

INDEX OF FIGURES

Fig. 1.1. Location of the wreck <i>Erquy-les-Hôpitaux</i> , Côtes d'Armor, France	21
Fig. 1.2. General view of the site; the wreck is situated near the yellow tractor and the group of people	22
Fig. 1.3. Orthophotography of the wreck	26
Fig. 1.4. Identification of the architectural elements	27
Fig. 1.5. The keel	27
Fig. 1.6. The open mortise in the aft extremity of the keel	29
Fig. 1.7. Three traces of assembly by iron pins/bolts in the keel	30
Fig. 1.8. The sternpost knee	31
Fig. 1.9. The best preserved iron pin/bolt between the floor timbers VR58 and VR59	34
Fig. 1.10. Planimetric view of the architectural remains	34
Fig. 1.11. Obliquely worked lower extremities of the futtocks; the direction of the bevel is reversed	36
Fig. 1.12. The master frame VR57 (floor timber)/VR55 (futtock)	38
Fig. 1.13. The tetrahedral pilot hole in the front end of the sternpost knee	38
Fig. 1.14. Planimetric view of the various wood species in relation with the architectural remains	40
Fig. 1.15. The filling boards (left to right) AC15, C14, AC13, AC12	41
Fig. 1.16. Reconstruction of the lines	45
Fig. 1.17. 3D reconstruction of the architectural structure	45
Fig. 1.18. 3D reconstruction of the coaster <i>Erquy-les-Hôpitaux</i>	46
Fig. 2.1. The Aveiro lagoon in the Iberian Peninsula map	53
Fig. 2.2. Archaeological site of the <i>Ria de Aveiro A</i> shipwreck	54
Fig. 2.3. View of the ship remains in an extreme low tide of 0.3 m, in 1993	54
Fig. 2.4. Underwater view of the remains (the heel in the foreground) completely uncovered and recorded, just before their archaeological dismantling in 1999	55
Fig. 2.5. RAVA. Plan of the architectural remains	56
Fig. 2.6. Underwater view of the terminal part of the heel of RAVA	56
Fig. 2.7. Heel (with its stern-knee) drawn by Lavanha in his treaty of the early 17th century	57
Fig. 2.8. Heel and stern-knee of <i>Varadouro</i> shipwreck (river Cávado estuary, Esposende), 16th century/1st half of the 17th century	57
Fig. 2.9. Heel of <i>Corpo Santo</i> shipwreck, 14th century	58
Fig. 2.10. Segment from the keel of <i>Ria de Aveiro A</i> with vertical scarfs in their extremities	58
Fig. 2.11. A segment of the keelson of <i>Ria de Aveiro A</i> where the rectangular sloping carving for the deck post sliding can be seen	59
Fig. 2.12. RAVA. Axial section of the preserved structure of <i>Ria de Aveiro A</i> with its iron nailing system	59
Fig. 2.13. Typical frame-futtock connection, through dovetail mortise and double fastening, with iron nails and wooden pegs	60
Fig. 2.14. The so-called Atlantic scheme of the master-frame and its adjacent frames	60
Fig. 2.15. Wooden barrel stave and fragments of wicker hoops	61
Fig. 2.16. Typical common earthenware production from the Aveiro region	61

