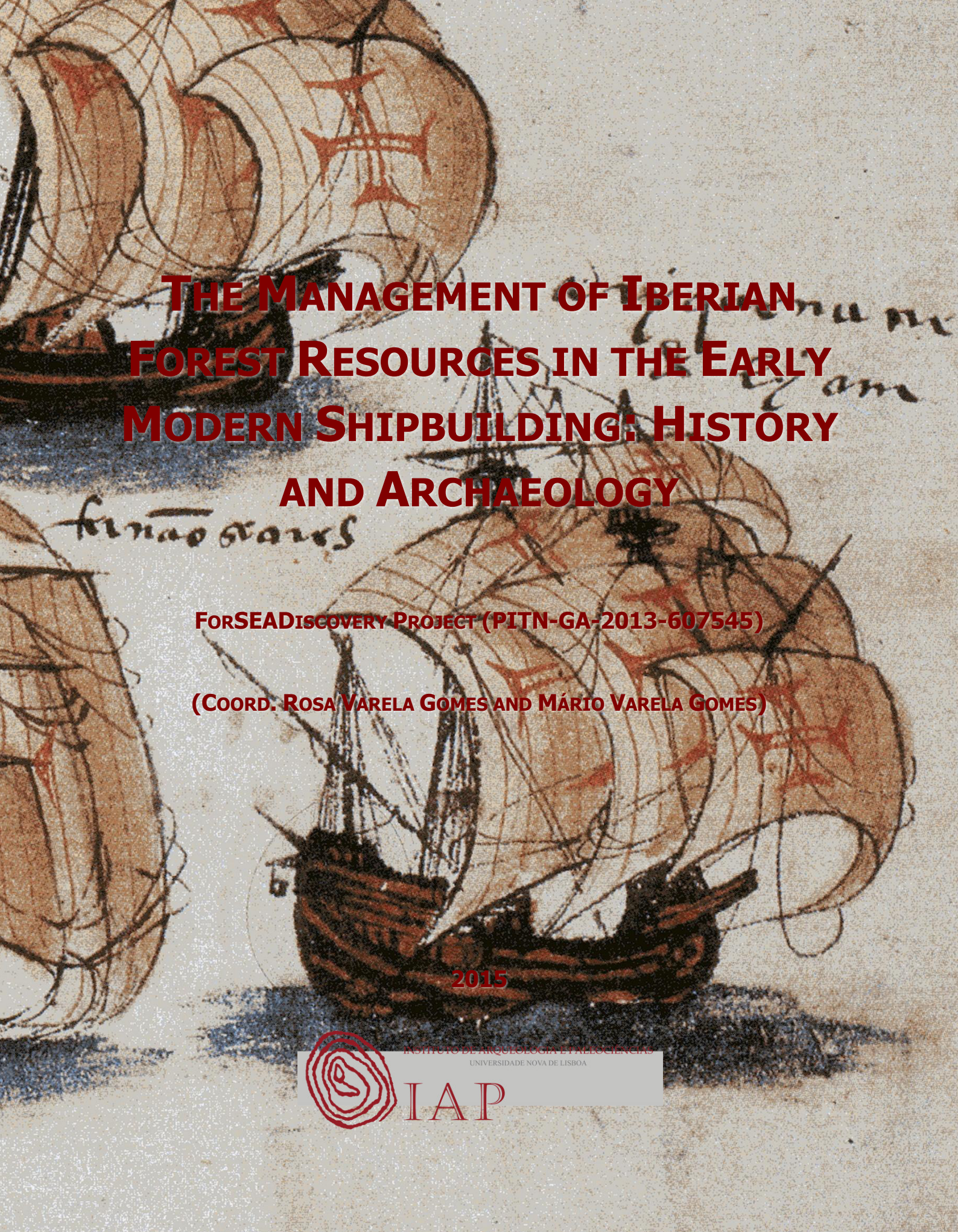


The Management of Iberian Forest Resources in the Early Modern Shipbuilding: History and Archaeology

ForSEADiscovery Project (PITN-GA-2013-607545)

(Coord. Rosa Varela Gomes and Mário Varela Gomes)

2015

INSTITUTO DE ARQUEOLOGIA E PALEOCIÊNCIAS
UNIVERSIDADE NOVA DE LISBOA
IAP

THE MANAGEMENT OF IBERIAN FOREST RESOURCES IN THE EARLY MODERN SHIPBUILDING: HISTORY AND ARCHAEOLOGY

FORSEADISCOVERY PROJECT (PITN-GA-2013-607545)

(COORD. ROSA VARELA GOMES AND MÁRIO VARELA GOMES)

LISBON

2015

INSTITUTO DE ARQUEOLOGIA E PALEOCIÊNCIAS
UNIVERSIDADE NOVA DE LISBOA
IAP

TITLE:

The Management of Iberian Forest Resources in the Early Modern Shipbuilding: History and Archaeology

ForSEADiscovery Project (PITN-GA-2013-607545)

COORDENATION:
Rosa Varela Gomes (IAP-UNL)
Mário Varela Gomes (IAP-UNL)

AUTHORS:
Adolfo Miguel Martins (UWTSD)
Ana Crespo Solana (CSIC)
Ana Rita Trindade (CSIC)
António Rocha Santos (IAP-UNL)
Beñat Eguiluz Miranda (UWTSD)
Cristina Joanaz de Melo (IHC, FCSH-UNL)
Filipe Castro (Texas A&M University)
Koldo Trápaga Monchet (IAP-UNL)
Miguel San Claudio Santa Cruz (Archeonauta S.L.)
Nigel Nayling (UWTSD)
Tânia Manuel Casimiro (IAP-UNL)

PHOTOGRAPHS:
Joana Gonçalves
Authors

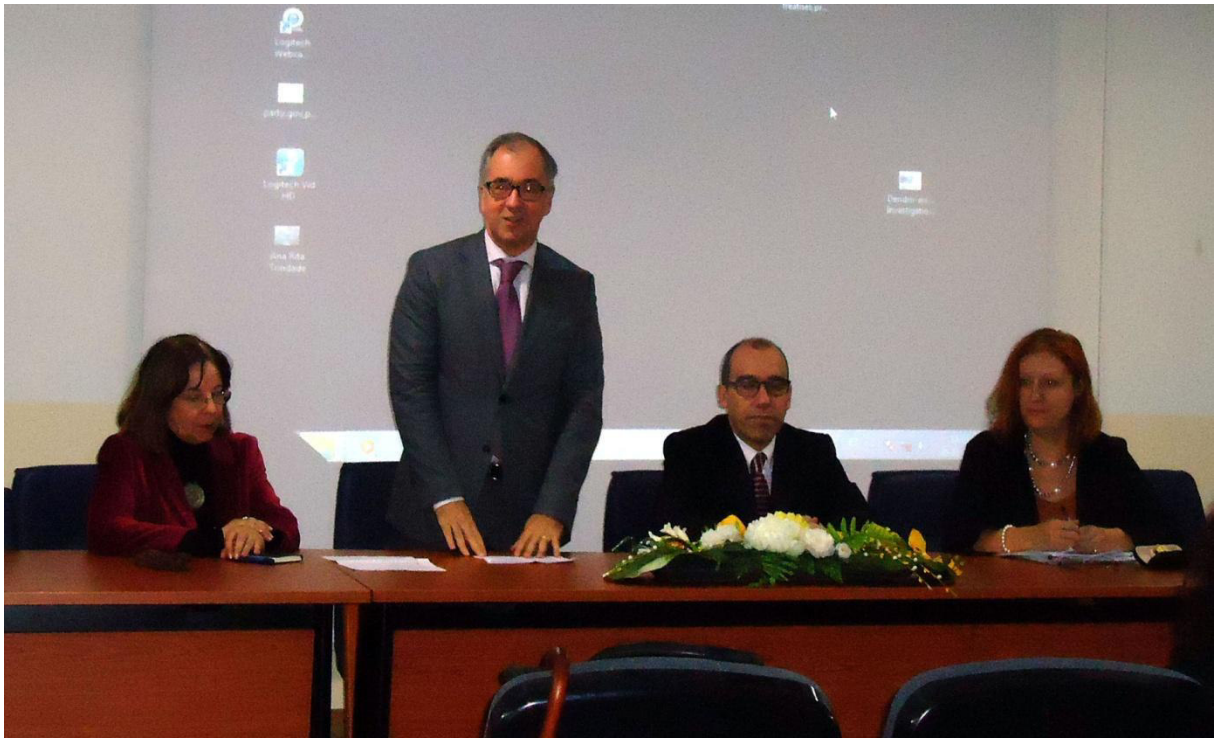
DESIGN:
Joana Gonçalves
Mário Varela Gomes

PRINTING AND BINDING
Ulzama Digital - Navarra - España
Print-run: 200 copies

ISBN: 978-84-7956-150-5
Legal Deposit: Z 1745-2015
Distribution: Pórtico Librerías, S.L. · Muñoz Seca, 6 · 50005 Zaragoza (España) · distrib@porticolibrerias.es · www.porticolibrerias.es

Sponsors:

INDEX



Sessão de abertura com Rosa Varela Gomes, Nuno Vassallo e Silva, Francisco Caramelo e Ana Crespo Solana.

Apresentação de comunicações: Tânia Manuel Casimiro; Ana Rita Trindade; Filipe Castro; Nigel Nayling; Cristina Joanaz de Melo; Koldo Trápaga Monchet.

INTRODUCTION: FORESTRY, SHIPBUILDING AND TIMBER SUPPLY IN THE AGE OF DISCOVERY

Ana Crespo Solana
(Consejo Superior de Investigaciones Científicas)
Nigel Nayling
(University of Wales Trinity Saint David)

Environmental History is today an international and interdisciplinary undertaking with roots in archaeology, anthropology and the introduction of ecology into Human Sciences (Winiwarter, 2004: 501-530). In recent years Cultural Heritage studies have come to complete this research landscape and new investigations are being developed in international programmes. As part of the ForSEAdiscovery project,[1] innovative research is being conducted which derives from three important disciplines: history, dendrochronology and nautical archaeology. Each of these sciences has in its own right shed much light on several issues: first, the historical reasons behind the construction of large navies in modern times; second, those beautiful and sometimes long forgotten cultural traces taking us back to the old, legendary ships which are now part of our underwater heritage; and third, the relevance of the forestry resources as the raw material *par excellence* although often taken for granted in social research.

These three combined disciplines can provide many answers in relation to the various issues resulting from the ever increasing human pressure on forests and how those resources have been used throughout the centuries as they were exploited by administrations and policies which paid no heed to environmental issues, human rights or the people's social and economic needs. History and nautical archaeology, as social and humanistic sciences, offer a broad overview/vision of the development of naval construction by collecting information from documents, historic literature, and treaties on the mechanics involved in building ships such as galleons and merchant vessels of all types. The variety and complexity of the choice of vessels is overwhelming in their development from the medieval vessels to the ocean-going ships of the Age of Discovery and overseas expansion (Phillips, 1986; Loewen, 2000; 2001). Besides, nautical archaeology has been the greatest ally of historical research, sometimes correcting or even refuting documentary evidence with material proof from the ships in the Modern Era, built in timber between the 15th and the 18th centuries. Dendrochronology[2] is the science of tree-ring dating, adding precious, unprecedented value to the research into naval construction and underwater heritage. Dendrochronology has the ability to provide previously unknown information on the source of the wood used to build the ships now found on the wreck sites under investigation by this project. Dendrochronology has become the barcode between history and archaeology, adding to and complementing the invisible and intangible ties between these two social sciences (Soberón, Pujol, Llergo, Riera, Juliá and Domínguez-Delmás, 2012; Rich, Manning, Degryse, Vanhaecke and Lerberghe, 2015; Nayling and Jones, 2014). This vision can only be embraced within the context of Environmental History as this is the foundations on which the intellectual rationale of ForSEAdiscovery rests (Crespo Solana, forthcoming; Crespo Solana and Nayling, forthcoming publication).

The history of deforestation in Europe is closely linked to economic development and military expansion (Richards, 2006). Wood was the first and most important natural resource to construct the first exploratory fleets, and subsequently to build and arm navies for the expansion and conquest of new territories, as well as for the associated mercantile operations. Therefore, the use and exploitation of forest resources over the modern period is comparable to the use of oil since the Industrial Revolution in terms of strategic importance. However, historiography has yet to develop nuanced analyses of the relationships between deforestation processes and the

use of resources for shipbuilding. Historical analyses of European expansion and Atlantic trade have traditionally been approached from economic, social, or political viewpoints (Crespo Solana, 2011), leaving *lacunae* with regard to the technologies and raw materials that enabled and sustained them. Similarly, previous historical studies have neglected the possible influence that commercial, maritime, and colonial European expansion had in the use of natural resources, especially forests. To date, only a few relevant works exist that relate expansion and deforestation (Chew, 2001), but their coverage of the Early Modern Period focuses on the 18th century, leaving references to 16th and 17th century brief and shallow. Some authors have pointed (if not directly then indirectly) to the role wood trade had in the economic growth of 16th and 17th century European empires (De Vries and van der Woude, 1995) and although other historical works have tackled the subject of the raw materials used for shipbuilding, they again mostly focus on the 18th century, including references to 16th century as mere anecdotes (Albion, 1926; Aranda y Antón, 1990). The role that the massive use of wood in shipbuilding played in deforestation in Europe in the Early Modern Period has perhaps surprisingly been assumed rather than subjected to sustained study and academic discourse. Some historical studies address the problem of deforestation related to the development of agricultural land, but they approach it from an ecological, peripheral view, more than as a historical global process that was linked to the expansion of the western world through commercial maritime routes. Shipbuilding may well have been a contributory factor in deforestation, but no empirical studies such as the one we propose with ForSEAdiscovery have been attempted (Buis, 1985; Williams, 1997: 169-187). Developments in recent decades, particularly in disciplines such as nautical archaeology and wood provenancing (through tree-ring research) allow a subject previously largely studied through historical enquiry to be re-examined through multi-disciplinary and trans-national research. Nautical archaeology has led to the discovery of numerous shipwrecks from the Age of Discovery and European expansion, both within and beyond Europe. Well-preserved remains of ship-hulls of European construction (often Spanish and Portuguese) have been discovered and excavated with a global distribution reflecting the rapid expansion of oceanic exploration, trade and colonisation in the Early Modern Age (Castro, 2008). The surviving timbers of these hulls present direct evidence of forests managed and exploited by maritime nations at this time, complementing contemporary documentary evidence and providing evidence where other information no longer exists (Casado Soto, 2001: 131-162). Whilst shipwreck assemblages from North Sea and Baltic Sea shipbuilding industries have been the subject of dendro-archaeological study, this has not been true for Iberian vessels. Although some studies published in the last decade have combined archaeo-historical or tree-ring research to address the question of shipbuilding in the Age of Discovery, there is still a lack of systematic research of such remains from a multidisciplinary perspective, which leaves unsolved questions, such as the date and provenance of timber-remains from Iberian shipwrecks (Bridge, 2011; Nayling and Suspérregui, 2014).[3] Advances in historical dendrochronology now allow the precise dating and provenancing of timbers originating from areas where regional tree-ring chronologies have been developed (Daly, 2007; Sass-Klaassen, Vernimen, Baitinger, 2008; Wazny 2005). While the tree-ring dataset has grown and acquired a high resolution in some areas of Europe (mostly in countries from central and northern Europe where this science was established decades ago), there are still data-gaps in crucial geographical areas, such as the Iberian Peninsula, that hamper the dating and provenancing of wood with this origin by means of tree-ring research (Haneca, 2009). Therefore, the development of reference tree-ring chronologies in areas from Atlantic Iberia that supplied wood for shipbuilding (e.g. Cantabrian Mountains and Cazorla and Segura Mountains in Spain, and Portugal) would be a first step towards the assessment of the date and provenance of Iberian ship-remains (Domínguez-Delmás *et al*, 2013; 2015).

In this historical context some problems that can be understood only from the perspective of a truly interdisciplinary research have emerged: Did forest resources sustain this increasing demand for ship timber, or was the wood imported from elsewhere? If so, how were the trade networks organized? Did a scarcity of raw materials encourage the technological changes which occurred in shipbuilding in the 16th century, or were they a result of socio-technological exchange between Mediterranean and Atlantic shipbuilding traditions? Did demand for timber lead to sustainable changes in forestry practice in the Iberian Peninsula or deforestation and increased dependence on imported material? The primary research goal is to find answers to these questions through a multidisciplinary, innovative and pioneer training research

program, to improve the understanding of our historical past, our cultural heritage, and our knowledge of the use of forest resources for shipbuilding as a basic raw material in the European expansion. These questions refer to general approaches within the ForSEAdiscovery project design that was presented for the first time in response to the European Commission Marie Curie Actions Initial Training Network call in 2012. A consortium of scholars from twelve universities and research centres led by the Consejo Superior de Investigaciones Científicas (CSIC) secured this European funding in July 2013, and the ForSEAdiscovery project formally started in February 2014. The combination of the Humanities (history and archaeology) with Life Sciences (dendrochronology) intended to address the *lacunae* in our understanding of the relationship between the problems of deforestation, the use, administration and management of natural resources and the development of societies where pre-industrial maritime shipbuilding became the key to understanding the progress of these maritime societies.

The research program ForSEAdiscovery is beginning to leave a legacy that is already reflected in the texts included in this book. The scientific meeting: *"A Gestão dos Recursos Florestais ibéricos na Construção naval da Idade Moderna: História e Arqueologia"* discussed some important topics related to forestry, shipbuilding and timber supply in Spain and Portugal. At the time of editing this volume, nearly two years after the start of the project, the ForSEAdiscovery team comprises sixteen fellows in training, all of them contracted under project funds, including thirteen PhD students and three experienced researchers. These fellows are opening new lines of research and creating new analyses within the framework of the project. Some of these investigations have already produced results which are published in this book. The book is composed of nine articles, five of which have been written by ForSEAdiscovery fellows. Adolfo Martins reviews approaches to the archaeological recording of ship timbers and considers the role that recent developments in 3D digital recording can play in allowing more nuanced characterisation and reconstruction of contemporary forestry practice and timber supply and selection. Beñat Eguiluz-Miranda reviews concepts of Iberian, Atlantic and Cantabrian shipbuilding traditions. In an erudite paper, Koldo Trápaga Monchet give an approach to the way the royal forests of the Portuguese Kingdom were used to remodel the naval power of the fleets of the Consulado and the Eastern Indies. Ana Rita Trindade explains the strategies for timber supply in Eighteenth-century Andalucia in the context of Spanish Naval policy; and António Rocha Santos explores forest management in Portugal (15^{th}-16^{th} centuries) by analysing documents from the age of King D. Manuel I. The articles by Cristina Joanaz de Melo and Tânia Casimiro deal with important matters about timber supply and shipbuilding techniques in Portugal and Portuguese trade with seventeenth-century England by analysing the port books which have interesting information about peoples and commodities.

