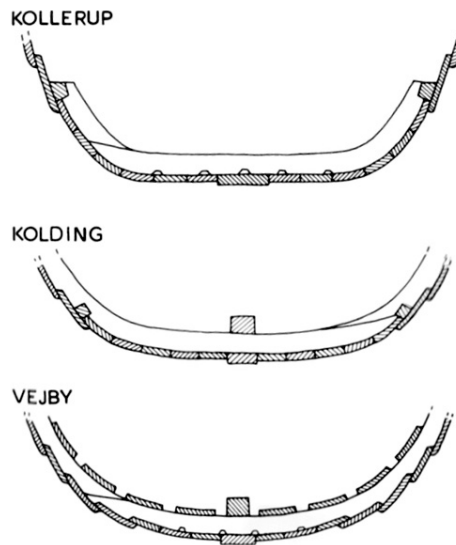


Fig. 2.32. Central sections of the cogs from Kollerup, Kolding and Vejby

Source: CRUMLIN-PEDERSEN, 2000: 234, Fig. 5 ff. CRUMLIN-PEDERSEN, 1979

About the place where the cog had its origin, Ole Crumlin-Pedersen²⁷ concludes: «The evidence from the cog finds known so far points in another direction for the early history of the seagoing cog of the 12th-14th centuries. It points to the northernmost Frisian area between the river Eider and Ribe as having the best potentials to be a

²⁷ CRUMLIN-PEDERSEN, 2000: 238-239.

primary area for the modification of a hypothetical older ‘proto-cog’ type, used for navigation on inland and tidal waters, into a seagoing cog capable of circumnavigating Cape Skagen/The Skaw [...]»; and, according to this author, the generalization of the use of the «classical» stern (heel/*couce de popa*) would have occurred in the north of Europe, fundamentally in the geographic space of the Hanseatic League, and specifically in its southeast — the Frisian area (Fig. 2.33).

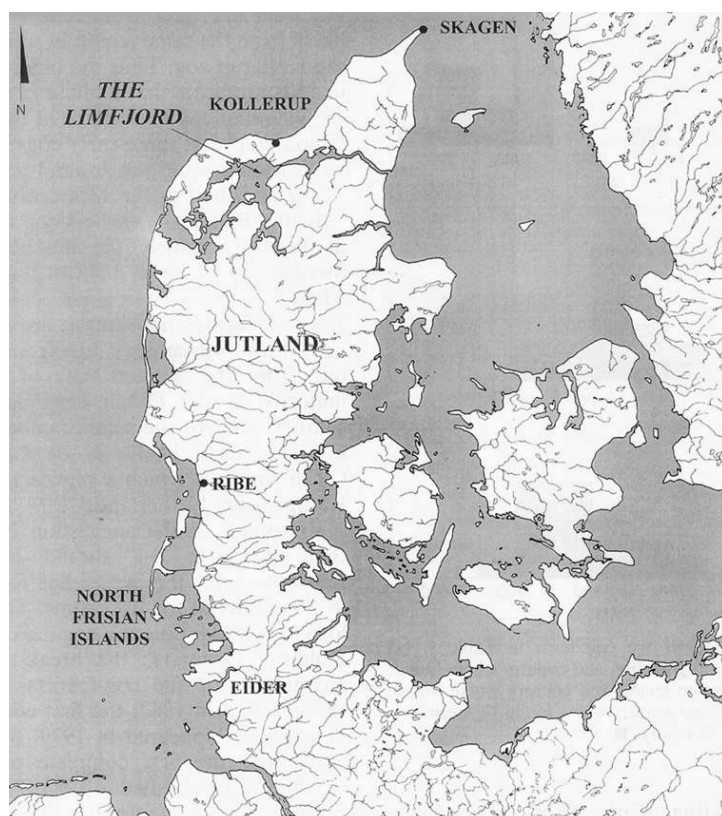


Fig. 2.33. Jutland map with the Frisian region and the Skagen cape pointed out
Source: CRUMLIN-PEDERSEN, 2000: 240, Fig. 8

2. DATED REFERENCES CONCERNING THE SUBJECT²⁸

Late 10th century–mid-12th Century²⁹ — Radiocarbon date of a clinker hull frame (Fig. 2.34) recovered in the 70s by a retro-excavator during water caption works in the plain (*várzea*) of Alfeizerão (centre-littoral of Portugal). This plain was originally a lagoon progressively and finally completely silted in the 16th century.