Fig. 2.17. Two bowls deformed and welded in consequence of a fire in the cargo hold	62
Fig. 2.18. Fragment of a starboard side hull plank burnt on its internal face	62
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)	63
Fig. 2.20. Drawing of the axial-transversal sections of the first three partially preserved frames	63
Fig. 2.21. View of the hull bottom of the <i>Contarina 1</i> shipwreck in the River Po delta in 1898	64
Fig. 2.22. Drawings and graphic reconstruction of the <i>Contarina 1</i>	65
Fig. 2.23. Detailed plan of the extreme fore part of the architectural remains	65
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	66
Fig. 2.25. Architectural sequence of the preserved frames, represented by the respective transversal sections	67
Fig. 2.26. <i>Ria de Aveiro A</i> shipwreck plan, reviewed and annotated by the A. (for Cadiz seminar, 2015)	68
Fig. 2.27. Eric Rieth and Paulo Rodrigues testing the curvature of the first frames of <i>Ria de Aveiro A</i> shipwreck, with the help of a mould of the master-frame, in the plywood model at 1:1 scale, said 'in 2D'	69
Fig. 2.28. View of the 2D and 3D models of the preserved framing at the CNANS facilities in 2004	69
Fig. 2.29. Cog sculpted on the southern tower of the Oporto Cathedral	71
Fig. 2.30. Bremen cog displayed in the Deutsches Schiffahrtsmuseum of Bremerhaven	72
Fig. 2.31. Central section of the Bremen cog	73
Fig. 2.32. Central sections of the cogs from Kollerup, Kolding and Vejby	73
Fig. 2.33. Jutland map with the Frisian region and the Skagen cape pointed out	74
Fig. 2.34. Clinker hull frame found in the 70s near Alfeizerão	75
Fig. 2.35. Low relief band of the baptistery in the Winchester Cathedral	76
Fig. 2.36. Lübeck town seal (1224)	76
Fig. 2.37. Danzig town seal (1299)	77
Fig. 2.38. Stralsund town seal (1329)	78
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	78
Fig. 2.40. Bica do Andaluz memorial stone	79
Fig. 2.41. Kiel town seal (1365)	80
Fig. 2.42. Representation of a cog on the memorial stone at the Chafariz de Arroios, Lisbon	81
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 <i>Ria de Aveiro A</i> shipwreck; behind them, the polypropylene tanks for impregnation also with polyethylene glycol of the Medieval dugouts 1 and 2 from River Lima	82
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	82
Fig. 3.1. Geometrical plane of the hull planking exterior	90
Fig. 3.2. Cut-to-length design	90
Fig. 3.3. Passing from the geometrical plane of the hull planking's exterior to the framework	92

Figure 3.4. Division and marking of the 40 frame lines	92
Figure 3.5. The process of obtaining the plane of transversal sections	93
Figure 3.6. Horizontal projection of balance lines	94
Figure 3.7. Transferring from the balance lines slope angles to the slope angles' wooden board, between the 30th and the 40th frames	95
Figure 3.8. Width extraction to the spline (1st step)	96
Figure 3.9. Transposing the widths from the spline to the wooden board (2nd step)	97
Figure 3.10. Moulds for wood shaping the frames	98
Figure 3.11. Moulds for wood shaping the frames, apart	99
Figure 3.12. Design of frame 33 in perspective	100
Figure 3.13. Section in the middle of the frame, dividing the odd and even parts	101
Figure 3.14. Reversing the position of the even parts with the odd parts in the master frame	102
Figure 3.15. Obtuse slope angles and acute slope angles	103
Figure 3.16. Wood shaping the floor timber of frame 33	104
Figure 3.17. <i>Counterdrawing</i> — Image of the <i>counterdrawing</i> grid	105
Figure 3.18. <i>Counterdrawing</i> the floor timber of frame 33	106
Figure 3.19. The completed floor timber	106
Figure 3.20. Wood shaping the second of frame 33 at the easels	107
Figure 3.21. Wood shaping the second of frame 33	107
Figure 3.22. <i>Counterdrawing</i> the second of frame 33	108
Figure 3.23. Wood shaping the fourth of frame 33	108
Figure 3.24. <i>Counterdrawing</i> the fourth of frame 33	109
Figure 3.25. Wood shaping the odd parts (the first, the third, and the fifth)	110
Appendix 1. Detail of a vessel under construction. A view of the shipyard of Rochefort, showing both vessels and galleys, Nicolas Berquin, 1690. Drawing in pen and black ink, brown and grey wash, watercolor highlights, marouflaged paper on canvas.	136
Figure 8.1. <i>Cutty Sark 2</i>	195
Figure 8.2. Replica ship <i>Shtandart</i>	197
Figure 8.3. <i>Shtandart</i> construction team in St. Petersburg (1999)	197
Figure 8.4. <i>Cutty Sark</i> (1869)	198
Figure 8.5. Visitors watching <i>L' Hermione</i> construction (2013)	200
Figure 8.6. Vila do Conde	201
Figure 8.7. Tres Hombres loading cargo for transportation under sails	202
Figure 8.8. Loading tea to tea-clipper in China	202
Figure 8.9. Drawings of <i>Cutty Sark</i> sails and rigging	203
Figure 8.10. Centerframe of <i>Cutty Sark 2</i>	204
Figure 8.11. Drawings of <i>Cutty Sark 2</i>	205
Figure 8.12. 3D drawings <i>Cutty Sark 2</i>	205
Figure 8.13. Design layout <i>Cutty Sark 2</i>	206