Two top essays are included in this monograph written by two senior members of the ForSEAdiscovery team: Miguel San Claudio dives into the historical and archaeological narrative of Galician shipwrecks in the context of the Armada's war of Phillip II. Filipe Castro explores the India route as the longest commercial one of sixteenth-century Portugal and describes the building of the Portuguese 'naus' and the importance, and adventured, narrative of the Indiamen, shipwrecks and the Portuguese shipbuilding in the context of Europe's history of science and ideas.

As ForSEAdiscovery leaders we are grateful to Francisco Caramelo (Subdirector de FCSH/UNL) and Nuno Vassallo e Silva (Director General del Patrimonio Cultural) for their kind sponsorship during the Colloquium and to our partner in the ForSEAdiscovery Consortium, Rosa Varela Gomes for having this providential initiative. The internationalisation and institutional recognition of the ForSEAdiscovery project continues, as it is increasingly becomes part of emerging environmental humanities and social sciences studies. This is made visible in this collective book which is not only attractive to humanists and social scientists but also scholars from many other humanities subjects as well as scientists from the natural sciences. Our vision is that such synergies guarantee major advances not only in history and nautical archaeology but also in ecological and cultural heritage studies.

BIBLIOGRAPHY

ALBION, R. G. (1926) – *Forest and Sea power: the timber Problem of the Royal Navy, 1652-1862* (Cambridge: Harvard University Press).

ARANDA y ANTÓN, G. (1990) – *Los Bosques Flotantes: historia de un roble del siglo XVIII* (Colección Técnica, Ministerio de Agricultura, Pesca y Alimentación, ICONA, Madrid).

BRIDGE, M. (2011) – "Resource Exploitation and Wood Mobility in Northern European Oak: dendroprovenancing of individual

timbers from the Mary Rose (1510/11? 1545)", *International Journal of Nautical Archaeology*, vol. 40(2), 417-423.

BUIS, J. (1985) – *Historia forestis: Nederlandse bosgeschiedenis*. 2 vols. (Utrecht).

CASADO SOTO, J.L. (2001) – "The Spanish ships of the Oceanic expansion. Documentation, archaeology and iconography form the 15th and 16th centuries", in Alves, F. ed. *Proceedings International Symposium on Archaeology of Medieval and Modern Ships of Iberian-Atlantic Tradition. Hull remains, manuscripts and ethnographic sources: a comparative approach. Trabalhos de Arqueologia*, 18. Instituto Português de Arqueologia, pp. 131-162.

CASTRO, F. (2008) – "A Group for the Study of Iberian Seafaring", in Castro, F. and Custer, K., eds., *Edge of Empire. Proceedings of the Symposium held at the 2006 Society for Historical Archaeology Annual Meeting*, Sacramento, California (Lisbon: Caleidoscópio).

CHEW, S.C. (2001) – *World Ecological Degradation: accumulation, urbanization and deforestation, 3000 B.C – A.D. 2000* (Rowman & Littlefield, Altamira).

CRESPO SOLANA, A. and NAYLING, N. (forthcoming) – "ForSEAdiscovery: Forest resources for Iberian Empires: Ecology and Globalization in the Age of Discovery (16^{th}-18^{th} centuries)", *IKUWA 5 Proceedings*.

CRESPO SOLANA, A. (2011) – "Geostrategy of a System? Merchant Societies and Exchange Networks as Connection Centres in the Spanish Atlantic Trade in the First Global Age", in Mukherjee, R. (ed.) *Networks of the First Global Age, 1400-1800*, Delhi, Primus Book, 11-32.

CRESPO SOLANA, A. (forthcoming) – "ForSEAdiscovery: Génesis y marco histórico-metodológico de un proyecto interdisciplinar en Humanidades" (Lisboa).

DALY, A. (2007) – *Timber, Trade and Tree-rings. A Dendrochronological Analysis of Structural Timber in Northern Europe, c. AD 1000 to c. AD 1650*, PhD Dissertation, Univ. of Southern Denmark.

DE VRIES J. and van der WOUDE A. M. (1995) – *Nederland 1500–1815. De eerste ronde van moderne economische groei* (Amsterdam).

DOMÍNGUEZ-DELMÁS, M., ALEJANO-MONGE, R., VAN DAALEN, S., RODRÍGUEZ-TROBAJO, E., GARCÍA-GONZÁLEZ, I., SUSPERREGI, J., WAZNY, T. and JANSMA, E. (2015) – "Tree-rings, forest history and cultural heritage: current state and future prospects of dendroarchaeology in the Iberian Peninsula". *Journal of Archaeological Science*, 57, p. 180-196.

DOMÍNGUEZ-DELMÁS, M., NAYLING, N., WAZNY, T., LOUREIRO, V. and LAVIER, C., (2013) – "Dendrochronological Dating and Provenancing of Timbers from the Arade 1 Shipwreck, Portugal". *International Journal of Nautical Archaeology*, 42(1), p. 118-136.

GUTIÉRREZ MERINO, E. (2008) – "La Dendrocronología: métodos y aplicaciones", Research Gate (accessed August 2015) http://www.researchgate.net/publication/228769173.

HANECA, K., ČUFAR, K. and BEECKMAN, H. (2009) – "Oaks, tree-rings and wooden cultural heritage: a review of the main characteristics and applications of oak dendrochronology in Europe", *Journal of Archaeological Science* 36, 1-11.

LOEWEN, B. (2000) – "Forestry practices and hull design, ca 1400-1700". In: Guerreiro, I. (ed.), *Fernando Oliveira and His Era: Humanism and the art of navigation in Renaissance Europe (1450–1650)*, (Patrimonia, Aviero), p. 143–151.

LOEWEN, B. (2001) – "The structures of Atlantic shipbuilding in the 16th century. An archaeological perspective", in Alves, F. ed. *Proceedings International Symposium on Archaeology of Medieval and Modern Ships of Iberian-Atlantic Tradition. Hull remains, manuscripts and ethnographic sources: a comparative approach*. TA, 18. IPA, 241-258.

NAYLING, N. and JONES, T. (2014) – "The Newport Medieval ship, Wales, United Kingdom", *The International Journal of Nautical Archaeology*, vol 43, 2: 239-278.

NAYLING, N. and SUSPÉRREGUI, J. (2014) – "Iberian Dendrochronology and the Newport Medieval ship", *The International Journal of Nautical Archaeology*, vol 43, 2: 279-291.

PHILLIPS, R. C. (1986) – *Six Galleons for the King of Spain. Imperial defense in the early seventeenth century* (Baltimore: John Hospkins).

RICH, S., MANNING, S. W., DEGRYSE, P., VANHAECKE, F. and LERBERGHE, K. (2015) – "Provenancing East Mediterranean cedar Wood with the 87SR/86SR strontium isotope ratio", *Archaeology Anthropology Sciences*, DOI 10.1007/s12520-015-0242-7.

RICHARDS, J. F. (2006) – *The Unending Frontier, An Environmental History of the Early Modern World* (University of California Press).

SASS-KLAASSEN, U., VERNIMMEN, T. and BAITTINGER, C. (2008) – Dendrochronological dating and provenancing of timber used as foundation piles under historic buildings in The Netherlands, *Int. Biodeterioration & Biodegradation* 61, p. 96–105.

SOBERÓN, M., Pujol, M., LLERGO, Y., RIERA, S., JULIÁ, R. and DOMÍNGUEZ-DELMÁS, M. (2012) – "El Barceloneta I. Una embarcación medieval a tingladillo en Barcelona", *Itsas Memoria. Revista de Estudios Marítimos del País Vasco*, 7, Untzi Museoa-Museo Naval, Donostia-San Sebastián, pp. 411-422.

WAZNY, T. (2005) – "The origin, assortments and transport of Baltic timber: historic dendrochronological evidence" In: Van de Velde, C., Beeckman, H., Van Acker, J. and Verhaeghe, F. (eds), *Constructing Wooden Images: Proceedings of the Symposium on the Organization of Labour and Working Practices of Late Gothic Carved Altarpieces in the Low Countries*, Brussels 25–26 October 2002. (Brussels: VUB Press): pp. 115–126.

WILLIAMS, M. (1997) – "Ecology, Imperialism and Deforestation"*,* in Griffiths, T. ed*., Ecology and Empire: environmental history of settler societies* (University of Washington Press): pp. 169-185.

[1] The ForSEAdiscovery Project has been funded by the Marie Curie Actions programme of the European Union (PITN-2013-GA607545), ITN-Multipartner. See web page: www.forsea discovery.cchs.csic.es

[2] See: Gutiérrez Merino, "La Dendrocronología: métodos y aplicaciones", Research Gate (accessed August 2015) http://www.researchgate.net/publication/228769173 (2008).

[3] See: Nayling, N. "Application of Dendrochronology to Underwater Archaeology" (http://forseadiscovery.eu/Application_of_Dendrochronology_to_Underwater_Archaeology) accessed September 1 2015.

How can we see trees in timbers? An approach to the Golden Age of shipbuilding

Adolfo Miguel Martins
PhD student in Archaeology, Marie Currie Fellow
University of Wales Trinity Saint David
a.martins@uwtsd.ac.uk

Abstract

The most essential part of an excavation is the record, it will give us the tools to analyse the site formation, its chronology and many other aspects. However, this process may be done using different methodologies: in the traditional way by hand drawing timbers and artefacts on mylar or in other available support. At the opposite we may use specific hardware and software to draw automatically on the screen of a laptop the shapes and features of the material culture. Both are always an option, what really differs is the approach. In the next few words I will try to present my research project and, in what it consists. For that purpose first will be presented the basic concepts for the research and then will flow through the aspects of dendrochronology and maritime archaeology (shipbuilding methods). Finally, the purposed method for the Iberian ship timbers record.

Resumen

La parte más esencial de una excavación es el registro de datos, que nos proporcionará las herramientas para analizar la formación del yacimiento, su cronologia y muchos otros aspectos. Aún así, éste processo puede ser realizado utilizando diferentes metodologias. De la llamada tradicional forma de recoger los datos mediante el dibujo de maderas y artefactos en mylar o en outro tipo de formato de soporte. Por el contrario puede que usemos programas específicos tanto de software, como médios de hardware diversos para dibujar automaticamente en la pantalla de un portátil las formas y características de la cultura material. Ambas son siempre una opción, pero lo que de verdade difiere en dichos formatos, es el enfoque. En las próximas resumidas palabras trataré de presentar mi proyecto de investigación y en que consiste. Para éste propósito primero presentaré los conceptos básicos para la investigación y después discurriremos a través de los aspectos dendrocronológicos y de arqueología marítima (Métodos de construcción naval). Por último, se mostrará el método propuesto para el registro de maderas de los navíos de tradición Ibérica.

1. Concepts

Man as part of Nature has been struggling against his need to cross boundaries and phenomenon, generated by the earth morphology and atmospheric events. However, the causes are not only related to the innate instinct for surviving, but also in large part to his need for achieving and / or to collect more and to understand what is behind the horizon. We may say, using our empirical experience of life that every man is different from the other, but as a team their strengths and beliefs are capable of generating the most marvellous piece of art, or the opposite, the worst catastrophes. These next words, paragraphs and pages, are related exactly to one of the most impressive achievements of mankind – the ability to build the means to, in a reasonably safe way, cross and return a large area of liquid matter. This technological advance may be clearly compared to the invention of the microchip, and maybe, it is not so far from the reality. The ingenious ability to choose a tree, shape its trunks and brunches and use them all together for sailing up the rivers or to follow the thin horizon line, give us nowadays a better understanding of our planet in several aspects.

This process obviously was not built in a constant rhythm, nor was it always successful, or even pacific in terms of diplomacy between countries. The learning process took ages for man to achieve the needed knowledge, to find an assertive way to combine four

major areas of expertise for purpose: - carpentry, navigation, physics and maths. This long process of tentative \ error had a remarkable stage for the advancement of the wooden shipbuilding technology in the early 16th century. From "now on" the knowledge has no boundaries and has led man on an intense and epic journey throughout the sea, known as the Golden Age of discoveries. New cultures, environments and goods were found, endorsing links between Europe and the most remote areas of the planet. The world started to be connected by maritime routes, which accelerated the decline of the millenary silk route. Providing for those who could buy exotic porcelains, smooth silk, black pepper and expensive furniture made by no less exotic wood coming from the Far East or the remote West. Nevertheless, the cultural exchange between all kinds of nations also promoted knowledge and increased the scientific understanding of botany, medicine, anthropology, trading, etc.

Behind all the challenges and risks undertaken by courageous men and women, comes Nature with the transformation of the basic substance CO2 into the essential by the chemical process of *photosynthesis* (Bartholomew: 2010, 124). This obviously provides, besides a healthy environment for every living organism on the face of the earth, all the tools that men need to carry on with his expectations, and allows him to have perfect raw material to build the magnificent wooden ships. However, these machines, as Steffy (1994, 3) said are "in reality, far more than a lifeless structure. It began as a desire for profit, a hope for victory, or a dream of exploration or conquest in the minds of its originators. The idea moved to the shipyard, where the efforts of shipwrights, carpenters, and smiths – who sometimes the marks of their tools or the signs of their ingenuity – converted hundreds of trees into a variety of shapes and joined them together."

Today much that archaeologists know about ships, shipbuilding methods, dockyards and maritime routes was brought to light from studies and underwater excavations undertaken all over the world. Theories, assumptions and essays have been done since already forgotten times when man under his scientific thoughts tried to understand how it could be possible to build such a highly complex machine capable of carrying in its interior a huge amount of goods, an enormous apparatus of provisions and guns, the crew and the passengers. Tons of timbers, nails, ropes and all the needed equipment was carried through seas and deserts of salt water.

Under this thematic area of expertise, this multidisciplinary research plan undertaken within the objectives of the Marie Curie Actions – ForSEAdiscovery Project aims to find answers related to the management, selection and usage of the trees used in shipbuilding from 16th to 18th centuries and which techniques man used to convert trunks and branches into timbers. The research plan baseline tries to combine three main areas of science under a maritime archaeology perspective, which are Archaeology, dendrochronology and History. The basilar structure for the research rests on the adoption of three basic concepts published by Steffy (1994), Schweingruber (1987) and Hocker (2004). The research project main tasks involve a self-critical analysis of the research main question: How can we see trees in timbers? The critical analysis of the previous researches in an attempt to rebuild theoretical hypothesis of the trees shapes based on ship timbers, which will converge into the PhD literature review. The development of digital techniques for 3D reconstruction of the growth pattern, age structure and morphology of parent trees employed in ship timbers in Iberian shipbuilding (16th to 18th centuries) from known Iberian shipwrecks, such as Belinho 1 (on lab, Portugal) and Ribadero 1, The Filipe II 1596 Armada, Madgdalena and Bayonaise (*in situ*, Spain). After the conclusion of the data analysis, all the results will be presented as a PhD thesis and published in open source.

The first challenges within the research plan are related to the dichotomy between the spatial traditional approaches for timber record used in the European northern countries and the southern. The developed research and studies by nautical archaeologists in the North, have undertaken research which integrates areas of expertise such as dendrochronology. However in the South (in Portugal and Spain as I am concerned), very few nautical archaeology publications touch on the importance of the wood as a material in shipbuilding. Even where attempts have been made to consider the shape of the timber in relation to the parent trees from which it was converted, this has been limited to two-dimensional drawings which do not synthesize all of the data available from the archaeological record and wood science. This means that most of the books and articles that we may read today about nautical archaeology in several languages, have a very professional interpretation about the site formation and a thorough timber record, but it does not tell us almost anything about the trees and where they came from or even how they were cut down. This

does not mean that there is a better or worst approach, or even that wrong methodologies exist. This means under a personal view point that all potential support from other areas of expertise are longed-for nautical archaeology research. Although, this paradigm may have an explanation based on the fact that the major part of maritime archaeologists in Portugal and Spain are truly focused on the shipbuilding methodology adopted by carpenters and disregard the forest management, the timber trade and tree shapes. Part of this explanation may also reside on the most used theoretical approach for dating the archaeological sites. The analysis of shipbuilding methods and artefacts located on shipwrecks sites are mainly used for dating a wooden ship, rather than using dendrochronology with an eventual combination with Radio-Carbon (^{14}C). Part of this explanation subsists in the theory that dendrochronology, as a discipline, cannot give a straight-forward answer for dating a shipwreck, because according to the archives the timbers should rest for several years in specific places on the dockyard before they can be used, which will give archaeologists wrong chronologies for the shipwrecks. Obviously all conjectures may be rejected or assumed, but they also mean a challenge for this research plan that intends to find specific answers for the way that man found to convert trees in timbers.

The major opportunities of the research plan are mainly the chance to use high resolution scan techniques, which includes hardware and software such as Faro-Arm and Rhinoceros. To gain a better understanding of contemporary forestry practice, the trees available for shipbuilding and the ways in which this raw material was converted, there is a need to make better use of the 3D digital techniques increasingly being used in nautical archaeology. The multidisciplinary structure of the For-SEAdiscovery Project is also an added-value for the research. The project comprehends three groups directly related to the three major areas of science to find specific answers to the question of timber supply for shipbuilding in the Age of Discovery and European expansion. Historical Wood Supply and Dynamic Trade Networks (WP1), Nautical Archaeology and Shipbuilding (WP2) and Wood Provenance (WP3) – Research Working Packages which will promote 15 individual sub-projects called ESR (1 to 15) – Early Stage Research (Fellow). In this specific research plan undertaken within the WP2/ESR6 aims to contribute for the application of ring-width analysis to recovered dendrochronology samples and delivery of data, samples and sub-samples to be analyzed by the ESRs of WP3.

The research plan also includes secondment especially for training sessions or fieldwork in Portugal, Spain and United Kingdom. As a Marie Curie Actions project is essential and compulsory to gain experience in different areas of research. In the particular case of the ESR6 is expected to participate in training sessions in the dendroarchaeology laboratory for sample recording, wood anatomy analysis and dating. Archaeology laboratory sessions for 3D CAD timber recording by using existing high resolution techniques, in order to collect and identify existing potential data for the research plan purposes. Underwater activities are essential in the research plan to improve skills, the existing techniques and the perception of potential data in already excavated wooden shipwrecks identified as part of Iberian shipbuilding tradition.