²⁸ Selection in a very preliminary approach of the theme.

²⁹ Intersections: 1001, 1012, 1017 cal DC; Intervals: 1 sigma: 989-1025 cal DC; 2 sigma: 971-1151 cal DC (ICEN-123).



Fig. 2.34. Clinker hull frame found in the 70s near Alfeizerão
Source: Eng.º geólogo, Teixeira Pinto (de Alfeizerão)

12th century — (Referring the «proto-cog» — the hulc): «dominant type of ship in the Atlantic, from Spain till Livonia, starting at the first decades of 12th century»³⁰.

1147 — «The earliest recorded use of the word cog for seagoing ships seems to have designated two of the Flemish vessels of the Second Crusade in 1147»³¹. This date corresponds to the conquest of Lisbon to the Muslims by the first King of Portugal, Afonso Henriques, with the help of a fleet of crusades from the north of Europe in their way to the Holy Land.

1153 — The first Portuguese King Afonso Henriques donated to the Order of Cister the *Coutos* of Alcobaça, which were, until the 16th century, a vast, rich, and navigable lagoon area, with several harbours, developing an intense maritime trade with the north of Europe, namely with the Hanseatic League³².

1159 — Foundation date of Lübeck and the Hanseatic League³³.

Late 12th century (1180?) — «Scenes from the life of St. Nicolas on the font in Winchester Cathedral» (Fig. 2.35). «The ship is believed to represent a hulc»³⁴, a typical round stern ship.

³⁰ MARQUES, 1959: 73-74.

³¹ BILL, 1997: 158 *apud* CRUMLIN-PEDERSEN, 2000: 238.

³² MARQUES, 1959.

³³ ELLMERS, 1994: 37.

³⁴ MCGRAIL, 1998: 118.



Fig. 2.35. Low relief band of the baptistery in the Winchester Cathedral
Source: MCGRAIL, 1998: 118, Fig. 8.18

1210 — «[...] The King of England himself had acquired a cog by 1210. Some of the crusaders who travelled from the North Sea to the Holy Land along the western coast of Europe made their journey by cog, so cogs were observed in the Bay of Biscay and in the Mediterranean»³⁵.

1224 — Town seal of Lübeck (Fig. 2.36): «It is a reasonable assumption that each town depicting a cog on its seal showed the latest stage in the development of ship construction. However, when Lübeckers depicted a cog with firrer in their first seal of 1224, that type of side rudder had already been replaced by the stern rudder, shown on the seals of all the other large Hanseatic towns»³⁶.



Fig. 2.36. Lübeck town seal (1224)
Source: CRUMLIN-PEDERSEN, 2000: 233 («after Ewe, 1972»)

1241 — «in 1241 [...] a cog is mentioned with a cargo capacity of about 240 tons. The Bremen cog from 1380 with a capacity of about 80 tons is just a small version of the type»³⁷.

³⁵ ELLMERS, 1994: 39.

³⁶ ELLMERS, 1994: 37.

³⁷ ELLMERS, 1994: 38.

1243 — «The oldest town seal [...] with additional external stem and sternposts is that of Stavoren in the Netherlands.»³⁸

1256 — «[...] In the Baltic it is that of Wismar [...]»³⁹.

1297 — Reference to the «gentes que andam nas Naes e nos Baixees e nos Aloques e nas Cocas de ffonte Rabia de Sam Sanaschão/de verm éo de Quitaria/de Crasto/de Laredo/de Santander/e de abelhes/e da Crunha que ora estam no Porto da dita Cidade de Lixbba [...]»⁴⁰, «I did not find, however, any allusion to cogs run by Portuguese. Should be concluded that they (the cogs) weren't used among us?»⁴¹.