The major expectation for this research plan follow Hocker (2004, 2) words on his book "we seek to create one of those departure points, a general theoretical statement on the process of shipbuilding, the most essential of maritime technologies. This is not meant to be definitive or final - in fact, the contrary. It should be noted that the authors do not always agree, and this divergence of view-points is an essential part of the book [In The philosophy of Shipbuilding]. It is meant to show both how far we have come and how far we have yet to go, what the major outlines are and where the gaps are. It intended to provoke discussion, to encourage our colleagues to come up with better ideas. If we have done our jobs well, this volume may still have some use in a «History of Archaeology» classroom in fifty years' time, but it should be rendered technically and theoretically obsolete long before then".

The following pages attend to promote separately the discussion of the matter and aims of the research plan on a path throughout that begins from the raw material – the trees to the basic concepts for shipbuilding and ships, the timber recording techniques and available technology. Ending on theoretical multidisciplinary approach of the research purpose.

2. ANATOMY OF TREES: UNDERSTANDING THE FOREST

Scheingruber (1987, 7) refers to Weizsäcker to express his understanding of the need for a multidisciplinary approach with the following words: "Barriers erected

between the different branches of knowledge are at the root of many of our problems. One specialized science is not able to provide a complete global picture which, in the complexity of our modern existence, would give us something firm to hold on to. This is why we are looking for a synthesis; we want a comprehensive view". This proposed analogy in fact explains wisely the need of a wide-open view, which is absolutely essential in archaeological research, but as the author demonstrates, also for any other sciences. By one definition, the theoretical meaning of the act of research resides in a subject or point that is under discussion or open to controversy, or in a proposition brought up for consideration by an assembly. Either way, the research baseline should involve any support from different sciences that might help to find conclusions. Apparently these words sound trivial to every researcher; however, regarding the previous studies related to wooden shipwrecks and shipbuilding techniques, in more than just a few cases there are breaches. As mentioned in the introduction of this article, a very professional and thorough approach toward the remains of a ship, does not meant that all the existing data on the archaeological site is being analysed. A researcher begins his work by defining which answer he wants to find, which at the beginning will define the entire research, by assuming this risk and because it is not expected that a human being will know about every matter. This chapter does not intend to focus the anatomy of trees under the scope of a wooden sciences expert, but under the perspective of a maritime archaeologist. The existing reason for this chapter resides not only in the consequent need to understand the trees and their behaviour, but also to find what the trees can tell us about themselves. These living beings, widespread over all the continents, have many applications, especially for building the means to support man's will. From experienced carpenters to common workers, finding the needed shapes for the building process requires a certain amount of experience. To cut a tree without purpose could represent in the past or even in the present a waste of raw material and cause a serious impact on the environment and economy. This common judgment is not a new expression, according to Devy-Vareta (1985, 1986 and 2002). In the 16th century the constant need for wood as a material was incredible, balanced with the enlargement of the urban areas and the shipbuilding (Devy-Vareta: 1986, 5). Forest management soon become part of the countries' strategic interests and considered as essential for progress. Cities with privileged locations near the shore, influenced by the mercantilist interests were transformed in large enterprises where could be found private, local and sovereignty consortiums. The quest for wood as a raw material brought profound changes in society. The wanton consumption of trees without the required time for renewal of the forest's integrity, generated claims from the merchants and manifest from farmers to keep their rights of exploitation and usage of the forests (Devêze: 1965, 605). To face this problem, countries adopted a progressive royal control on the forests in general, which ended the degradation of forests by unbridled exploitation of this natural resource, even in countries such as France and some German states, where rules or forestry codes were enacted during the fourteenth century (Devy-Vareta: 1986, 6). Nonetheless, in the Southern European countries, where the ecological environment was already weakened by farmers considerably to extend the crops and pastoral work necessities. Furthermore, during the previous centuries, the Mediterranean trade and along the Atlantic coast promoted the extinction of forests to assure needs of this raw material for shipbuilding as never before, especially in Italy and in the Iberian Peninsula. In these countries, depending on the geographic location and morphology of their cities, were established, in many cases, one of the largest consumers of wood – the dockyards. In these places, where the knowledge was passed from master to apprentice, was in fact when the trunks and brunches gained specific shapes for shipbuilding usage. How were these men able to fulfil their objectives? Archaeologists and historians already have some conclusions, by analyzing treatises and performing excavations and studies related to shipbuilding. But regarding the understanding of trees and shapes, archaeologists still have a long journey ahead. A naval carpenter can be compared to an artist, by analogy. A carpenter possesses the ability to look at a tree, just like a sculptor looks at a rock and observes a fine and magnificent shape. The incoming knowledge related to the trees theoretically comes from successive action – reaction in order to achieve the purpose of "The shipbuilding [has] processes that preceded and may have influenced the development of Iberian shipbuilding are numerous and varied. Essentially, the subject encompasses the history of shipbuilding technology as it evolved throughout the Mediterranean region and northern and western European coasts and rivers over a period of more than ten millennia" (Steffy: 1994, 49). "We can only guess at the origins of watercraft in these two great maritime theaters. Certainly there were reed boats and animal skins and rafts of various

sorts, but eventually wood became the most widely accepted material for hull construction; it remained the material of choice for most ship and boat builders until the last century. From a practical standpoint, formal shipbuilding technology began when two or more pieces of wood were assembled to produce a displacement vessel. It, too, was a process that originated thousands of years ago and continues to evolve to this day" (Steffy: 1994, 49).

To understand how those brilliant men, the master carpenters, chose different kinds of trees and shapes is essential to uncovering the veil of an empirical knowledge passed from generation to generation. Therefore, by observing a tree under the perspective of dendroarchaeology as any other living being we may find answers on their structure and how they are influenced by the environment: geographic location, landscape morphology, astronomic cycles and atmospheric events.

2.1 Tree anatomy. From the empirical wisdom to the scientific approach

Trees tend to grow vertically, disregarding the shape of the soil in order to capture the sun essential for photosynthesis. Depending on different types of rocky soil or sandy, the roots have the imperative mission to find and gather water from underground (Schweingruber: 1988, 11) and also help to purchase and react to the stimuli promoted by earth movement and wind. Her vertical shape is also influenced by spatial environment where they live. By observing the differences between trees that live in a dense forest or at the opposite, in open areas, we will be able look in the first case at high trunks with confined canopies at the top and, small trees with large canopies in the second. These differences may be also observed in cut trees, by the length of the trunk and the knots' main concentration, which means that a tree that lives with less space and energy provided by the sun will have consequently bigger trunks and far more concentrated knots at the top.

The growth process will record different patterns depending on the altitude, temperature and location on the planet. As Schweingruber (1998, 6) has said "A tree is a stationary living thing. Its crown, trunk and roots are capable of receiving to environmental factors: some parts of the tree receive signals from the surrounding while others react to them. (…) This ability to integrate is reflected in many different kinds of tree characteristics, such as geographical distribution, tree crown and tree rings. In the course of evolution plants have developed on every site, being best adapted to the particular conditions obtaining there". Directly related to the growth patterns is the reaction time, where measurements of any environmental conditions are reflected in the tree rings and expressed in a very complex way in the annual ring. Within the growth process another influence caused by the environment is the tilting of the earth's axis, the gestation periods depending on the hemispheres trees growth in different occasions of the year. Between June and September in the northern latitudes is when the trees are receiving more energy and consequently growing, but this process is only observed on the southern part of the equatorial line during the months of December and March. It is precisely this process that provides by itself a very specific data for dendrochronology, archaeology and climatology. However, these facts cannot be seeing as a rule for every tree or any other "thing" that carries a growths pattern. Stones (i.g. agate), shells (i.g. freshwater mussel) and bones (i.g. mammoth tooth) or even some species of trees have astronomic cycles. Although, the most popular trees used for shipbuilding are oaks (*Querqus* – *Angiospermae* family - broadleaf that form tension wood) and pines (*Pinaceae* – Gymnosperm family - conifers that produce compression wood) (Schweingruber 1998, 10; Mitchel: 1984, 15).

The *Quercus* tree family is classified as part of the hardwood and comprises approximately 600 known subspecies. These groups of trees possess large cells also called vessels. Oaks in cross-section, "the wood shows rings of large cells separated by rings of small cells. Such woods are called *ring-porous*. In some other trees, such as beech and birch, the vessels are similar, rather small of mixed sizes throughout the season. These are called *diffuse-porous* timbers. The difference between these two types is easily seen and is the first important feature used in determining the genus of the tree from which a sample of wood is derived. Hardwood timber contains two other kinds of cells. The *fibres* are usually thick-walled, narrow, sharp-ended cells found fairly uniformly trough the annual ring. The *parenchyma* are thin-walled brick-walled cells which are mainly arranged in radiating *medullary rays*. It is these that give the «figure» or graining in timbers like oak, where they are very large, and are most prominent on the face which is parallel to the rays, that is, the radial face" (Mitchel: 1984, 19).

On the other hand, conifers or softwood timbers only have two kinds of cell – the vessels and fibres. These cell are "united in an intermediate form cell, the *tracheid* which combines the functions of the two kinds, and the *parenchyma"* (Mitchel: 1984, 19) which are much similar to the broadleaf trees.

To understand the structure of these trees, Mitchel (1984, 19) has said that "the *vessels* and *tracheids* are conducting tissues forming long, wide tubes joined end to end. Vessels have large plates at the ends with perforations to permit the flow of sap, or sometimes they are joined with end-plates at all. Tracheids are joined by a long overlap and their side-walls communicate by rows of holes. The fibres of hardwoods are entirely for strengthening, allowing the vessels to be thin walled for better conduction of sap. In softwoods there are no fibres and the tracheids have to be strong and thick walled as well as good conductors of sap, hence a long overlapping arrangement and small pits in their walls are necessary to permit the flow of sap through thick-walled, rigidly joined cells. The *parenchyma* is storage tissue, holding reserves of nutrients during the winter when the sap is scarcely flowing, ready for the time of greatest need, in spring when growth must start before the new leaves and roots are functioning".

This chemical process is continually generating new rings year after year as long as the tree still keeps receiving all the nutrients that it needs to be alive. Although, we may observe another chemical reaction in the tree structure, promoted by the cells when they become lignified. This process applies from the pith (core) to the bark and is in a straight line related to the death of the cells. Generating the heartwood which is much darker, stronger and durable and gives the necessary strength to the structure to allow the tree to growth vertically. At the opposite the sapwood has a pale colour, less strength and is much more permeable.

2.2 Tree shapes. Management versus natural growth

To obtain the shapes of timbers for the purpose of shipbuilding, trees must also have the needed shape for the futtock, keel and any other part of the ship. To achieve that combination between the needed timber with the hardiness and natural grain, the master carpenter had to have in his mind a clear view of what he wanted to find. As mentioned before, he needs to understand how the trees behave and which properties they must have.

According to Rackham (2003, 3) trees form part of four existing traditions of land-use, which are: the plantations where we may find a significant number of trees belonging to the same species and having approximately the same age; woods which are a combination of different species, ages and might have been intentionally planted; wood pastures wherein its growth is directly influence by the grazing animals; and, finally the non-woodland communally used to separate fields in different counties, such as United Kingdom and in some parts of the northern Portugal and Spain. However, regarding the carpenters need to found specific natural angles, sizes and shapes, there were only two ways to achieve the purpose. By pollarding or lopping which "is the practice of cutting a tree at between 6 and 15 feet [182, 88 cm and 457, 2 cm] above the ground, leaving a permanent trunk called a bolling (…). This sprouts in the same ways as a coppice stool, but at a height where animals cannot reach the spring, and yields and indefinite succession of crops of poles" (Rackham: 1976, 9; Rackham 2003, 3). A variant of this forest management type is shredding, in which side-branches are continuously cut off, leaving the tuft at the top of the tree, which provides correct shapes to convert the tree into timber and also helps to feed animals (cattle). The second tradition to manage forests were coppicing and suckering, which consisted of cutting the tree on the lower part of the trunk. However, because the animal interaction with the left roots these areas could not be unprotected from the absence of boundaries and security.

2.3 Finding the timbers on a tree

From a tree independently, if it is from the trunk or the branches, there are four distinct parts: the pith, heartwood, sapwood, bark edge (*libri (Charles: 1919, 7)*) and the bark. Besides all of them have an important function on a living tree, when the purpose is to have ship timbers some tree components are disregarded. From the viewpoint of a shipbuilder, the pith gives the exact understanding of the natural grain and shape of the tree to convert in the timbers. The densest and strongest part: the heartwood. The softest part is the sapwood, where new cells are still open allowing the sap to flow through the filaments, which makes it more vulnerable and permeable. The bark edge is the part that divides the sap-

wood from the bark and defines the limits of a trunk or branch for the shipbuilding purposes. By understanding different wood characteristics, carpenters may obtain the timbers that they need to use for building a ship. Another fundamental aspect was: which moment was the correct to cut a tree? This may varies from country to country, location to location or even from dockyard to dockyard, and was directly related to the astronomic cycles. Which means for instance that in the temperate areas of Portugal some carpenters chose to cut the trees in late autumn immediately after the leaves fall (Castanheira: 1991, 1). Other carpenters ("Mestres carpinteiros do antigo Arsenal do Alfeite" – Master carpenters from the old nay dockyard, Ribeira das Naus, Lisbon Portugal) preferred the month of August, especially for the pine (*pinus pine* and *pinus pinastre*), and the oaks (*Quercus Suber*) between October and February when the sap is less active (Valente: 1948, 52). Nevertheless, they could not disregard that "the size and fine growth of a tree is not an infallible sign of goodness of quality in the wood. The connection of the age of a tree with its development and the nature of the soil in which it grew, ought to be inquired into to enable a judgment to be formed of the quality of the wood" (Desmond: 1919, 8). This means that characteristics such as durability, uniformity of substance, straightness of fibre, strength and elasticity are fundamental for shipbuilding. But, another challenge exists: there are no such things as perfect trees to convert in perfect timbers. The carpenter still needed to find the place in the available raw material where the knots and cross-grained could be avoided. These kinds of "imperfections" usually represented weak points in the timber structure, especially because it interrupts the natural grain of the trunk or branch and, in case of being subjected to high pressures, may generate cracks or even worse, the promotion of holes caused by natural extraction of it.

2.4 The storage and converting process: Converting trees into timbers using an axe or saw

After the trees are cut, the growth process is completely interrupted leaving the timber exposed to all environmental events and it will inevitably start the degradation process. Therefore, if proper storage was disregarded, timbers could naturally split in case of fast dehydration, if they suffer high temperatures, it will initiate fermentation, which will be followed by loss of consistence and consequently attacked by worms. To avoid the loss of these precious raw materials, the timbers had a special place to be stored in the dockyards known by "a peculiar odor" (Desmond: 1919, 9), where they were piled by using two basic rules: to pile timber by shape and reduce the contact between them at all cost (this procedure helps the circulation of air and the fixation of harmful microorganisms). Another technique used to store timbers was to bury them in an anaerobic area "nas proximidades da embocadura de um rio e num ponto em que a mistura da agua doce do rio com a salgada do mar seja em quantidade a não deixar sobreviver o taredo / nearby a river where the fresh and salty water meet and avoid the presence of *teredo navalis* (shipworm) ". However, in any of the adopted storage criteria the display of the timbers should be organized by its special characteristics, size and function, which means that in general at the shipyards should exist a place where the timbers were separated by – hull timbers, rigging, paus direitos, curves (Castanheira: 1991, 30) until needed.

Once the carpenters needed the timber they could split them into several parts using an axe or saw. These processes mainly depend on the shipbuilding tradition. For instance, in Portugal, the trunks and branches were first converted into timbers with gross forms and when needed they were finally shaped with the exact measurements to fit its place in the ship frame. This final shaping could be done by using saws or other special tools in the shipyards. Another possible method consisted in first identifying the natural cracks in the tree and using them to split in the needed part by using an axe.

3. Anatomy of ships: basic concepts for box to sail

Either for boats and ships, there are three basic concerns: buoyancy, gravity and stability (Steffy: 1994, 8). Buoyancy is an inevitable need when the purpose is to carry something safely through water from one place to another (Pomey: 2001, 26). When used in direct proportion with gravity, it allows one to combine available space with increased weight. Furthermore, by joining this rule with balanced shapes and proper raw material (strength), the shipbuilder achieves the stability. "Whatever the degree of elaboration or complexity, from the most basic boat to the most sophisticated ship, the construction of a vessel is never an act of chance. It is a response to a demand and to specific needs" (Pomey: 2001, 26).

The ForSEAdiscovery Project objectives are centred in the reconstruction of the past Iberian Peninsula forestry and shipbuilding between the 16th and 18th centuries. This chronological period represents the so-called Age of Discoveries, the Golden Age of Shipbuilding, or any other to expression to represent one of the most significant periods for the advance of knowledge in humankind.

In these chapters related to shipbuilding, the next few words may be considered absolutely justified when looking at the main objectives for the WP2 / ESR6 objectives. The search for answers related to the main question: How did the carpenters see timbers in trees, needs to centre on a close view of the time (chronology) and place (geography) of the subject. Which leads us automatically into a review of the methods used in shipbuilding in the Iberian Peninsula for the Modern Age. Different studies were undertaken by teams of historians and archaeologists, especially when related to ship wrecks along the coast of Portugal and Spain. These ones may tell us much about the methods used in the dockyards of these two countries. However, to define what is an Iberian ship still is not an easy task, and it may not be possible to find a straight answer (Barker: 1998; Castro: 2008). In this project perspective that uses a combination of maritime archaeology and dendrochronology, an Iberian ship may be: a ship built in the Iberian dockyards, a ship built with native trees, a ship built by Iberian carpenters, or a ship built under Iberian treatises. Maybe the definition could become overly attached to the team's own skills and interests, or to the research line that guides the ForSEAdiscovery Project. There is no absolute truth regarding a scientific project for humanities research. Although, "the combined textual and ethnographic evidence suggests, nevertheless, that Iberian ship design and construction was strongly influenced by imported Italian shipwrights, following a conceptual model that is believed to originate in Mediterranean galley construction, although archaeological proof of this is inconclusive. Arab influence may also have been important, although it is even more difficult to prove because there is an almost complete lack of evidence" (Castro: 2008, 63). But interpretation under the perspective of the wood sciences an Iberian ship is a vessel built with native trees from the Iberian Peninsula. So, to find a balance between these two main concepts was considered that independently of the shipbuilding tradition, a ship is always considered as a box that carries something and from one point to another by water. Which means that for the purpose of this research project, all known ships that belong to the two countries between the 16th to 18th centuries are potential candidates for the research.