1299 — Town seal of Danzig (Fig. 2.37) representing a cog with its stern rudder⁴².



Fig. 2.37. Danzig town seal (1299)
Source: ELLMERS, 1994: 41

1304 — «In the summer of 1304 the Florentine chronicler Giovanni Villani wrote: “Then the pirates of Bayonne, of Gascony, came in their ships, which they called cogs, through the Straits of Gibraltar and into the Mediterranean, and caused much damage. Since then people from Genoa, Venice, Catalonia have also started using cogs, and have given up sailing in their large ships, as the cogs are cheaper to build, and more seaworthy. There has thus been a major change in the types of vessel we use in our seafaring”»⁴³.

1329 — Town seal of Stralsund (Fig. 2.38) representing a cog with its stern rudder⁴⁴.

³⁸ ELLMERS, 1994: 37.

³⁹ ELLMERS, 1994: 37.

⁴⁰ PICO, [s.d.]: 90.

⁴¹ PICO, [s.d.]: 91.

⁴² ELLMERS, 1994: 37. The following reference (1333/34) gives an answer to this question.

⁴³ ELLMERS, 1994: 39.

⁴⁴ ELLMERS, 1994: 29.



Fig. 2.38. Stralsund town seal (1329)
Source: ELLMERS, 1994: 29

1334 — «in the year of 1333/34 occurred in the reign of Aragon an important rise of cereal prices. To supply the city of Barcelona the Municipal Consellers gave the order to their chief of fleet, Galferán Marquet, to seize all ships with a wheat cargo. In June of 1334 were seized by the mentioned Marquet 6 portuguese cocas transporting wheat to Portugal; this provoked a serial of complains of the Portuguese King and of the municipal authorities of Lisbon addressed to Alfonso El Benigno and the Consellers of Barcelona [...]»⁴⁵.

1336 — «The clincker construction is pictured in several representations of ships of the 14th century, as in the memorial stone of Bica do Andaluz, (1336)»⁴⁶ (Fig. 2.39). This stone includes at the right of the bas-relief an engraved inscription (not always reproduced together), which indicates the era of 1374⁴⁷.



Fig. 2.39. Representation of a hulk on the left side of the memorial stone at Bica do Andaluz in Lisbon; part of the inscription appears to the right
Source: <<https://www.pinterest.pt/pin/46302702402862754>>. [Access on 18/08/2016]

⁴⁵ FILGUEIRAS, 1982: note 27, 117; CALLICÓ, 1968.

⁴⁶ CASTRO, 2012: 26 *apud* FONSECA, 1935: 15.

⁴⁷ This date refers to the Hispanic Era which in Portugal had been in use until 1422. In the Christian Era (which began 38 years later) it corresponds to the year of 1336, VITERBO, 1865: II, 289-292.

The clinker ship illustrated at *Bica do Andaluz*, with its round stern and lateral rudder, is not a cog but a hulk, as represented on the town seal of Lübeck. However, in this case the symmetrical drakkar protomos of Scandinavian tradition were replaced by the traditional pair of crows turned inside, veiling the deceased Saint Vincent, in accordance with the Christian funerary liturgy and Lisbon heraldic iconography, referring to the transfer of the Saint's body from Algarve (south of Portugal) to Lisbon.

1360 — «Although not having the central rudder represented, a typical cog of the 14th century is sculpted in the memorial stone of the fountain of Arroios (1360, era 1398), with the characteristic straight stem and stern, clinker sides and a single mast lifting a single square sail»⁴⁸ (Fig. 2.40). However, a more careful observation reveals that instead of a typical straight stempost, the Arroios stem is progressively curbed, approaching the typical profile of the 14th century Bayonnese cog⁴⁹, and of the early 15th century model known as *coca of Mataró*, nowadays in the Maritime Museum Prins Hendrik of Rotterdam.