3.1 Building a ship. Shaping the hull

Before any attempt to build a ship there is a need to draw in 2D the first lines where the hull shape was defined, and the theoretical perspective of where the master futtock, the bow and the stern meet each other. Those magic lines representing the three views (or plans) attend to materialize the idea that the shipwright had in his mind and, in fact they are more than just simple straight and curve lines. They represent centuries of knowledge achieved and passed from generation to generation. The basic lines gave to the carpenter the angles, the measurements and especially the shape that the hull must have.

There were three major shipbuilding methods used in Europe between 16th and 18th centuries – bottom first, shell first and skeleton first. Since the last mentioned in the Iberian dockyards is essential to understand how it is developed. The process started to be materialized when the first tree parts were place in the *Carreira* by joining the keel at one end to the bow, and at the other the stern, and the master futtock at mid-ship. When these main parts are in place, the skeleton is filled by all other similar parts with small variations between them. This gave the "box" the necessary shape, buoyancy, strength and stability to sail. The hull-form, even when associated to one specific shipbuilding tradition, may vary from place to place because it was continuously "affected by the extent of technical knowledge, available materials, intended routes, cargoes, economics, environment, social structure, political influences, and a host of other prevalent factors" (Steffy: 1994, 12).

3.2 Shipbuilding treatises

Besides the knowledge passed from master to apprentice, to increase safety at sea countries developed the need to standardize measures, shipbuilding methods and basic rules. This increased need came when the ships became bigger and heavier than ever. A launched ship at sea with the crew and cargo was too expensive to be lost. The first Portuguese treatises for shipbuilding were written by Fernando Oliveira (1580) *Livro da Fabrica das Naus,* and

by João Baptista Lavanha (1610) *Livro Primeiro da Architectura Naval*. These books tell us the basic rules, measures, and ships' main characteristics, but disregards the basic knowledge already achieved in the 16th century. However, "the combined textual and ethnographic evidence suggests, nevertheless, that Iberian ship design and construction was strongly influenced by imported Italian shipwrights, following a conceptual model that is believed to originate in Mediterranean galley construction, although archaeological proof of this is inconclusive. Arab influence may also have been important, although it is even more difficult to prove because there is an almost complete lack of evidence "(Castro: 2008, 63).

In Spain Juan Escalante de Mendoza (1575) *Itinerario de Navegación de los Mares y Tierras Occidentales*, Diego García de Palacio (1587) *Instrucción nautica para el buen uso de las naos, su traça, y gobierno conforme à la altura de México* and Tomé Cano's (1611) *Arte para Fabricar, Fortificar y Apareiar naos* contain the best descriptions of Spanish ships from late 16th to 17th centuries (Castro: 2008).

3.3 GLOSSARIES

Steffy (1994: 6) has said that "shipbuilders and sailors talked strangely. They spoke of futtocks and timbers and martingales and moonrakers". Considering that a ship is a world inside a world, every part of itself needed to have a name. Sailing on these vessels was a tremendous challenge, and the crew needed to understand instantly which part was meant, just by hearing to a name. For instance, when the ship was at sea sailing, there were no margins for bigger errors, so that every sailor on the masts needed to understand what was said by the masters of each mast, in order to perform the correct actions. Even today, the new cadets when aboard need to know the name of each part of the ship. However, the names changed from place to place and from time to time. The glossary is an essential tool to understand the treatises and to demystify the rules and measures, so that we may comprehend the shipbuilding techniques. The main challenges for building a glossary are the dating, the local terms and the shipbuilding tradition. Why cannot we "adopt one maritime dictionary as a standard?" (Steffy: 1994, 6). The answer for this question resides in the fact that we are studying ships that were built in several places, by different kinds of people and in such distant places. These three aspects are not established by a hierarchy between themes, but on the contrary they are strongly connected.

To develop the tasks undertaken in this research project, it is essential to have a glossary to help to establish in one way a link between the timbers as a part of the ship and, at the other to understand what kind of characteristics the timbers should have to be used in shipbuilding. This process is not linear and many referred names related to any other parts that do not involve the usage of wood, such as timber frames, planks or masts will be mainly disregarded especially because the main core of the project is to find answers related to the trees as a raw material.

Directly associated to glossaries is the data storage. Every excavation brings to light a huge amount of data related to an archaeological site, from which references are built and may tell us about shipbuilding traditions, artifacts and methodology. This data may be provided from several areas of expertise – multidisciplinary archaeological projects. In many cases, at the end each project the dissemination process takes place, and eventually the exhibitions of preserved artifacts. But, what will come after, all challenges, efforts and risks took by the team in order to achieve the aims to understand the construction principles and methods of a ship, that governed its conception and realization in a precise historical context (Pomey: 2011, 34). According to Steffy (1994: 189) "Piles of rotten timbers and broken artifacts constitute a wealth of information, yet much of that knowledge will remain unrecognized unless one develops a proper method of access to it. In case of shipwrecks, though, access is the mastery of a discipline … which is essentially the means of access the wealth of information stored in the remains of ships and boats and the orderly dissemination of the knowledge derived from them". Advances in technology such as computing, recording instrument and tools have impacted fieldwork development and how the data is presented and stored. Software "such as HPASS (Green and Souter 2002), Site Surveyor (Holt 2008), Photomodeler (Green, Mathews, and Turanli 2002) and Rhinoceros (Rhinoceros 2009) illustrates examples of applications used in nautical archaeology ranging from GPS and triangulation to CAD and 3D modeling" (Castro et al: 2011, 329). For the particular case of building glossaries, it may be considered relevant to combine sources from archaeological sites with the archives that may tell us the words and names of every ship part. Apparently this could be judged as common sense, but the joint between

archives and material culture may be present in several ways. One hypothesis is being developed under this research project by using collected data from archives, archaeological sites and previous studies and presenting it through a digital scheme. The selected timbers will be recorded using a digital 3D CAD with methods of precise accuracy, and displayed in layers in order to build a 3D glossary with multiple databases associated. The biggest risk of developing this glossary / database is the eventual need of having a powerful server to assist in any demands. However, to the end user all the information may be provided as a webpage and consequently available in any desktop, tablet or other device. The bigger advantage, is without any doubt the chance to have as much data as the server allows in real time. By using this process it is also expected to have enough data to understand some of the main key points for the Iberian shipbuilding tradition, its origins and evolution and outside influences.

4. IMPROVING THE TIMBER RECORDING METHODS IN MARITIME ARCHAEOLOGY

The recording methodology may be considered one of the most essential processes of excavation. This task usually involves a great part of the project's financial resources and team effort. Although, the record of timbers (and artifacts) is always an interpretation of the facts. By the assumption that every archaeologist uses their own skills, experience and knowledge, we will always have studies influenced by perspectives. Because of this perception, the biggest challenge may reside in what available technology we have today. As I am concerned, in the past 30 years of maritime archaeology, the record of underwater archaeological sites were done by using sophisticated techniques and software to achieve the objectives and purposes for the research. In comparison, the excavations in the early 80s (past century) for the excavation (coordinated by Alves) of the Admiral French ship *L`Ocean,* which sank nearby the fishing town of Salema, Lagos in Portugal, with the campaigns (coordinated by Alves and Castro) of the presumed *Nossa Senhora dos Martires* in late 90s (nearby Lisbon, Portugal), we may say that they were developed with a very thorough and professional methodology. But in fact, the times have changed and the pursuit for knowledge is remarkable. In the first decade of the 21st century the record of underwater archaeological site – ships became extremely advanced by using available technology in the purposes of archaeology. Image capturing devices adopted for underwater combined with specific software, such as Photoscan (Agisoft), new version of Rhinoceros (5.0), Autodesk (Maya) and others are being used to obtain more and accurate data. Also reduces storage physical space and is accessible in a faster and reliable frame.

Hocker (2006: 2) state: *"In the Philosophy of Shipbuilding we seek to create one of those departures point, a general theoretical statement on the process of shipbuilding, the most essential of maritime technologies. This is not meant to be definitive or final – in fact, the contrary. It should be noted that the authors do not always agree, and this divergence of view-point is an essential part of the book. It is meant to show both how far we have come and how far we have yet to go, what the major outlines are and where the gaps are. It is intended to provoke discussion, to encourage our colleagues to come up with better ideas. If we have done our jobs well, this volume may still have some use in a "history of archaeology" classroom in fifty years' time, but it should be rendered technically and theoretically obsolete long before then".*

The interpretation of Fred Hocker's words, leads us to constantly challenge the used methodologies for recording timbers. Most of the excavations that took place in Portugal and Spain adopted the 2D recording method by using a simple marker or a laser point. These drawings are remarkable and give to next generations enough information for data review. However, besides the existing rules and recommendations for the purpose the drawings are an interpretation of what the archaeologist saw in that moment. Years later may come the need to analyze those drawings and the perspective may already change and we will need to draw the timbers again (if they still exist). What is meant to say is that under a research project all the available tools should be used (reasonably and effectively). For instance to analyze the remains of the *Cais do Sodre* Ship (C14 – c. 1500) or the Corpo Santo Ship (C14 – c. 1400) or even the Ria de Aveiro A Ship (C14 – c. 1500) we will observe a very thorough and professional drawing displaying the timber shape, the nail holes, tree knots and scarves. But regarding the available data for this research project, as I am concerned it only give us a few details of the timber as a raw material and will not be enough to rebuild the trees. Which consequently will not provide sufficient data to

identify tree shapes, evidences of forest management or the pith location for tension (bend) analyses.

To develop a theoretical approach of the choices taken by carpenters regarding the usage of trees for shipbuilding, it may require in same cases to re-analyze all the timbers again. Obviously, this process may happen ever since a new technology became available for archaeology. Although, for maritime archaeology, especially when it refers to the interpretation of a shipbuilding tradition "the choice of trees to fell as a function of their species, the morphological characteristics of each individual tree, and the different structural element that it could provide, then the felling, transport, and storage, all set in motion a series of operations that reveal the organization system of the society that built the vessel" (Pomey: 2011, 31).

4.1 Previous studies: recording the past

Published in the 2000 in the Maritime Archaeology Newsletter from Roskilde Denmark nr. 14 the article 'New tools to archaeology' by Fred Hocker, states that "our [archaeologists] task is to develop better methods of collecting and managing the raw material of archaeology. "Better" means producing higher quality data that will allow archaeologists to answer current questions with more confidence, as well as new kinds of data to allow exploration of new avenues of research. "Better" also means finding ways to produce usable data more efficiently and to communicate the results of our research effectively. Finally, it means finding more effective ways of preserving the objects and sites we investigate, so that they can continue to generate new data for future archaeologists" (Hocker: 2000, 8).

The recording of ship timbers may be done in many ways, including the traditional 2D drawing, where the archaeologist represents the relevant data for his research. This process may be compared to the layers or sections on the excavation of archaeological sites inland. However, regarding shipwrecks, especially when the recording of timbers is taking place, there is an alternative methodology which is capable of representing those timbers not by layers, but by the three-dimensional thought of the shipwright when he was drawing the basic lines of the hull, and the carpenter when is choosing and shaping trees to convert them into timbers. This alternative recording method is also able to provide solutions based on the archives and remains of ships to rebuild the theoretical shape of the hull and ship. Using this specific methodology, that may be called reverse engineering, it will be possible to find answers for: What shape has the tree before been cut; how many timbers were used from the same tree in order to identify the converting used methods; and what methods were used to manage the forests? All these questions may vary from project to project, and in this research project it will be used for purposes mentioned in the introduction, but may be used in other investigations.

It may be considered that the excavation of the Newport Medieval Ship, which led to the usage of three-dimensional digitizer arms to record the ship's timbers, is most successful until the first quarter of this century. In fact, this procedure based on other previous studies generated a new way of looking through the timbers and collecting reliable data, under 3D CAD user friendly, easy to store, fully accessible by any person without special computing requirements, permitted the reconstruction the ship under a theoretical approach and, finally launched the challenge for the future of maritime archaeology.

4.2 The 3D CAD timber recording methodology: a different approach

The usage of three-dimensional digitizer arms to record ship timbers, as I am concerned, started under the development of a project undertaken by a team from the National Museum Denmark in co-operation with Klaus Stettrup Jensen of DKC (Hocker: 2000, 30). However, the increased usage of the 3D CAD recording occured during the excavation of the Newport Medieval Ship, discovered in 2002 where after the complete removal of timbers and artifacts, the Riverfront Theatre and Arts Centre in the city of Newport in South Wales was built. The team of archaeologists and conservators cleaned, recorded and initiated the conservation process of the timbers. The entire ship was disassembled and the timbers were displayed in tanks of fresh water for preliminary conservation. During this process, which included the analysis of the shipbuilding adopted methods, the artifacts and by the dendrochronological and historical research, the collected data indicated that the ship was built in the "middle of the 15th century possibly in South Western France" (Jones: 2008, 85). This process also included the recording of the complete set of timbers by using a FaroArm

three dimensional contact digitizers and Rhinoceros 4 digital modelling software, which allowed "to produce three dimensional physical and digital solid 1:10 scale ship model by converting three-dimensional draw into a by using using modelling software packages including Rhinoceros 4 and Solidworks" (Jones: 2008, 85). The timber shape was manufactured by a process of selective sintering, that consists in the usage of a laser beams to melt successive layer of finely ground nylon plastic dust. This allows the setting of the planks along the timber frames to achieve the hull shape and consequently the original hull form.

Another advantage of this process is the chance to generate the theoretical ship shape from the keel to the rigging and develop digital essays related to the hull performance in the water as well as for dissemination purposes.

CONCLUSIONS: CHALLENGES AND THOUGHTS

This specific research project will run for three years (started in 2014, 1 of September) and aims to develop a dendrochronological approach in maritime archaeology to understand how the carpenters choose and convert trees into timbers, as well as to contribute for the next step of the digital timber recording. This necessarily involves tree ring analysis, diving operations to collect samples from presumed Iberian shipwrecks, and improving skills in digitizer arms and computing.

The major challenges in this research are to keep looking at the remains of shipwrecks either at sea or in land and to see the trees through the timbers and hull shapes to identify possible shapes already visited by the carpenters, moments before they started to give them the needed angles in the dockyards.

REFERENCES

ALVES, F. (2003) – *Projecto Ria de Aveiro A – 2000 (FCT) Relatório da campanha de 2002*, Trabalhos do CNANS 8, Lisboa, Portugal.

ALVES, F. (1998) – *International Symposium on Archaeology of Medieval and Modern Ships of Iberian-Atlantic Tradition: hull remains, manuscripts and ethnographic sources; a comparative approach*, Centro Nacional de Arqueologia Náutica e Subaquática, Academia de Marinha, September 7. to 9. Lisboa, Portugal.

BARTHOLOMEW, A. (2010) – *The story of water. Source of life.* Floris Books, Norwich, United Kingdom.

CASTANHEIRA, E (1991) – *Manual de construção do navio em madeira*. 1.º ed. Lisboa, Portugal.

CASTRO, F. (2003) – *Cais do Sodré ship frames 2002 field season.* Ship lab report4, Texas A&M University, United States of America.

CASTRO, F. (2008) – *In search of a unique ship design concepts.* Historical Archaeology 42(2) p. 63-87, United States of America.

CASTRO, F.; FURUTA, R.; MONROY, C. (2011) – *A digital library perspective: the synthesis and storage of maritime archaeological data to assist in ship reconstruction*. Oxford Handbook of Maritime Archaeology. Oxford University Press, United States of America.

CHARLES, D. (1919) – *Wooden shipbuilding.* The Rudder Publishing Company. New York, United States of America.

DEVEZE, M. (1965) – *La vie de la forêt française au XVIe siècle.* Ecole pratique des Hautes-Etudes, VIe section, Centre de recherches historiques. Les hommes et la terre, VI, Paris, France.

DEVY-VARETA, N. (1985) – *Para uma geografia histórica da floresta portuguesa. As matas medievais e a coutada velha do rei.* Revista da Faculdade de Letras, vol.1, p. 47-67. Porto, Portugal.

DEVY-VARETA, N. (1986) – *Para uma geografia histórica da floresta portuguesa. Do declínio das matas medievais á política florestal do renascimento (sec. XV e XVI).* Revista da Faculdade de Letras, vol.1, p. 5-37. Porto, Portugal.

DEVY-VARETA, N. (2002) – *Fomento e ordenamento da floresta das regiões litorais durante a Idade Moderna.* O litoral em perspetiva histórica (sec. XVI a XVIII), p. 167-176. Porto, Portugal.

HOCKER, F. (2000) – *New tools for maritime archaeology.* Maritime Archaeology Newsletter 14, p. 27-30. Roskilde, Denmark.

HOCKER, F.; WARD, C. (2004) – *The philosophy of shipbuilding.* United States of America.

JONES, T. (2008) – *Newport medieval ship project update.* Archaeology of Wales 48. p. 85-88.

LAVANHA, J. B. (1610) – *Livro Primeiro da Architectura Naval.* Lisboa, Portugal.

MITCHEL, A. (1984) – *A field guide to the trees of Britain and northern Europe.* Collins Grafton Street, London, United Kingdom.

OLIVEIRA, F. (1580) – *Livro da Fabrica das Naus.* Lisboa, Portugal.

RACHAM, O. (2003) – *Ancient woodland its history, vegetation and uses in England.* Phoenix Press. London, United Kingdom.

SCHWEINGRUBER, F. H. (1987) – *Tree Rings Basics and application of dendrochronology.* Kluwer Academic Publications, Nederlands.

STEFFY, J. R. (1994) – *Wooden ship building and the interpretation of shipwrecks.*

STEFFY, R. (1994) – *Illustrated Glossary of Ship and Boat Terms.*

STEFFY, J. R. (1998) – *The development of ancient and medieval techniques of shipbuilding.* Texas A&M Publications. United States of America.

VALENTE, M. S. (1948) – *Carpintaria e construção naval de madeira: apontamentos*, Livraria Avelar Machado, 2.º ed. Livraria Avelar Machado. Portugal.