Fig. 2.40. Bica do Andaluz memorial stone

Source: <<http://lisboahojeontem.blogspot.pt/2012/11/chafariz-de-arroios.html>>. [Access on 18/08/2016]

In what concerns the representation of the Arroios ship hull, which looks like a brick wall, the A. of the present paper considers that it is so schematic and rough that it does not allow us to interpret it as a carvel or a clinker-built (even if in this case,

⁴⁸ CASTRO, 2012: 28 *apud* FONSECA, 1935: 17.

⁴⁹ ZWICK, 2016: 655, reproduces two images of what is supposed to be a Bayonnese cog, taken from the site http://www.navalmodel.es/Naval_Model/La_afilada_pluma_de_Lizarraga.html. The upper-left image is a photo of the medallion of «a vault in Bayonne Cathedral, from the late 14th century», whose central subject (apparently in painted relief) is a supposed Bayonnese cog with its typical straight stern and round stem, showing a clear clinker planking alternately represented in yellow and brown. The right-down one shows a beautiful conjectural model of a Bayonnese cog, referred to as «trabajo de Miguel Laburu, ampliado y actualizado por J. M. Lizarraga. Fotos J. M. Lizarraga». Curiously, this model presents a stern/keel skeg (corresponding to the original representation?).

theoretically, the clinker system could be compatible with any dimensional planking constraint, obviously depending on the framing spacing). Indeed, it should always be kept in mind what Sarah C. Humphreys wrote in conclusion, regarding any iconographic interpretation: «[...]. One should always remember, in interpreting iconographic evidence, the rebuke of Matisse to a visitor who was criticizing one of his nudes, for lack of realism: ‘Madame, you seem to be making a mistake. What you are looking at is not a woman: it is a picture’»⁵⁰.

1365 — Town seal of Kiel (Fig. 2.41) representing a cog with its stern rudder⁵¹.



Fig. 2.41. Kiel town seal (1365)
Source: ELLMERS, 1994: 38

1380 — Conventional date of the Bremen cog remains discovered in October 1962. Dendrochronology dates point to 1378 DC.

1430 — «in 1430 Lisbon and Danzig have established permanent commercial relations [...]»⁵².

CONCLUSION

The *Ria de Aveiro* A ship, in spite of being an incomplete find, constitutes so far the closest and sole example in the world of what might have been an early Portuguese caravel, whose origin and development should have occurred in any of the Portuguese coastal zones, either estuary or lagoon, or any other rich in maritime mixed traditions, Atlantic and Mediterranean — especially in the art and science of shipbuilding. The use of ships with a central sternpost and an axial rudder as well as its introduction and diffusion in Atlantic Europe constitute, no doubt, a topic of major significance, in the

⁵⁰ HUMPHREYS, 1978: 79; CASTRO, 2012: 26 *apud* ALBUQUERQUE, 1994: 484.

⁵¹ ELLMERS, 1994: 38.

⁵² CASTRO, 2012: 26 *apud* ALBUQUERQUE, 1994: 484.

context of World History, for the history of techniques, naval architecture and navigation. Indeed, the Hanseatic cog and the Portuguese caravel of *Quattrocento* represent two of the most paradigmatic examples — oceanic and transoceanic, respectively — in late Medieval Europe; the heel of the cog having or not definitely influenced the caravel.

ADDENDUM

The structural remains of the mid-15th-century shipwreck *Ria de Aveiro A* make it, until now, the closest contemporary example of what would have been a caravel of the African coast Portuguese exploration of the 15th century. They are comprised of hull framing and planking elements, parts of the keel, the heel and the keelson, as well as a significant part of the cargo, mainly composed by local common earthenware of large European and even transoceanic diffusion.

Today, twenty years after the beginning of the archaeological excavation in 1996, 17 years after a careful underwater dismantling of the structural elements of the ship in 1999, followed by the beginning of their laboratorial desalination, and 13 years after the beginning of their conservation treatment by impregnation with PEG in water solution (heated, filtered and circulating under monitored conditions) (Figs. 2.42 and 2.43), nothing can guarantee those remains did not undergo an irreversible process of degradation.



Fig. 2.42. Representation of a cog on the memorial stone at the Chafariz de Arroios, Lisbon
Source: Francisco Alves



Fig. 2.43. View of the conservation laboratory of the National Centre for Nautical and Underwater Archaeology in Belém, Lisbon, dismantled in 2010, and not remounted in the new CNANS facilities in the new intermunicipal Central Market of the Lisbon Region, at Loures. The two large tanks (of steel 316) were used for the treatment with PEG of the remains from the *Ria de Aveiro A* shipwreck; behind them, the polypropylene tanks for impregnation also with polyethylene glycol of the Medieval dugouts 1 and 2 from River Lima
Source: Francisco Alves



Fig. 2.44. Steel shelf-stand, hanging from a crane, for the immersion of the wooden structural pieces of RAVA. It could be moved, longitudinally and transversally, over the tanks' area, by means of a «chariot» with manual control working on rails supported by an iron structure composed with H-shaped girders, anchored to the concrete pillars of the building
Source: Francisco Alves

Effectively, the laboratorial conservation process was interrupted in 2010, due to the transfer of the Service of Nautical and Archaeological Archaeology (CNANS, Belém, Lisbon) to a warehouse in the near municipality of Loures. The transfer was not followed by the remounting of any of the devices indispensable to the safety of the structural wooden hull pieces. Even the periodical biological control of the immersed wood was therefore interrupted, with the inevitable risk of degradation of those precious relics.

It must be remembered that conservation treatments (even the preventive ones), on a large scale, of archaeological waterlogged large pieces of wood was introduced for the first time in Portugal under the initiative of CNANS (as part of Portuguese Institute of Archaeology [IPA, 1997-2007]) that, for this purpose, had a conservator following a six-month stage in the Arc-Nucléart of Grenoble, one of the world's most reputed specialized laboratories in conservation of ancient waterlogged woods. However, in 2006, facing the impending official decision to reduce the staff of CNANS, this specialized conservator accepted the invitation to integrate the team of the conservation project *Monitor* (an ironclad dating from the American Civil War times), promoted by NOHA, in association with the Mariner's Museum and Park (Newport News, Virginia).

This situation, promoted and/or tolerated by all Portuguese Governments since 1997, foretold an intolerable calamity to the Portuguese underwater cultural heritage⁵³, and representing an inadmissible disrespect of the 2001 UNESCO Convention on the Protection of the Underwater Cultural Heritage ratified by Portugal in 2006 — following the unanimous and effusive vote of all members of the Portuguese Parliament — represented effectively the progressive disqualification and the final destruction of CNANS in its original version.

EDITED SOURCES

- ALBUQUERQUE, Luís (1994) — *Dicionário de História dos Descobrimentos Portugueses*. Lisbon: Editorial Caminho.
- ALVES, Francisco (1993-1994) — *Por mosaicos nunca dantes navegados. Sobre a iconografia da nave de Ulisses do mosaico de Santa Vitória do Ameixial*. «Conimbriga», vol. 32-33, p. 247-261.
- (1998) — *Archaeology of a shipwreck*. In AFONSO, Simonetta Luz, ed. — *Nossa Senhora dos Mártires: The Last Voyage*. Lisbon: Pavillion of Portugal in the Expo'98; Verbo, p. 182-215.
- (2009a) — *A arqueologia subaquática em Portugal – o legado de Octávio Lixa Filgueiras*. In GARRIDO, A.; ALVES, F., coord. — *Octávio Lixa Filgueiras – Arquitecto de Culturas Marítimas*. Lisbon: Âncora Editora, p. 125-134.
- (2009b) — *O navio português do século XVI de Oranjemund, Namíbia — Relatório das missões realizadas pela equipa portuguesa em 2008 e 2009*. In *Trabalhos da DANS*, 45. Lisbon: DANS-IGESPAR.
- (2011) — *The 16th century Portuguese shipwreck of Oranjemund, Namibia – Report on the missions carried out by the Portuguese team in 2008 and 2009*. In *Trabalhos da DANS*, 45. Lisbon: DANS-IGESPAR.

⁵³ Calamity, not only in what concerns the structural remains of *Ria de Aveiro A* shipwreck, but also the ultra-rare proto-roman dugouts, 4 and 5 of Lima river (Lanheses), (ALVES; RIETH, 2007; RIETH, 2009) — which are still immersed in basic preservation since 2003, but should already be entered in PEG impregnation treatment.