ATLANTIC SHIPBUILDING AND THE IBERIAN CANTABRIC TRANSITION, 1560-1680

Beñat Eguiluz Miranda

A THEORETICAL FRAME FOR A NEW RESEARCH

INTRODUCTION

Centuries of sailing along the Atlantic waters carved the tradition of a community of seafarers known for their deep relationship with the ocean. Such people developed a tradition that was preserved by their remains in seas and archives, so that it could be recovered from its dormant period. It is time to bring back to life the culture from a community that was connected by a common feature, the Atlantic vessels. The aim of this article is to review the estate of the Iberian shipbuilding topic and open a debate related to the way it is conceived and how potential research lines can develop from this point. This article aims to contribute to open the discussion related to the Iberian shipbuilding concept and to explain a new potential research. It is mentioned as well how this conception has contributed to learn more about these complex vessels, but especially in which ways it has done it.

REFLECTIONS ON THE CONCEPTS OF IBERIAN AND ATLANTIC SHIPBUILDING

IBERIAN OR ATLANTIC VESSEL?

There is a common name that connects the Iberian Peninsula's shipbuilding tradition, as well as a wider denomination for the Atlantic space. Regarding the cultural implications of these concepts, there is a potential debate to be discussed. Both concepts refer to different spaces, but they are attached to various preconceptions that will be presented here.

The Atlantic concept and the Iberian one represent different levels of culture, as well as convergence. By different levels of culture, I refer to the percentage of similarities or differences, which could be observed on a ship, such as construction features, techniques, shapes, style or even artistic representations. In this sense, one could find the connexion from a geographical space to a shipbuilding tradition, and define it with more detail as a *space of convergence*, where a high level of cultural similarities could be interpreted. Atlantic and Iberian denominations have different appearances on a map, as one can easily notice. But it is the relationship between these two names that marks the perspective in this article. Both definitions need to be clarified, for the main point of this article to be understood.

ATLANTIC VESSELS?

The Atlantic denomination is a much open term. Represents a wider space than the Iberian shipbuilding tradition. From the Iberian geographical scale, the Atlantic space would be the next level of connections. The use of the Atlantic denomination call for a wider tradition, not so local, but more as a general big group that connects different local levels. Regarding the implications of this word, it is obvious that it is talking about a tradition that is facing the Atlantic, and is challenged by it. This way, the tradition is connected by a variety of areas that bear in common a maritime shipbuilding tradition in the same façade of the sea. This concept should not be taken as a definitive concept. The definition of the term has a theoretical origin, and it requires further archaeological and archival sources to support the idea of this connected maritime culture.

Could the word Atlantic be used as a substitute for Iberian or other traditions?. In this paper, Atlantic shall be only used for identifying the wider connections between the English, Portuguese, Andalusian, Basque-Cantabric and French traditions. Brad Loewen already has founded some evidences for this western atlantic area, by looking at the casks from vessels (LOEWEN, 1999)[1]The precise boundaries of this Atlantic shipbuilding is something that needs research to be developed. However, such a geographical name is related to a cultural concept beyond its

geographical limits. Therefore, it is open to the tracing of its cultural similarities or relationships, as Italian ships have been identified as part of this tradition already[2] (CASTRO, 2008)[3]. Hypothetically constructed and documented such statements are open frames to be complemented, with other perspectives and research lines.

THE CONCEPTION OF THE 'IBERIAN' TRADITION

Iberian shipbuilding is a cultural conception that refers to the Atlantic Spanish and Portuguese tradition. The Iberian Peninsula gave the geographical name to this tradition. The geographical concept, has created a relationship between the Iberian culture and this geographical frame. However, this geographical perspective creates a problem here to be explained.

Portuguese and Spanish cultures are part of this geographical conception, as they are now the main countries in the peninsula. But here relies a problem related to a nationalist perspective that could barely be traced in its integrity back into the age of discoveries. Such terminology can be easily confusing and uses the same modern conception of nations in an older period. In this sense, it marks geographically as well the limits of this shipbuilding tradition.

What was Spain like in the 16th century?. The political reality in Portugal from the 16th century was different as well, but it is mainly in Spain that the reality becomes complex when it comes to culture, nations and the political misinterpretations, which can be many. This is an important reflection that needs to be considered.

The maritime culture of these communities is the main source for this research. This perspective has brought the idea that there are cultures developed beyond the boundaries of modern states, as will be explained later. For this reason, a nationalist frame will limit the horizon of this research and obscure it with a contemporary concept that cannot be applied in the same way to the age of discoveries period, when we are talking about shipbuilding and the Iberian tradition. The political perspective needs to be considered, as it affects majorly to the development of these traditions, but it is the culture that is the source we are analysing.

For this reason, the political limits shall be transcended and the roots of this paper will come from a cultural perspective. The explanation for this perspective comes from the political history. As many times has been forgotten, if the time will go back to the 1500s to the Iberian Peninsula, one will find that there are four nations, two of them united, that formed the political panoramic of this century: the kingdom of Portugal, the kingdom of Castille, the kingdom of Navarre and the kingdom of Aragon. Aragon and Castille united a long time before the early 16th century. In 1469 the king of Aragon Fernando married Isabel, and in 1474 both kingdoms were united. Only in 1512 the Kingdom of Navarre was conquered, but in 1522 they revolted against the crown. This conquest is an important point regarding the Iberian shipbuilding conception. The only relevant point is that part of the old kingdom of Navarre was not conquered, in the French side of the Pyrenees, and this area, called Labort, had an old cultural convergence with the area of Navarre and some provinces that in those times were named after Bizcaia, but it might be more familiar if it is mentioned as the Basque Country. The kingdom of Navarre was born in the early middle ages and was gradually conquered by Castille and France during the medieval and modern period. The problem created from this conquest is that the relationships that developed between the communities that lived in Navarre during the medieval centuries were forgotten. After the political end of this kingdom, the cultural remains still survived through time. But these bonds and the intensity of them is something that affects the Iberian conception.

Labort is in the south-west of France, and in this province people speak *euskera* (Basque language) as their relatives in the Iberian Peninsula did, but it was geographically out of the peninsula. Although this is an important difference, there are strong hints and many authors have already pointed out thess past cross-border relationships (LOEWEN, DELMAS, 2012; BERNARD, 1966)[4].

This is the only reason why the Iberian concept should consider as well the cross-border cultures, and the effect of the nationalist frame, that does not look beyond the borders. For this reason the Iberian shipbuilding should be consider spaces beyond its geographical limits, such as Labort, as potential research areas to expand our knowledge on the topic. This very same problematic happens with the Catalonian side in the Mediterranean. It is hard to give here further evidence to argue this idea, apart from the evident similarities between this Basque cross-border culture and the Catalonian one.

THE IBERIAN SPACE OF CONVERGENCE

Iberian is just a theoretical approach for a cultural reality yet to be understood. There is a classic question on this topic that many authors have already formulated: *What is an Iberian ship*? There is no simple answer to such a simple question, and this is the paradox of the Iberian shipbuilding: there is not only one possible answer, but thousands of them. There is an answer to this question and actually, there have been many already. Depending on your research perspective there are studies related to documents and archaeology. But every time an answer is found, the researcher comes to the same point: *what is an Iberian ship?*

So it is obvious that there is nothing like just a simple Iberian vessel, a single one that will be a model for all of them, but a rich variety of them, nourished by the experience and encounters with the oceans that shaped the timbers of this shipbuilding tradition on a very slow rhythm. This tradition is affected sometimes by the interests of different actors, such as Kings and merchants, and these people's intentions accelerated, changed and ruled many times the slow, ongoing transition of Iberian vessels. The word transition is a word that refers to a non-static element, a vessel in this case, exposed to the constant changes of a dynamic maritime culture that adapted very fast sometimes, and changed quickly, and remained the same sometimes, for long periods without innovation. But the whole point of using this word is to express the essence of this shipbuilding Iberian culture, where change is a major issue to adapt to the changing nature of the oceans and necessities that required to be fulfilled regarding to the vessel type, interests of the owners and purpose of its navigations.

There is no simple answer to such a question. If one always asks the same question to every ship believed to be Iberian in every decade, thinking there will be a definitive answer, they would be wrong. Every vessel found with some certain features that are considered to be as Iberian brought more light to this changing process of vessels. It made the whole perspective broader, richer. The problem is that the Iberian vessel has changed through time, and each of the ships seems to be the ideal Iberian vessel type. But it is clear here that it would be interesting to see the whole transition and change through the decades. The Iberian ship not as a ship, but as a cultural process of refinement, decadence and change. Refinement because the vessel itself is an imperfect masterpiece, reflection of the gathered experience of thousands of sailors each century that learned how to deal with the ocean. Decadence, because it sometimes improves for the better refinement, other times the vessel just changes for the interests of the shipbuilders and from an ideal perspective, sometimes it does not evolve, but involve, as it happens in the 17th century in the Spanish shipbuilding of galleons (ALBERDI, 2012)[5].

THE BASQUE-CANTABRIC AREA

Cantabric refers to a geographical denomination of the *Bay of Biscay*, in the north of the Iberian Peninsula and west of France and is linked to the *Cantabric Sea* throughout the northern Spanish shore. The use of this name has as an objective, as this paper does, chiefly to point out a space where there is a common shipbuilding culture, such as the Basque-Cantabric space. The Cantabric tradition therefore is based on the northern Iberian shipbuilding culture. This area differs from the Portuguese one, on the western shore of the Iberian peninsula, but receives influences and shares common features with it, as well as differences. Galicia would be the border of this spatial cultural concept and the southern Basque French area of Labort would be the eastern border of this conceptual space.

But here lies a problem as well, related to the frame it has developed for research. There is a possible misinterpretation of the intention for naming all these spaces. It might seem that every space is closed, and is a defined tradition, closed to the others, such as the Basque-Cantabric shipbuilding tradition. The most dangerous misinterpretation for this research frame is when one reads these denominations, such as Cantabric, and thinks of them as separate, especial conceptual areas, without connections to other spaces. The key understanding for identifying all these sub-traditions by different names, is not to mark the special features from these areas. The key point for this conceptualisation of the spaces, is to develop a spatial frame from within which one could compare different traditions, in order to draw the lines of these shipbuilding cultures and the boundaries of them that are connected to others. Especially, the aim of such framing structure is to develop a theoretical spatial tool to generate a deeper understanding of the relationships between the shipbuilding spaces on the Iberian space, the influences and the origins of them, as well as to

define the Atlantic, Mediterranean, and all influences that gathered together in this composite shipbuilding assembly that flourished in the Iberian Peninsula.

THE INFLUENTIAL CORES IN SHIPBUILDING

There is another important concept that needs to be introduced as well. The cultural influential core, in shipbuilding, refers to the idea of the exemplary shipbuilding space for a specific time. Not in the sense of the best, or most advanced shipbuilding technology, but in the sense of having become part of a social reference and respected icon in maritime terms. It is interesting to mention that these referential traditions have been many during history, and in different areas of the world. But when talking about Iberian ships as a lineage, Portuguese and Basque Cantabric traditions became the next influential technological cores after northern Atlantic clinker vessels, such as Cogs and Mediterranean carvel vessels, such as Galleys. These influences have been already pointed out by other authors, such as Filipe Castro or Thomas Oertling (CASTRO, 2008, OERTLING)[6], and are not original to this article.

A major relevance should be pointed out regarding the use of terminology such as 'superior, best or most advanced'. There is a potential misunderstanding if we would have this interpretation of the maritime shipbuilding technology. As it has already been mentioned, there is a fluent change in the role that different cultural communities have been played within the maritime culture, and how they have perceived by others. Innovations that have been socially exposed to different areas sometimes become practical and wide-spread. There is a social interpretation of innovation, when its defined as a hierarchy related to a maritime elite. In this conceptualization there is always some separation between the reality and the constructed idea, as there is an unreal attribution of the whole maritime culture to a single community. Whereas in reality, the traces of a maritime culture have multiple origins and there is more than one culture that have participated in the construction of Iberian vessels. The key point here is to be able to understand the whole interaction and connections between areas and communities in order to have the panoramic on the topic. If one would just only focus on the beauty and shapes of a leaf in a tree, he would not see the whole beauty of the tree, neither the forests. The ancestors of these trees as well, would have been forgotten. This is the same potential risk of a research frame that would be only focused on the Iberian Cantabric ships.

There is no such thing as 'superior' or 'inferior' cultures in the maritime world. This is a social interpretation of technology, such as 'developed' and 'undeveloped' economy. Here relies the importance of this point, since anybody can argue that 'my culture is superior' and construct an argument to defend this, but there is always some personal interest in the interpretation involved in this explanation. These types of denominations have some risk in misinterpreting the technology from a historical-archaeological perspective. One can see that Iberian ships became respected vessels and therefore a predominant style in the 15th and 16th centuries. But as historians and archaeologists, we cannot forget that this is a temporary social conception of a specific type of technology and it was only like this for some specific areas of Europe. Technology itself is not superior. However, it is very obvious that technology itself can have different features, characteristics, advantages, disadvantages, levels and ranges of quality. This is always relative to specific terms of quality, e.g. such as resistance, speed, cargo capacity, durability of the ship or stability and sailing quality. Many points could be discussed here, but will be always relative to our maritime conception of 'hierarchy' in technology.

In order to illustrate this idea, one should think about Chinese ships that were much longer than their European contemporary ones in the 15th century. However, no European shipbuilder met any of these Chinese massive oceangoing vessels that carried more than 1000 passengers, and some were longer than 100 meters. No European navigator met Zheng He's fleet in this century, and therefore was not exposed to this culture. So no sociable exposure to this tradition influenced the Atlantic one, and therefore Chinese shipbuilding was not considered a reference for Europeans. From a practical point of view, Chinese shipbuilding could have brought to Europe a technology to increase the cargo capacity for the trading routes. But they were not even known. So when talking about technology, the discussion will be always relative to the purpose of the ship, and its relative qualities to different capacities.

In this sense one cannot be forget that by identifying only a specific type of technology as the most advanced one, this does not give any historical-archaeological quality. There is a risk of forgetting the connection

and origins of this invention, of separating a connected cultural process. Some innovations are clearly distinctive for a specific area and some inventions have obviously a beginning. But the attribution of the merit of a technological shipbuilding feature, cannot be reduced and simplified to a single culture, such as the Spanish, the Portuguese or the English. The contributions of each different cultures have their value, and these interpretations lack a historical-archaeological quality. From a cultural point of view, the shipbuilding cultures are connected and influencing each other, not separated or isolated. So the track left by a technological feature, cannot be exclusively related to a single shipbuilding community. As a whole, the shipbuilding activity is an ongoing process that develops beyond the national boundaries and connects differences and bonds cultures to a common maritime purpose, to navigate the oceans.

THE BEGINNING OF THE END OF IBERIAN SHIPS

It is not an original idea from this article that the Iberian ships conformed a temporary tradition. This is a key reflection to be understood. There is definitely an end to this tradition that occurs in between 1640 and 1680 (ALBERDI, 2012)[7]. This temporary concept makes sense with the concept of transition, since it is an ongoing process. Iberian ships have an end, because from a shipbuilding point of view, there is the end of a ship type (Galleon) that becomes obsolete from the mid-17th century onwards. This archaic perception from the own shipbuilders made them think in major reformations for the shipbuilding industry (SERRANO, 1998)[8]224. There is a slightly different view for this perception on the decadence of the shipbuilding activity on the mid-17th century, depending on the perspective. Serrano Mangas has an interesting point referring to this different view. He thinks that the Iberian Cantabric shipbuilding activity was not obsolete or primitive, but just differed on the interests of the Spanish crown to develop an military oriented Armada to maintain their political control over the European possessions and overseas conquests. Basque-Cantabric shipbuilders were more focused from 1640 onwards on different objectives, such as the Newfoundland fisheries, or the Indias trading route, and did not follow the interests of the Spanish crown to fulfil the Imperial dream, that was obviously set aside by their own king after the 1640s, and especially after the battle of the 'Dunas' or 'Dunes' in 1639 against the Dutch fleet. The Spanish Imperial dream passed away and new maritime powers took control of this predominant position over the oceans.

There is a major change at the end of this century in shipbuilding that is a reflection of the political crisis and changes that the Spanish Crown suffered during and after the thirty years war and especially in their imperial war against the predominant France of Cardinal Richelieu. The mentality of the whole elite changed, and Spain relegated its naval predominance to stronger maritime powers such as England and the Dutch. The mirroring effect of this fact on the shipbuilding style was obvious. Basque-Cantabric shipbuilders started to imitate and inspire themselves from Dutch ship designs and from their companies (SERRANO, 1998)[9].

Ship types develop with time and change. The Iberian confluence was just a stage on the shipbuilding era. There is distinct vessel type formed by multiple inventions that was built in the space defined as Iberian, within this Atlantic tradition. The extension of this tradition is something cannot be specified in this paper, or argued, since there is much to be done yet related to this hypothesis. The Iberian tradition as a core influential space had its own period. Possibly between 15th and 16th centuries it is more clear this predominance of the so called Iberian vessels. However, it is yet to be specified and documented with relevant sources. By the end of the 17th century there is a dramatic change that, according to Cruz Apestegui, broke with the traditional Iberian system from the 1660s to 1712 (APESTEGUI, 1998)[10]. Shipbuilders of the size of Garrote, or Gaztañeta became a revolution that drastically changed the Iberian tradition, emulating their northern neighbours, such as the British shipbuilders. From a shipbuilder's perspective, the changes were so abrupt, that a type of ship came to its end: the Galleon[11]. For this reason the previous maritime culture identified as Iberian, was no longer the predominant style and was set aside for a new vessel brought by northern influences: the ship of the line. This is why the ship that was born in the peninsula ended, and it was the end as well for a shipbuilding icon. Iberian ships became obsolete for the Spanish kings' military purposes. From there on, British and French influences became predominant in the Spanish Royal Shipyards during the 18th century (APESTEGUI, 1998)[12].

However, the traces of this Iberian tradition changed, but did not vanished forever. The problem related to

this tradition was that it did not supply for the king's purposes the vessel type they needed. That is why the Galleon was relegated to become memories. However this, the remains of the Iberian tradition were continued by other communities, such as Britain, who became pioneers with the ship of the line. This temporary existence of the Iberian shipbuilding lacks an archaeological documented source and an archival one to support this temporary perception of this shipbuilding tradition.

General overview of the Iberian Cantabric shipbuilding research lines

Iberian and Iberian Cantabric research lines

Iberian shipbuilding, but especially the Basque-Cantabric shipbuilding, is a topic that has its own research lines developed, and there are many. Archaeology and History are the main perspectives in this topic. A different type of source is the only distinction between these two disciplinary approaches. All of them, as scientific researchers, have a common purpose in mind, to discover the answer to a question: What is an Iberian ship?

Within these research lines, it is normal that some have become more influential than others, as well as many of these research lines have not developed in the same way. In this sense, archaeological research has become very important regarding Iberian ships. Its visibility is definitely one of the factors. However, documents and historical research have the same importance as these archaeological sources, but have not been as much influence as the wooden remains in the society. This is a very important point. In this paper I would like to explain the effect of these one sided researches and the potential of the combination of them. After many years of specializing in a specific methodology, both historians and archaeologists become very efficient in their areas and expertise. It is obvious that it is a complicated task to develop different skills in different methodologies, and still be a valuable researcher. This is one of the challenges to explain in this paper through the research that it is going to be developed.

Regarding the Iberian ships, chiefly Portuguese and Spanish ones have been defined as such. However, whereas the Portuguese identification is coherent with the cultural traces in the shipbuilding tradition, the Spanish one requires more precision, since it is three traditions that form this Iberian Spanish tradition. Therefore, the use of this denomination is not very helpful when one tries to understand the cultural space of a maritime community. The national perspective, as it has been explained before, does not help at all to approach the Iberian shipbuilding in this age of discoveries. For this reason, cultural identifications match quite precisely with the spatial distribution of these maritime communities.

Within the Spanish crown, three traditions could be distinguished: Basque-Cantabric shipbuilding, Andalusian shipbuilding and Mediterranean shipbuilding. All of them have connections related to the technology they share and vessel types, but also as they belong to different areas with diverse climate and sources, e.g., the Atlantic and Mediterranean Sea and the northern oaks and Mediterranean pines. These differences have brought the attention of this paper to the Northern area, the Basque Cantabric one, for many reasons that will be later explained.

Archaeologically, the Iberian shipbuilding has been expanded and widely illustrated by many authors and researchers. In general, there are many that have discussed the conceptualisation of this maritime tradition.

The major perspective from which most of the archaeologists have approached the topic comes from the interpretation of the archaeological and documental remains. How these wooden remains are assembled, which is the construction sequence, and which are the visible shipbuilding patterns that are replicated in different Iberian shipwrecks, are some of the major approaches. These researchers, in order to answer these questions, have developed many methodologies that really illustrate much further what these Iberian ships were like.

Rather than the questions that researchers asked, the methodologies are what marked a distinctive aspect on this research lines. We can find many approaches to the Iberian shipbuilding topic, both archaeologically and historically, as detailed here: Underwater archaeology or maritime archaeology, archaeology, dendrochronology, experimental archaeology and history in all its varieties as we will specify when talking about all the possible topics.

Archaeological methodologies are basically a system through which the researcher interacts with the ancient remains from the past and records the information. This methodology supplies different ranges of data to the researcher, which brings different views related to these Iberian vessels. Methods such as timber

recording, tool marks, surveying, photogrammetry, photomosaic, photography, drawing, 3D modelling, pottery, wax, tar and pollen interpretation, C14 dating, wood identification, dendrochronological samples, tree ring measurements and many others bring different perspectives to construct a wider picture of the topic.

Historically the Iberian shipbuilding has a similar approach to the key questions: how is the ship designed or what measurements did it have, but also as its own ones. Historically documents can show people's names, shipbuilders businesses, details related to trade, cargo and crews, timber origins and quantities, mention of shipwrecks, description of techniques used for shaping timbers, forest management, forestall laws, shipbuilding economy, interests of the people behind a document, and so on. The variety of sources is not as different as in archaeology, but the typology of document can be compared with such different sources. In this sense, private and royal contracts, Ordinances, treatises, lawsuits and notarial protocols are the most common varieties of sources.

RESEARCH IN IBERIAN CANTABRIC SHIPBUILDING

The available topics related to the Iberian tradition can be so many that this paper needs to be very focused just on shipbuilding in order to be not too long. Some of these topics have already been mentioned in the methodology, but in order to illustrate the research up to the date, it will be explained what has been done and how has it been approached. This way the reader also can appreciate as many possibilities as one could research related to the Iberian shipbuilding.

Shipbuilding has developed a large amount of papers explaining the concept of Iberian vessel that includes the Portuguese, Andalusian, Mediterranean and Basque-Cantabric spaces. However not so many have focused on the northern Basque-Cantabric space. This general overview will be focused on the relevance of these papers related to the Basque-Cantabric area.

As the reader will observe, Loewen, Oertling, Castro, Steffy, Grenier, Huxley and Barkham have all participated to some extent in developing research and data related to the archaeological side of the Basque-Cantabric Iberian tradition. Many worked in trying to define the Iberian conceptual ship, mainly from an archaeological source. Some of their methodology is a reference that shall be used in this paper as well, as it will be explained later. The archaeological Iberian features and shipbuilding patterns are one of the key methodological approaches for their research. This same archaeological approach will be shared into this papers research proposal. Most of these authors are mainly grounded from the archaeological sites from 16th and early 17th century when they talk about Iberian ships. Their work will be helpful to point out future potential archaeological sites for this very limited Basque-Cantabric frame.

Brad Loewen has a very important implication in this case. His statement that the Iberian northern forests were standardized is an interesting point suggesting an organized use of the pollarded[13] forest. His view on the timber shapes, standard shapes and forest practices are the same way giving new perspective to the archaeology. His papers on Iberian ship design and shipbuilding features explains the general features of this tradition, chiefly based on the Basque San Juan vessel, but as well as the English Mary Rose and other important shipwrecks from different places. His thesis is a good example of the idea of Atlantic northern shipbuilding space and its wider connections. He based mainly the argument on the casks from the Red Bay vessel that connect the northern Atlantic space, between Iberia, France and Britain. His perspective is cultural and supports the idea of these cross border cultural connexions. Both his archaeological and archival research have shed light on both of type sources. He's a key author for this Basque Cantabric area related to the 16th century in Iberian shipbuilding, mainly for his work in the Red Bay San Juan whaling Nao (GRENIER, 2007)[14]. The archaeological and historical work that was done in Red Bay is the most significant shipwreck work for the Basque-Cantabric area. This shall be as well one of the main references for this research for the archaeological and the historical view.

Robert Grenier as well worked in the San Juan shipwreck. There is a synthesis of the archaeological results from the vessel San Juan. In this paper he explains the main features of this vessel and some of the unique key shipbuilding concepts to understand the shipbuilding process of the ship (GRENIER, 1998)[15].

There is a short participation in the archaeology of the Huxley Barkham family (Shelma, mother and Michael, son) but the contribution of Shelma Huxley has been tremendous and essential to the discoveries. Shelma Barkham's research about the Basque whaling industry in

the 16th century was the key for the San Juan archaeological discovery, found by maritime archaeologists from Parks Canada (HUXLEY, 1979)[16]. The relationship she found between the Basque toponymy for Newfoundland and the contemporary places, but especially her discovery of the San Juan shipwreck in the archives, led to the largest underwater archaeological projects in Canada. The posterior excavations and research during thirty years produced a vast amount of data from a well preserved San Juan vessel in the murky cold waters of the Canadian shore of Labrador. Further discoveries of other shipwrecks were as well pointed out by parks Canada and by the Huxley Barkham family as well[17].

Thomas Oertling's papers had a wide archaeological view on the concept of Atlantic vessels and his view is that different features can be a guideline to identify these Atlantic patterns. According to Brad Loewen, Thomas Oertling developed the Iberian Atlantic typological features in 1989 (DELHAYE, 2006)[18]. His methodology is a compilation from different shipwrecks and explains the theoretical frame created to identify Iberian ships from many archaeological discoveries. His view is cultural as well, as he is grounding his statements in the archaeological evidence and cultural patterns. His compilation of shipwrecks is important for Iberian ships, but as well as other Atlantic vessels from other areas, such as Britain (OERTLING, 1998, 1989)[19].

Filipe Castro works with an archaeological perspective, focused on reconstructions of vessels and trying to understand the ship design in the Iberian features (CASTRO, 2008)[20]. His approach is both based on the shipbuilding features as well as the ship architecture of the master frames and projections of these ones on a plan. His work is much related to Portuguese shipwrecks, but his research is equally a valuable perspective for the Basque Cantabric area as he talks about the Iberian concept (CASTRO, 2008)[21]. Castro works with 3D reconstructions of the shipwrecks and calculated as well the hypothetical behaviour of the ship full of cargo and sailing (CASTRO, 2006)[22]. He has worked with other authors for calculating the *arqueo* or cargo capacity of Iberian vessels (CASABAN et alii, 2013)[23] as well as participated in some potential Cantabric vessels, such as *Ribadeo*[24]. His approach is a valuable methodology for understanding the behaviour of Northern Basque-Cantabric ships as well as the ship design concepts. Castro's paper on the Iberian concept is a reference for Portuguese, Andalusian, Mediterranean and Basque-Cantabric shipwrecks.

Richard Steffy is another important author. His book is a reference related to the 16th century wooden ships, as well as for many other centuries. His perspective is mainly archaeologically based and looks to be a general explanation for the Iberian shipbuilding through different examples in a variety of shipwrecks. He connects traditions as well such as the Mediterranean and the Iberian ones. His approach is to describe how an Iberian ship was built and designed.[25]

However, Archaeologically the Basque-Cantabric area has been researched from the 15th century onwards. Shipwrecks such as the Urbieta (RIETH, IZAGUIRRE, 2004)[26], found in Guernika, Basque Country, North Spain, Barceloneta (SOBERON, 2012)[27], found in Barcelona, Catalunya, Spain and Newport[28], found in Newport, Wales, Britain, are contemporary from the second half of the 15th century. This archaeological sites had shed light to the northern Iberian tradition and this local Basque-Cantabric area. Furthermore, Cavalaire (DELHAYE, 2006)[29] found in Provenza and Aber Wrach' 1 (L'HOUR, 1989)[30] found in Brittany are another two shipwrecks that are possibly Cantabric in their origin. This early shipwrecks that precede to the Nao's and Galleons are good examples to trace the shipbuilding tradition and its evolution. They are important as well to understand the local typologies and use of timbers from this period, but especially to use them as a tool to compare with other local traditions.

Dendrochronology is one of the most relevant aspects in Iberian shipbuilding that still has many things to teach to us. Only two relevant papers have been published related to the Iberian tree ring sequences. However, one of them from the Newport (NAYLING, 2014)[31] and the other from the San Juan (WADDLE, 2007)[32], are just two examples for such a vast research line as the Iberian dendrochronology. Only one of them is directly connected to the research period presented in this paper, from the *San Juan*. However, these papers are pioneers in the archaeological discipline. The potential of such methodology is so inspiring that it needs to be explained to the reader. As it has been shown, mainly shipbuilding patterns and ship design and shapes have caught the attention of many scholars. It is not the same case for dendrochronology.

This discipline studies the tree rings of the wood that are developed in areas where there is a different behaviour of the tree during the year. These trees that

develop one ring each year, are used for dating wood. If a tree is sampled, from its core, one could see the age of this tree species. Identification of the wood is another of the data that can be brought from this source of information. The most relevant feature of the wood that has been very useful for dating and relating pieces of wood is the tree ring pattern that they develop. Each tree is affected by all type of stress that the environment creates around them. In response to the variety of growing factors, such as water, temperature or nourishment from the earth, specific trees in connected climatic areas develop a growing pattern that can be identified on a graphic. These correlations between different trees can lead to the creation of a master sequence of an area. This master sequence combines samples from many sources, such as living trees, buildings or ideally shipwrecks as well. Through the results in these connected sequences of wood (From the same species and measured by looking at the same factor, such as precipitation) archaeologists can date timbers from archaeological sites, and locate them in time and space, depending on the number of samples taken and variety of places for them. This type of master sequence ideally will shed light on the Iberian shipbuilding, but would be especially relevant for the timber supply. Dendrochronological studies have a very interesting potential, therefore, this paper will try to explain the reason why it is so relevant for the research that will be presented.

Experimental archaeology is the last archaeological discipline that is mentioned in this review. Based on the archaeological sources, such methodology differs immensely from traditional approaches in the Iberian shipbuilding studies. It has not developed a research line, but it has all the potentials as any other discipline. When one talks about experimental archaeology in Iberian ships, the reader might imagine an Iberian vessel sailing across the ocean, on route to Newfoundland. That is exactly the approach of this discipline. There is only a place where Iberian ships have been replicated and have experimented with traditional shipbuilding and sailing techniques, and this is Albaola, in the Basque Country, where the old shipbuilding industry of Pasaia took place as well centuries ago.

First it was the Beothuk txalupa and now the San Juan Nao. Albaola is the Basque society for the maritime Basque culture that promotes, preserves and is bringing back to life these old Iberian traditions. Albaola built the Beothuk txalupa, a small nine meters long rowing and sailing boat. They travelled across the Saint Lawrence estuary and navigated through the historical fisheries of Newfoundland, reviving in situ and bringing back to the memory of a culture, that has forgotten its maritime past. The Beothuk txalupa was an archaeological replica, from the txalupa found in Red Bay, Labrador, under the San Juan whaler. This archaeological replication was done by using the tools and techniques of the old carpenters. The sailing techniques as well were not modern, but archaic. Two sails and seven rows carried a small txalupa throughout Canada, to the place it was found, in Red Bay, Labrador.

The second replica is being built in Pasaia in Albaola's shipyard. Historians, archaeologists, carpenters and master carpenters have gathered in this inspiring project that will bring back to life a Basque whaling ship from the 16th century. The Nao San Juan, of 22 meters, will sail back to the Newfoundland fisheries, as the Basque ancestors used to do more than 400 years ago. Sailing this wooden vessel across the Atlantic waters will be an archaeological navigation, where the crew will have to navigate for at least two months to arrive to the Canadian lands. This project is very relevant for the empirical and practical reconstruction of the shipbuilding techniques of the Iberian tradition. For this reason, as a methodological approach, such perspectives will be included in the research that is presented in this paper.

Historically, the Iberian Cantabric shipbuilding has been interpreted in many ways from many authors. Behind this apparently simple shipbuilding topic, lies an immense variety of aspects such as timber supplies, forest practices, Ordinances and royal laws, conflicts of interests and trading monopolies. All of these apparently minor aspects, are actually as relevant as the shipbuilding itself.

Through the historical sources, such as documents, many authors participated already in understanding what the Iberian shipbuilding is. A variety of sources supplied a number of different studies that can be connected with the Iberian shipbuilding and specifically with this Basque-Cantabric cultural space. The Basque Shipbuilding, forest management and the relationship between the shipbuilding and the local elite have been some of the main historical approaches to the topic.

Some historians related to the shipbuilding should be pointed out here as it follows: Xabier Alberdi, Michael Barkham, Jose Luis Casado Soto, Fernando Serrano

Mangas, Cruz Apestegui, Lourdes Oyarbide Odriozola, Marta Trutxuelo, Blanca Margarita Rodriguez Mendoza and Francisco Fernández González.

Xabier Alberdi in his thesis has a whole chapter regarding the Basque shipbuilding and the conflict of interests in there. His perspective tries to explain the conflicts behind the different interests, represented by different local or imperial elite's that developed different mentalities to run their economies. His work is very relevant to the northern archives in Spain, but especially for the Basque province of Gipuzkoa (ALBERDI, 2012)[33]. His research is developed chiefly through the modern period, 16th-17th-18th-centuries. However, it is only the 16th and 17th centuries that this paper will study.

Michael Barkham's work is very important related to the shipyard of Zumaia and Motriko, as well as for the Basque-Cantabric space. His many publications as well as his thesis have given a perspective that was very focused on the ships and their proportions, as well as measurements (BARKHAM, 1984, 1991, 1996)[34] about this northern shipbuilding industry.

Marta Trutxuelo is related to Orio and the shipbuilding activity in this age of discoveries. Her publication shows a local perspective of a wider topic for the northern shipbuilding[35].

Jose Luis Casado Soto has with no doubt participated immensely in this topic. He is one of the main authors historically talking about the Spanish fleets and shipbuilding. His works related to the Spanish Armada[36] and the Cantabric shipyards[37] as well as his many publications, changed the view through documents of the *Black legend* of Spain. His perspective through iconography, documents and archaeology, shed light to the stories of these Atlantic ships[38]. His view on the topic is very relevant related to the distinction between Iberian vessel types, such as Naos and Galleons. He questions some authors' statements of the multiple use of ships, since he disagreed with this view and thought each ship was precisely equipped and unequipped for different purposes.

Fernando Serrano Mangas is very oriented to the shipbuilding industry in the Northern and southern Spain, but as well as the Indias shipyards. His perspective shed's light to a conflict between the semi-monopoly of the northern Basque shipbuilders and shipowners and the new American elite, known as *Criollos*. His view is very relevant to show the different interests in the Spanish monarchy and the problems created from such disparity of perspective[39].

Cruz Apestegui is a historian but has participated equally with archaeologists in papers. His work is very relevant for the changes in the tradition during the 17th and 18th centuries (APESTEGUI, 1998) [40]. His analysis is oriented to the periods and styles that become predominant in each shipbuilding stage in Spain. He is a very technical author that makes an important point, by differing shipbuilding from ship architecture.

Lourdes Oyarbide Odriozola is maybe the most relevant author regarding to the Basque area and sources. Her works are focused in the 18th century, as she did her thesis in this period and explains from the beginning the shipbuilding activity in the northern shipyards, especially oriented to the province of Gipuzkoa (ODRIOZOLA, 1998)[41].

Blanca Margarita Rodriguez Mendoza has a thesis related to the Ordinances from the early 17th century that affected all the shipbuilding in the North. Her work is a deep review of these royal laws and show the ideal proportions for the Galleons and behind these could be understood the intentions of the Spanish crown[42].

Francisco Fernández González is relevant to this paper for one of his works related to the Galleons[43]. His view in this article talks about the origin of galleons, their apogee and decadence.

Another three authors that area linked to the forests and the use of timbers will be the last historians of this review: Brad Loewen, John Thomas Wing and Alvaro Aragón Ruano. Their work related to the use of timber, conflicts regarding to the source of timbers and royal laws, complement the view needed for this general review.

Brad Loewen, as mentioned, has worked with documents related to this northern Basque-Cantabric space. His most significant contribution regarding forest resources one can find in the Red Bay volume III[44]. In this paper Brad Loewen talks about the timber supplies network in the northern Gipuzkoan shore.

Another relevant author to the timber supply and forest management is Alvaro Aragón Ruano. His thesis in the Gipuzkoan forest and many papers are related to the use of the forest, conflicts of interests regarding to

timbers and the evolution of its use (ARAGON, 2001, 2004, 2009)[45].