- (2013) — *O salvamento dos vestígios estruturais do navio português do século XVI de Oranjemund, Namíbia, 2008-2009 – um exemplo de cooperação entre um estado «costeiro» e um estado «de bandeira»*. «Revista Tecnologia e Ambiente, Dossiê IX Jornadas de Arqueologia Iberoamericana e I Jornada de Arqueologia Transatlântica», vol. 19, n.º 1, p. 248-261.
- ALVES, Francisco *et al.* (1998) — *A cerâmica dos destroços do navio dos meados do século XV Ria de Aveiro A e da zona Ria de Aveiro B. Aproximação tipológica preliminar*. In *Actas das 2.ªs Jornadas de Cerâmica Medieval e Pós-Medieval*. Tondela: Câmara Municipal de Tondela, p. 185-210.
- (2001a) — *The hull remains of Ria de Aveiro A, a mid-15th century shipwreck from Portugal: a preliminary analysis*. In ALVES, Francisco, ed. — *Proceedings – International Symposium on Archaeology of Medieval and Modern Ships of Iberian-Atlantic Tradition – Hull remains, manuscripts and ethnographic sources: a comparative approach*. Lisboa: IPA, p. 317-345.
- (2001b) — *Ria de Aveiro A: a shipwreck from Portugal dating to the mid-15th century; a preliminary report*. «International Journal of Nautical Archaeology and Underwater Exploration», vol. 30, n.º 1, p. 2-36.
- (2001c) — *The remains of a 14th-century shipwreck at Corpo Santo, and of a shipyard at Praça do Município, Lisbon, Portugal*. In ALVES, Francisco, ed. — *Proceedings International Symposium on Archaeology of Medieval and Modern Ships of Iberian-Atlantic Tradition – Hull remains, manuscripts and ethnographic sources: a comparative approach*. Lisbon: IPA, p. 405-426.
- BARATA, João da Gama Pimentel, ed. (1996) — *João Baptista Lavanha. Livro Primeiro da Architectura Naval*. Fac-símile. Lisbon: Academia de Marinha.
- BILL, Jan *et al.* (1997) — *Fra stammebåd til skib*. In *Dansk søfarts historie 1. Indtil 1588*. København: [s.n.].
- BONINO, Marco (1978) — *Lateen-rigged medieval ships. New evidence from wrecks in the Po Delta (Italy) and notes on pictorial and other documents*. «International Journal of Nautical Archaeology and Underwater Exploration», vol. 7, n.º 1, p. 9-28.
- CALLICÓ, Jaume Sobrequés (1968) — *Sequestro de naves portuguesas en Cataluña (1334)*. In *Congresso Luso-Espanhol de Estudos Medievais (Oporto, 18 to 23 of June, XI Centenário da Presúria de Portugale por Vímara Peres)*. Porto: Câmara Municipal.
- CARVALHO, Patrícia; BETTENCOURT, José António (2012) — *De Aveiro para as margens do Atlântico: a carga do navio Ria de Aveiro A e a circulação de cerâmica na Época Moderna*. In TEIXEIRA, André; BETTENCOURT, José António, coord. — *Velhos e Novos Mundos – Estudos de Arqueologia Moderna*. Lisbon: CHAM, vol. 2, p. 733-746.
- CASTRO, Filipe (2001) — *A Portuguese Indiaman at the Mouth of the Tagus River*. Texas: Texas A&M University. PhD dissertation.
- (2012) — *Os navios dos séculos XVI e XVII: linhas gerais de evolução, unidades de medida e arqueio*. In DOMINGUES, Francisco Contente, coord. — *História da Marinha Portuguesa – Navios, Marinheiros e Arte de Navegar – 1500-1668*. Lisbon: Academia de Marinha, p. 17-45.
- CRUMLIN-PEDERSEN, Ole (2000) — *To be or not to be a cog: the Bremen Cog in perspective*. «International Journal of Nautical Archaeology and Underwater Exploration», vol. 29, n.º 2, p. 230-246.
- ELLMERS, Detlev (1994) — *The cog as a cargo carrier*. In GARDINER, R.; UNGER, R., ed. — *Cogs, Caravels and Galleons, The Sailing Ship 1000-1650*. London: Conway's History of the Ship, p. 29-46.
- ESPARTEIRO, António Marques (1974) — *Dictionary of naval terms (English-Portuguese)*. Lisbon: Centro de Estudos de Marinha.
- EWE, H. (1972) — *Schiffe auf Siegel*. [S.l.]: [s.n.].
- FENWICK, Valerie (1978) — *Graveney boat*. «Oxford: NMM Archaeological», series 3, BAR 53.
- FILGUEIRAS, Octávio Lixa (1982) — *A nave esculpida numa torre da Sé do Porto. Ensaio de identificação*. «Arqueologia», vol. 6, p. 112-117.