The last author is John Thomas Wing. His thesis and some articles related to the royal use of the forest and laws. His perspective of analysing the royal ordinances gives a panoramic view through the modern period in Spain and its forestall sources (WING, 2009, 2013)[46]. His papers points out the conflicts behind these valuable timbers for the time.

A THEORETICAL APPROACH FOR A RESEARCH IN THE IBERIAN CANTABRIC TRADITION

The perspective that comes from this paper is related to this transition in the Iberian Cantabric tradition. There are different authors and people that inspired this idea for this paper.

THE SPANISH KINGDOM AND THE LOCAL ELITES

In the late 16th century the Spanish Kingdom of Phillip II was increasing its military activity throughout Europe and their oceanic acquisitions. Many processes were shaping the monarchy. The king needed more than ever to control his vassals in order to fulfil his purpose in war. An escalation of the tension and participation in different conflicts required all the effort from Spain. The Dutch provinces revolted and England was becoming an uncomfortable neighbour in Europe. The control over the *Armada* was not ideal for the military purposes of Phillip II. There was nothing like a permanent fleet anchored in the harbours. Furthermore, the Spanish fleet was something more attached to the trading and fishing activity, than war oriented. This was a problem for the Kingdom, that was interested in a military defence of the seas by having a fleet constantly watching the Spanish shores. But there was no such thing. That is why the king had to get involved directly over the maritime issues.

This political interests from the King became very relevant to sustain the empire, therefore, other mercantile interests were set aside in favour of this Empire. For such purposes, the kingdom designed a new interventionist political plan oriented to change a mercantile fleet into a military one.

The Spanish power and as a paradox its weakness as well was in the sea. The maritime power become very essential to the king's purpose and therefore, many efforts were delivered in order to complete these new requirements for the empire. The golden fleet and silver fleets carried in the cargoes of the transatlantic vessels were absolutely fundamental to maintain the power of Phillip II. For this reason, the monopoly over the Indias trading route and gold was all controlled and oriented by the interests of the monarchy, through local elites. Seville was a very important axe in this game were America and Spain were essential to the kingdom. Through the military predominance of the sea, Spain maintained the control over the seas and the new American colonies. But by the end of the 16th century other countries began challenging Spain's power. By 1580 Portugal became part of Spain as well, with all its colonies in Africa, Asia, America and the Pacific.

However, the lack of organisation and disparity of interests in the peninsula were becoming an obstacle for the control of the local elites. Differently oriented, local elites under the Spanish crown already had their own objectives and economical sources, differing many times from this Imperial dream. There is a strong northern elite connected to this Basque-Cantabric shipbuilding tradition that was very much oriented to the northern trading routes and the Atlantic fisheries. They had their own businesses and managed to prosper. However it is obvious that Phillip II was not benefiting neither from the whaling and cod fishing activity developed in the Basque Country or the Northern Spanish trading routes. There was no monopoly of the King in Newfoundland and his power could not reach so far. For such reasons, there was a big difference between the interest of the Imperial elite, oriented to an economy of political conquest and war, whereas on the other hand, as an example, the Basque elite was more economically oriented on these trading and fishing activities.

THE ELITE BEHIND DIFFERENT VESSEL TYPES

This disparity of objectives created a difference as well that was reflected in the maritime culture. As the differences were becoming more problematic for the King, the intervention on the shipbuilding activity became necessary to fulfil the royal purposes. This marked the beginning of a transition. The intervention took gradually place during the 15th and 16th century and still was an ongoing process especially in the early 17th century. During the 18th century as well one could understand that the state

was getting stronger and managed more efficiently its maritime efforts and sources. But the period of interest for this research is 1560-1680. This period was a symbolic moment in time were one type of vessel was set aside, the Nao and another one took its place, the Galleon.

According to personal interpretations, each type of vessel, both the Nao and the Galleon, were designed for certain purposes in order to fulfil the interests of the shipowners that built them. The Nao was a transatlantic vessel, designed to carry big cargoes across the ocean. It was not a military vessel, although could be used for war and was armed. But it was a heavy rounded ship, not very adequate for sea warfare, due to the low upper works it had. It was not very fast and originally was not armed with as many cannons as it could have if it was equipped for war. It was definitely a merchant and cargo oceangoing Atlantic vessel, robust and big enough to navigate the northern seas. This type of vessel would be associated to the elite that was flourishing and was interested in the fisheries and trading routes. An example of this local elite could be the Basque one.

On the other hand, the Galleon was a similar vessel, especially according to Brad Loewen and Michael Barkhams ideas that was very similar on the lower hull shape, but not on the upper works. The key difference was that the Galleon was part of the King's vessels and Armada, for this reason it was armed with cannons, more than an average Nao. The idea is that such vessel type was conceived for war and to fulfil the purposes of the King. In this sense, as a personal interpretation, a relationship could be interpreted from the Indias monopoly and the type of vessel that will fulfil the requirements of such controlled and essential golden and silver fleets. The Galleon is war oriented, but as well as transport oriented as well, in order to protect the valuable cargo from the enemies of the Spanish king. The Galleon therefore was related to this elite that would benefit from the monopoly of the king and flourish the same way.

THE PERIOD 1560-1680, THE TRANSITION FROM THE NAO TO THE GALLEON

Here lies the key of such transition, the interest of a group of people to change the Iberian tradition to their new requirements. This transition is a process to be understood. It is obvious that the Iberian Spanish treatises were trying to shape this old Iberian shipbuilding traditions into a new one, were the king wanted to take control over the whole process of the shipbuilding industry. They were a response from the King to a lack of control in the shipbuilding activity. Forests as well suffered more control from the Kingdom, but in this space, there were many interests from different people fighting for the use of the same source: Timbers.

The Iberian treatises developed from the end of the 16th century in order to be as a guideline for shipbuilders to create the ideal ships for the King. If they succeeded or not is something to be understood yet, since there is more treatises at the beginning of the 17th century. What needs to be understood is what effect had these interventions as a whole in the Iberian shipbuilding, but especially in the Basque-Cantabric space, since this was the area were many of the ships for the King were built.

THE HYPOTHESIS

'Is there a transition in ship type from the end of the 16th to late 17th century on the Iberian Cantabric Shipbuilding?'

THE METHODOLOGICAL APPROACH

There are three key points for this research methodology to be understood. These three ideas are part of the core of this research proposal it has been explained in this paper:

First, a comparison between the archaeological and archival sources will be the main methodology to shed light and complement both sources of information in order to cross match it and reassure the argument. It is very significant in this point to understand the main role that will dendrochronology have as well. Through this dendrochronogical perspective, this research will bring new original information related to timber supplies, shipbuilding and timber trade. It will be a key issue related to reconstruct a master chronology for the Iberian peninsula.

The second main method will be the use of shipbuilding patterns and features to distinguish and give detail to this Iberian Cantabric tradition. This approach will help to reconstruct the connections and differences in order to define the Basque-Cantabric space.

The third one will be the experimental view from the reconstruction of the Iberian cultural techniques itself. This view will show aspects that neither through archaeological nor archival sources could be understood. The use of experimental archaeology will be focused in the shipbuilding techniques, but further research will shed light to arqueo-navigation.

CONCLUSIONS: A POTENTIAL CONTRIBUTION FOR RESEARCH

This paper have tried to explain the general situation of the Iberian shipbuilding, but has been very focused in the Basque-Cantabric area. It is obvious that many researches could be planned for the future, and this is just another one. However, the interpretations of this theoretical frame need to be yet contrasted in order to be able to reach further in the research. The contribution of this paper might open a discussion for the Iberian Spanish shipbuilding and the way it can be approached for future research.

Further publications will answer more precisely to the theory that has been explained here. For the moment, this is as far as I can go right now. Future answers are a mystery now, but there might not be such thing. At least this effort will challenge and contribute to participate in such adventurous part of the history, were humans used to sail to lands beyond their reach, on the edges of the world were opportunities were worth living.

[1] LOEWEN, B., Les Barriques de Red Bay et l'espace Atlantique septentrional, vers 1565. Thesis. Université Laval, Quebec, 1999.

[2] John Patrick Sarsfield has this vision as well, that connects Italian and Mediterranean cultural traditions with the Atlantic ones and disagrees with the idea of an original Atlantic culture, but an influenced and connected one. (OERTLING, 1998, pp. 237)

[3] CASTRO, F., 'In Search of unique Iberian ship design concepts', Historical Archaeology, Vol. 42, Nº 2, 2008, pp. 63.

[4] For further reading, see: LOEWEN, B. DELMAS, V. 'The Basques in the Gulf of St. Lawrence and Adjacent Shores', Canadian Journal archaeology, Vol. 36, Issue 2, December, 2012, pp.214. And as well as: BERNARD, I., 'Les types de navires iberiques et leur influence sur la construction navale dans les ports du sud-ouest de la France', in Les aspects internationaux de la decuverte Oceanique, París, 1966, pp. 195-222.

[5] ALBERDI LONBIDE, X., Conflictos de intereses en la economía Marítima Guipuzcoana Siglos XVI-XVIII, Servicio Editorial de la Universidad del País Vasco, Bilbao, 2012. pp. 464.

[6] CASTRO, F., 'In search…, op. cit. pp. 74-76. And, OERTLING, Thomas J., 'The concept of Atlantic Vessel', in ALVES, Francisco (ed.). Trabalhos de arqueología, International symposium on archaeology of medieval and modern ships of Iberian Atlantic tradition, 18, Lisboa, Igespar, 2001, pp. 237.

[7] ALBERDI LONBIDE, X.,. Conflictos de… op. cit. pp. 483.

[8] SERRANO MANGAS, F., 'Realidad, ensayos y condicionamientos de la industria de construcción naval vasca durante el siglo XVII en la Carrera de Indias', Itsas Memoria, Revista de estudios marítimos del País Vasco, Untzi Museoa-Museo Naval, Donostia-San Sebastián, 1998, pp. 224.

[9] SERRANO MANGAS, F., 'Realidad,… op. cit. pp. 230.

[10] APESTEGUI, C. 'Arquitectura y construcción navales en la España Atlántica, el siglo XVII y primera mitad del XVIII. Una nueva sistematización' In Hull remains, manuscripts and ethnographic sources: a comparative approach, edited by F. Alves, Trabalhos de Arqueologia, 18. Lisboa: Instituto Português de Arqueologia. 1998, pp. 168.

[11] FERNANDEZ GONZÁLEZ, F., 'El Galeón Español', in Investigación y Ciencia, ISSN 0210-136X, Nº 191, 1992, pp. 63.

[12] APESTEGUI, C., 'La arquitectura naval entre 1660 y 1754. Aproximación a los aspectos tecnológicos y su reflejo en la construcción en Guipúzcoa', Itsas Memoria. Revista de estudios marítimos del País Vasco, 2, Untzi Museoa-Museo Naval, Donostia-San Sebastián, 1998, pp. 237-266.

[13] Pollard(ed) tree: Tree that has been modified by intentionally cutting it in certain moments of the year to guide the branches of the trees and produce timbers. This technique is very used in the northern area of the Iberian shipbuilding.

[14] GRENIER, R., Marc-André Bernier and Willis Stevens, eds. *The Underwater Archaeology of Red Bay: Basque Shipbuilding and Whaling in the 16th Century*. 5 vols. Ottawa: Parks Canada. 2007.

[15] GRENIER, R. 'The basque whaling ship from Red Bay, Labrador: a treasure trove of data on iberian atlantic shipbuilding design and techniques in the mid-16th century', in ALVES, Francisco (ed.). Trabalhos de arqueología, International symposium on archaeology of medieval and modern ships of Iberian Atlantic tradition, 18, Lisboa, Igespar, 2001, p. 269-293.

[16] HUXLEY, S., GRENIER, R., 'Divers find sunken basque galleon in Labrador', *Canadian Geographic*, vol 97, 3, 1978-1979, 60-63. or.

[17] HUXLEY, Shelma, BARKHAM, Michael. 'Una nota acerca de cinco pecios vascos documentados del siglo XVI en puertos del sur de Labrador/A note on five documented 16th century Basque Shipwrecks in harbours of Southern Labrador', *Itsas Memoria*, 5, 2006, 771-776. or.

[18] DELHAYE, M., LOEWEN, B., THIRION, G.: Épave médievale de Cavalaire-sur-Mer wreck, c. 1479', in BLUE, L, HOCKER, F., ENGLERT A. (eds.): Connected by the Sea. Proceedings of the Tenth International Symposium on Boat and Ship Archaeology, Roskilde 2003, Oxbow Books, Oxford, 2006, pp. 99.

[19] OERTLING, T. J., 'The concept of Atlantic Vessel', in ALVES, Francisco (ed.). Trabalhos de arqueología, International symposium on archaeology of medieval and modern ships of Iberian Atlantic tradition, 18, Lisboa, Igespar, 2001, 233-240.
OERTLING, T. J., 'The Highborn Cay wreck: The 1986 field season', in The International Journal of Underwater Archaeology, 18.3, 1989, p. 244-253.

[20] CASTRO, F., 'In search…, op. cit. pp. 63-87

[21] *Ibidem*

[22] CASTRO, F., 'Sailing the Pepper Wreck: a Proposed Methodology for Understanding an Early 17th -Century

Portuguese Indiaman' in, The International Journal of Underwater Archaeology, 35.1, 2006 b, p. 97-103.

[23] CASABAN, J. L., CASTRO, F., SAN CLAUDIO, M., 'Fórmulas de arqueo y construcción naval ibérica a principios del siglo XVII', in I Congreso de Arqueología Náutica y Subacuática Española, Ministerio de Educación, Cultura y Deporte, 2013, pp. 567-574.

[24] SAN CLAUDIO, M., GONZÁLEZ GALLERO, R., CASABÁN, J. L., CASTRO, F., DOMINGUEZ DELMÁS, M., 'El pecio de Ribadeo, un excepcionalmente bien conservado pecio español del siglo XVI', in I Congreso de Arqueología Náutica y Subacuática Española, Ministerio de Educación, Cultura y Deporte, 2013, p. 208-243.

[25] STEFFY, J. R., Wooden ship building and the interpretation of shipwrecks. Texas A&M University Press, College Station, 1994. pp.128-186.

[26] RIETH, E., IZAGUIRRE, M..:'El pecio medieval de Urbieta (Gernika)', in UNSAIN, J.M. (dir.):La memoria sumergida. Arqueología y patrimonio subacuático vasco, Untzi Museoa-Museo Naval, Donostia, 2004, pp. 142-151.

[27] SOBERON, M., PUJOL, M., LLERGO, Y., RIERA, S., JULIÁ, R., DOMÍNGUEZ, M., 'El Barceloneta I. Una embarcación medieval a tingladillo en Barcelona', in, Itsas Memoria. Revista de Estudios Marítimos del País Vasco, 7, Untzi Museoa-Museo Naval, Donostia-San Sebastián, 2012, pp. 411-422.

[28] NAYLING, N., JONES, T., 'The Newport Medieval Ship, Wales, United Kingdom', in The International Journal of Underwater Archaeology, 18.3, p. 2013. p. 1-40.

[29] DELHAYE, M., LOEWEN, B., THIRION, G.: Épave médievale de Cavalaire… op. cit.

[30] L'HOUR, M., VEYRAT, E.: 'A mid-15th century clinker boat off the north coast of France, the Aber Wrac'h I wreck: A preliminary report', in The International Journal of Underwater Archaeology, 18.4, 1989, pp. 285-298.

[31]NAYLING, N., SUSPERREGI, J., 'Iberian Dendrochronology and the Newport Medieval Ship', in The International Journal of Nautical Archaeology, 43.2, 2014, 279-291.

[32] WADDLE, P. J.A., 'Wood Identifications of selected 24m timbers' and, LA ROCHE, Daniel, 'A Synthesis of Dendrochronological studies', in GRENIER, Robert, Marc-André Bernier and Willis Stevens, eds. *The Underwater Archaeology of Red Bay: Basque Shipbuilding and Whaling in the 16th Century*. Ottawa: Parks Canada. 2007. Vol 5, p. 71-73, 75-81.

[33] ALBERDI LONBIDE, X. *Conflictos … op. cit.* pp. 417-490.

[34] BARKHAM, M. 'La construcción naval vasca en el siglo XVI: La Nao de uso Múltiple', in Vasconia, 3, 1984, pp. 101-126.

BARKHAM, M. *Shipowning, Shipbuilding and Trans-Atlantic Fishing in Spanish Basque Ports, 1560-1630: a case Study of Motrico and Zumaya*, Doktorego Tesia (non-published), University of Cambridge, 1991.

BARKHAM, M., 'Las pequeñas embarcaciones costeras vascas en el siglo XVI: notas de investigación y documentos de archivo sobre el 'galeón', 'la chalupa' y la 'pinaza', in Itsas Memoria, Revista de Estudios Marítimos del País Vasco, 2, Untzi Museoa, San-Sebastián, 1996, p. 201-222.

[35] TRUTXUELO, GARCÍA, Marta. Orio historian zehar, Bizker digitala, Lasarte Oria, 2003.

[36] CASADO SOTO, J. L.: Los barcos españoles del siglo XVI y la Gran Armada de 1588. Gran Armada, 4. Madrid, España: Editorial San Martín 1998.

[37] CASADO SOTO, J.L., Barcos y Astilleros: La Construcción naval en Cantabria. Santander. Puerto de Santander, 1993.

[38] CASADO SOTO, J.L.: Construcción naval atlántica española en la época de Felipe II, Felipe II, la ciencia y la técnica, Acta editorial, Madrid, 1999, 369-390.

CASADO SOTO, J.L., 'Flota atlántica y tecnología naval hispana en tiempos de Felipe II', in Congreso Internacional Las Sociedades ibéricas y el mar a finales del siglo XVI. Madrid: Sociedad estatal para la conmemoración de los centenarios de Felipe II y Carlos V- Pabellón de España, Expo '98-Lisboa, 1998. t.II: La monarquía Recursos, organización y estrategias.

CASADO SOTO, José Luis: 'The Spanish Ships of the Oceanic Expansion. Documentation, archaeology and iconography from the 15th and 16th centuries', in ALVES, Francisco (ed.). Trabalhos de arqueología, International symposium on archaeology of medieval and modern ships of Iberian Atlantic tradition, 18, Lisboa, Igespar, 2001, 131-161.

[39] SERRANO MANGAS, F., 'Realidad,… op. cit.