- FONSECA, Henrique Quirino da (1935) — *Memórias e conferências sobre história e arqueologia*. Lisbon: Serviços Industriais da C. M. L.
- HUMPHREYS, Sarah C. (1978) — *Artists' mistakes*. «International Journal of Nautical Archaeology and Underwater Exploration», vol. 7, n.º 1, p. 78-79.
- MARQUES, António H. R. Oliveira (1959) — *Hansa e Portugal na Idade Média*. Barcarena: Editorial Presença.
- MCGRAIL, Seán (1998) — *Ancient Boats in North-West Europe — The Archaeology of Water Transport to AD 1500*. London; New York: Longman Archaeology Series.
- MENDONÇA, Henrique Lopes, ed. (1991) — *Fernando Oliveira, O Livro da Fabrica das Naos*. Fac-símile. Lisbon: Academia de Marinha.
- NIETO, Xavier; RAURICH, Xim, coord. (1998) — *Excavacions arqueològiques subaquàtiques a Cala Culip, 2. Culip VI*. Girona: Museu d'Arqueologia de Catalunya-Centre d'Arqueologia Subaquàtica de Catalunya.
- OERTLING, Thomas (2001) — *The concept of Atlantic vessel*. In ALVES, Francisco, ed. — *Proceedings International Symposium on Archaeology of Medieval and Modern Ships of Iberian-Atlantic Tradition — Hull remains, manuscripts and ethnographic sources: a comparative approach*. Lisbon: IPA, p. 233-240.
- PICARD, Christophe (1997a) — *La mer et les musulmans d'Occident au Moyen Âge – VIII^e-XIII^e siècle*. Vendôme: PUF.
- (1997b) — *L'océan Atlantique musulman: De la conquête arabe à l'époque almohade: navigation et mise en valeur des côtes d'al-Andalus et du Maghreb occidental (Portugal-Espagne-Maroc)*. Paris: Editions UNESCO.
- PICO, Maria Alexandra Carbonell [s.d.] — *A terminologia naval portuguesa anterior a 1640*. Lisbon: Sociedade de Língua Portuguesa.
- RODRIGUES, Paulo et al. (2001) — *L'Épave d'un navire de la deuxième moitié du XV^e siècle/début du XVI^e siècle, trouvé au Cais do Sodré (Lisbonne). Note préliminaire*. In ALVES, Francisco, ed. — *Proceedings International Symposium on Archaeology of Medieval and Modern Ships of Iberian-Atlantic Tradition — Hull remains, manuscripts and ethnographic sources: a comparative approach*. Lisbon: IPA, p. 347-380.
- VITERBO, Joaquim de Santa Rosa de (1865) — *Elucidário das palavras, termos e frases que em Portugal antigamente se usaram e que hoje regularmente se ignoram...* Lisbon: A. J. Fernandes Lopes.
- ZWICK, Daniel (2016) — *Bayonese cogs, Genoese carracks, English dromons and Iberian carvels: Tracing technology transfer in medieval Atlantic shipbuilding*. «ITSAS Memoria. Revista de Estudios Marítimos del País Vasco», vol. 8, p. 647-680.