[40] APESTEGUI, C., 'La arquitectura naval entre 1660 y 1754. Aproximación a los aspectos tecnológicos y su reflejo en la construcción en Guipúzcoa', Itsas Memoria. Revista de estudios marítimos del País Vasco, 2, Untzi Museoa-Museo Naval, Donostia-San Sebastián, 1998, pp. 237-266.

APESTEGUI, C. 'Arquitectura y construcción …op. cit.

[41] ODRIOZOLA OYARBIDE, Lourdes,'La construcción naval en Gipuzkoa. Siglos XVI-XVIII', Itsas Memoria, Revista de Estudios Marítimos del País Vasco, 2, Untzi Museoa-Museo Naval, Donostia-San Sebastián, 1998, pp. 93-146.

[42] RODRÍGUEZ MENDOZA, Blanca Margarita: Standardization of Spanish Shipbuilding: Ordenanzas para la Fábrica de Navíos de Guerra y Mercante – 1607, 1613, 1618. Doctorate Thesis. Nautical Archaeology Program. 2008.

[43] FERNANDEZ GONZÁLEZ, F., 'El Galeón Español', in Investigación y Ciencia, ISSN 0210-136X, Nº 191, 1992, p. 54-63.

[44]LOEWEN, B., 'The Basque shipbuilding trades: Design, Forestry and Carpentry' in GRENIER, R., … op. cit., pp. 253-299.

[45] ARAGÓN RUANO, Álvaro, 'El bosque guipuzcoano en la Edad moderna: aprovechamiento, ordenamiento legal y conflictividad', Munibe Suplemento, ISSN1698-3807, 14, 2001, 1-285.

ARAGÓN RUANO, Álvaro, 'La conflictividad en torno al bosque guipuzcoano en la Edad Moderna: Recorte y apropiación de los usos y bienes concejiles', in ARANDA PÉREZ, F.J. (Coord.) El mundo rural en la España Moderna. Cuenca, Editorial de la Universidad de Castilla-La Mancha, 2004.

ARAGÓN RUANO, Álvaro, 'Los Robles Trasmochos guados o Ipinabarros: Una apuesta sostenible de futuro para una técnica forestal olvidada', in 'Actas de la III Reunión sobre Historia Forestal', Cuad. Soc. Esp. Cienc. For. 30, 2009, 137-142.

[46] WING, John Thomas, Roots of empire: State formation and the politics of timber access in early modern Spain, 1556-1759, Thesis, University of Minnesota, 2009.

WING, John T., 'Keeping Spain Afloat, State Forestry and Imperial Defense in the Sixteenth Century' in Oxford Journals, May, 2, 2013. p. 116-145.

'THY KING COMMANDS TO PRESERVE STICKS FOR THE ROYAL SERVICE'
POLITICAL IMPLICATIONS OF TREES MANIPULATION AND TIMBER SUPPLY FOR THE NAVY, THROUGHOUT THE MODERN AGES, IN PORTUGAL

Cristina Joanaz de Melo
Research developed under the program financed by FCT, reference BPD/2775/2010.

INTRODUCTION

It is well known that throughout the Modern Age, the European empires overseas became dependent on shipbuilding to cross the oceans. Therefore timber and other woodwork ought to be supplied to the royal shipyards.

As it has already been explored for the Portuguese case, the masters of the royal shipyards as the master of the royal timber preserves would know how to select the best trees for shipbuilding since the beginning of the 15th century.

However, in addition to the supply of timber for the navy, the royal game preserves and the parked woodlands would also provide wood, charcoal, timber, sticks, logs, fodder and other woodwork resources to the noble house, for many tasks. Then, the goods from the woods would be collected according to specific functions like the branches of the trees, for example, used for farming tools, fencing or wood burning.

Indeed attention will be drawn to the way in which the technical expertise on forestry management contributed for the Portuguese monarchs to take back rights granted to the nobles, in this case rights over the forests, in the domains of seigniorial landlords without accusing the highest nobility of the realm of high treason, from 1575 onwards.

This will bring us to the core of this work: unveiling what would be - the profound knowledge about woodlands and trees management, pollarding and pruning - in the king's estates that, unexpectedly, led to social impact while increasing the effective capacity of the monarch to control powers at a local level.

Such privilege would allow him to rise above aristocratic *Primus Inter Pares*, symbolically as well as effectively, in the Ancient Regime from the Middle Ages.

PRESERVING GAME AND FORESTS: FROM SELF CONFIRMATION OF 'A GOOD KING' TO A MONARCH IN COMMAND

In Portugal, since the Middle-Ages the right to make preserves was an exclusive prerogative of the monarch. This right of the king expressed in king Duarte I's Code of Laws in… was almost a duty and the proof that the king was a good sovereign. Parks for hunting and forest rights were a common donation to aristocracy.

Along the 14th and 15th centuries, the act of creating preserves and donating them to the highest nobility of the kingdom sealed the king's commitment of paying tribute to his *Primus Inter Pares* in the realm.

While raising aristocrats, laics or ecclesiastics to his level, making and granting a preserve as well as receiving it would be, quite probably, a mutual honour. In the late 16th century, preserving stick for the royal service would become, in my view, an operative tool for the king not only grant the timber supply for the fleet but also under the premise of protecting the royal preserves both for hunting as for timber production the monarch created a new Noble House with the task of policing the woodlands and parks. The title and the function were instituted in 1521 as the house of the Major Keeper of the Realm.

Indeed, throughout the late middle Ages and mostly until the discoveries in the late 16th century (1575), this prerogative had almost no meaning as an operative

tool for the royal control over the rights of the high nobility, nor over the common secular laws.

It was only in 1575 with the proclamation of the 'Act of the cork tree forest' that we will notice an escalade of the monarch's capacity to restrain aristocratic donated rights, on noblemen estates, interfering symbolically and territorially in their ethos and status.

Actually, before and after the imposition of the regiment of the cork tree of 1575, the aristocratic privileges – except on felling this species – were confirmed almost by default, after the coronation of a new king as well as after the death of the head of a noble house, to his successor.

In those confirmations, exclusive rights to the head of the noble house such as the reserves for big game as well as private ponds for water resources would be included.

This would not change during the process of controlling and stabilizing local jurisdictions, intermediate social powers, military, judicial and administrative bodies in the Portuguese European continental territory.

In 1575, imposing the prohibition of cutting cork trees along the major area of the river Tagus water basin to everybody except the king, was possible due to a former development of the monarchs capacity to rise above those same almost Primus Inter Paris.

The demonstration of the monarch extended power over his counterparts was possible in a context of a wider centralization of powers in the person of the royal figure. That one had been taking place along the 15th and 16th centuries under a specific context of the Portuguese monarchy.

In the last quarter of the 15th century the King Manuel I, the 6th person in the line of the princes for the succession, became not only the ruling monarch but controlled as well the masters of the military orders gaining the monopoly upon the overseas empire. He became the first seigniorial house undisputed in income, jurisdictions, estates and municipalities, endorsing and paying himself part of the income of the highest aristocracy of the realm.

Under this context was possible to D. Manuel I and his successors starting diminishing some donated prerogatives of the nobility of the realm. Indeed, until the need to exceed the borders of the royal preserves and game parks, for the supply of timber for the navy the monarchs did not dare to take back forest rights to aristocracy. And this responded to a crucial need of timber supply for the shipbuilding activity.

This one depended on an accurate perception of forest and wood management in a small territory as Continental Portugal is. Therefore keepers ought to know about trees. Prohibiting felling trees wouldn't be enough to keep a fleet overseas. Yet, the awareness of what to preserve and how, would.

Indeed the knowledge about forest renew would take such a long time that the trees required for the royal service had to be acquired beyond the preserves existing in the 15th century. Coherently to this need, the area of the royal preserves was profoundly extended in the second half of the 16th century, as it will be referred further ahead.

MASTERING WOODLANDS AND THE MANAGEMENT OF THE TREES

In the early 16th century, his tasks concerning the management of the parks had been attributed accordingly with status of the king as an aristocrat. The Major Keeper of the Realm had mainly to grant the privileges of game hunting in the royal woods, preventing and severely punish poaching. This was functioning accordingly with the paradigm of the first among equals, the monarch, be shown by practicing big game hunting. However, with the stability of the route of spices from India to Portugal, the navy would need a constant supply of wood, timber and other woody resources for the royal shipyard.

The demand increased with the official acknowledge of Brazil in 1500 and the voyages in the Atlantic. Yet, the supply of timber from the New World was not immediate to grant enough timber in Lisbon to keep and increase an operational fleet for war and for trade.

That timber exchange between the two margins of the Atlantic would be gradually developed in the course of the 16th century and onwards. Thus timber supply for the increase of both navy and commercial boats was increasing.

Coherently to those concerns, there was an increase of parks and forest preserves, conciliating both game catching as the service of protecting and renew sticks for the royal service of a fleet for trade and naval protection.

This concern was quite, indirectly induced in the amazing increase of the number of royal preserves created in the kings' estates in the water basin of the River Tagus Between 1572-1579. D. Sebastião I almost doubled the area of timber and hunting preserves, created in the former kingdoms.

It is plausible to assume that, this king that perished in Alcacer Quibir in 1580, aimed not only to assure the fleet spices root to the Indic, the trade and penetration in Brazil but aiming to conquest the north of Africa would need a permanent operational war fleet. That would require a substantial increase of timber supply for war affairs.

The Regiment of the Cork Trees of 1575 would order that, from that moment onwards all the oaks included in a certain perimeter of the River Tagus (figure 1, page 4) would become the monopoly of the crown.

Apart from the king's jurisdictions and lands, many of the estates and properties inside those limits belonged to the highest nobility of the kingdom, to monasteries and municipalities. That is to say that king Sebastião I was taking back forest rights from all those entities not only by means of a decree but also by assuring the implementation of such a measure.

The Head of the Royal Forests was given power to submit everyone to this regiment, except the king himself. Yet, that officer was himself an aristocrat, head of the noble house of the Major Masters of the Royal Forests, founded in 1521, which was socially at the same level or above the entities to be subdued to that Act.

The exclusive right of the monarch to make preserves could then be extended all over the estates of the realm, including the highest aristocratic and ecclesiastic entities of the kingdom.

This prerogative acquired both social and political impact while contributing to strengthen some sort of internal control upon all bodies of society along the Ancient Regime, in what concerned access to forest goods and natural resources.

As long as the 'sticks' were useful for the royal navy, the logs and their trees would be preserved in the estates of the nobility, the church, municipalities and commons inside the perimeter established by the royal acts for that purpose.

Those trees would be marked by the keepers of the royal preserves and could not be fallen down without the permission of the Head of the Royal Preserves and never without the surveillance of the master of woodmen and the keepers in charge of protecting the royal woods and hunting parks.

Totally contradicting a mainstream theory of ecological destruction and depletion of natural resources by human hands the regiment of the cork trees of 1575, as the acts to protect forest uses in Portugal do in my view contradict the ecological vision of resources depletion. Instead they reveal a profound Knowledge about forest management. This doesn't mean that shipbuilding was not responsible for forestry destruction across some regions of Europe.

For instance, Frederic Lane advanced in his work *Venetian Ships and Shipbuilders of the Renaissance* the theory that the Venetian fleet was one of the major pillars of the Doge´s power in the 16th century. In this manuscript, the author argues that the Venetian fleet had been destroyed and since it could not be replaced due to the lack of wood supply the Empire faded away.

The Doge used to import woods from the Adriatic and Tyrrhenian seas. In other words, the maintenance of the fleets for war affairs as well as for trade and transport demanded permanent logistic support.

However in my view the cork trees act of 1575 reveals the opposite concerning the Portuguese approach towards forest in the 16th and 17th centuries: an outstanding vision of the future-need for forest and timber production, leading people to use, cut and renew forests, years and decades ahead.

In Portugal the concern about preserving and increasing woodlands would be a permanent concern expressed in the preserves regulations towards the Management of forests since, at least the 14th century, as Nicole Devy-Varetta, Carlos and Cristina Joanaz de Melo have proved.

Felling trees was carefully planned has much as the ruling for replacing the ones cut. These premises were present in all the regiments of the preserves since the 14th century, reinforced in royal codes of the realm with the King D. Afonso V in the 1th century, under the kingdom of D. Sebastião I in the 16th century and in the new regiments as in the general law of the real of Filipe I of Portugal (II of Spain) in the 17th century.

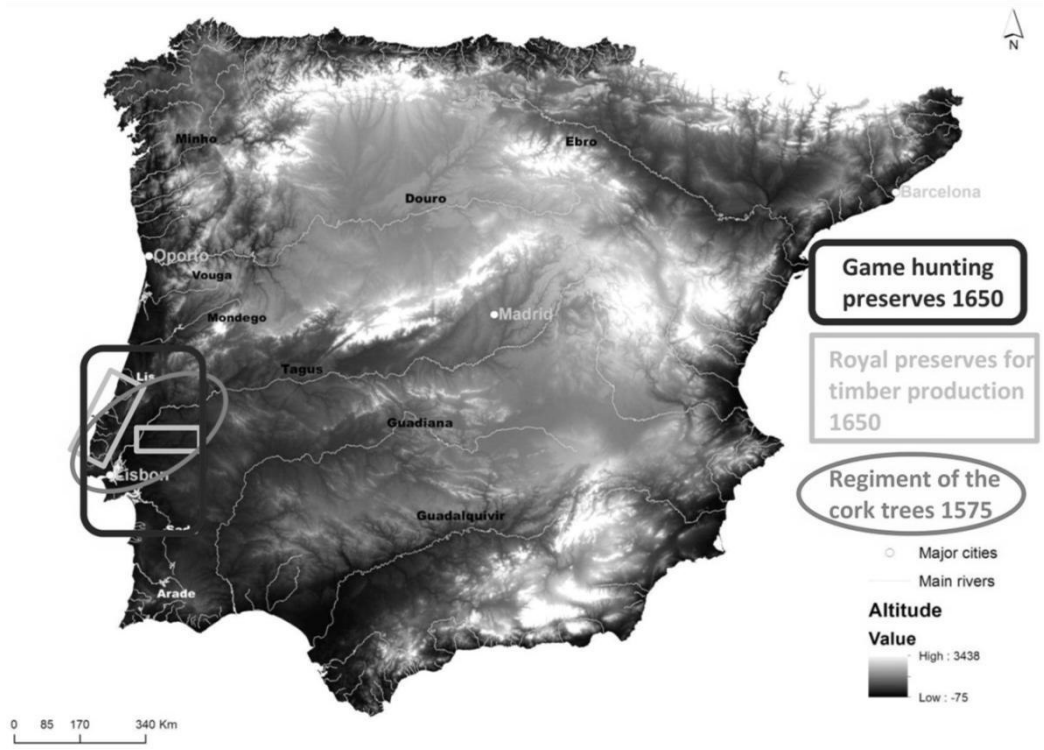


Figure 1. Cork tree and Perimeter of the Royal preserves centuries XVI and XVII. (Source: Daniel Alves; source: SIGMA Sistema de informação geográfica e modelação de dados aplicada à História de Portugal e Atlas - Cartografia Histórica http://atlas.fcsh.unl.pt).

Under the unification of the Iberian crowns from 1580-1640, the completion of British, Dutch and French Fleets for the master of the oceans, then in the second half of the 17th century, increase of timber consumption has provably increased in such a way that renew was not possible in the narrow physical space of Portugal.

So far the prerogative of preserving logs and timber in seigniorial domains in Portugal, Spain and France under the forest acts, of D. Sebastião in 1575, Filipe IV of Spain, in 1614, and Colbert in 1669, has been interpreted has a way to control a scarce resource. In Portugal the cork tree Act would mean something more: that the *Quercus suber* specie would be renewed in a very long, as a minimum of 50 years while Pine trees would take 20 to 30 years to reach their maturity.

And while the cork tree was preserved no other forest tree species was prevented from being cut outside the royal preserves, no other became monopoly of the crown ever. The only forest specie that was preserved as monopoly of the crown upon the water basin of the Tagus was the *Quercus suber*.

This is precisely what seems distinctive in the Portuguese management of the royal forests when comparing it with other European forest acts, the long run perspective to avoid scarcity of one tree fit for floating in the kingdom, in Europe. First the Portuguese and afterwards the Spanish Hapsburgs, wore concerned about granting independent sources of timber. The epopee of mastering the Pacific was yet to be of interest for European monarchs. That's why in the 16th and 17th century, producing, preserving and renew trees was of such importance for the new worlds and Imperial sources of wood supply were yet to be discovered, managed and mastered, as their transport and trade.

The profound knowledge of European forest allowed building the war and trade fleets. In Portugal, the need for timber, logs and branches, would encourage and induce to specialization of woodcraft works as well as eventually trees management, at least in pine trees for products made of resin which would be quite important in boats isolation, a duty that remained until the 18th century and beyond, confirmed in the 'new Regiment of the royal pine tree woodlands of Leiria, 1751'.

The Regiment of the royal forests of 1605, from Filipe I of Portugal (Filipe II of Spain), maintains the order for the renewal of the forest for timber production and does not abolish the former act of 1575.

Often, still in the late 18th century, fires were started by peasants or poachers as revenge against the keepers and the judges of the royal preserves, who would not allow them to spook and hunt game or to have access to charcoal and wood when licenses were refused.

Punishment against intentional fire was evident in all the singular regiments of the royal preserves since the early 1500s, and severely punished. Shipbuilding industry and the navy supply had nothing to do with this sort of *depletion* of trees.

Therefore, woodlands control and even maybe the design of woodlands for different purposes, might have been developed in such a way that in the last quarter of the 18th century, in Leiria's woodlands of pine trees, peasants were not only allowed but encouraged to proceed on wood-gathering to clean the woods, and even during Portugal's occupation by Napoleonic troops in 1812, this practice kept being endorsed by the French government.

It was not a mere question of preventing scarcity and stop the irrelevant population from having access to the woods, those laws could actually mean a nursing planning for a very rational management of the woods which could, in fact be in danger of depletion, if trees consumption would be intensively required in the short term. Moreover, the risk of trees depletion was maybe more serious and feared from fire, started by criminal hands.

It is also true that in 1575 Brazil was not yet the major target of the Portuguese empire, and wood supply for royal shipyards was still granted by the royal preserves in Continental Portugal. However until the 18th century there were also other concerns that demanded a careful management of the forest, namely defending social order, protecting the populations, craftworks, farming lands against fire in the woods.

Indeed we could suggest that during the 1500s and the 1600s in Portugal, rulers would have a holistic view on forest raw-materials consumption, considering every layer of the society in all social classes depended on immediate supply of tree products, by far beyond timber for shipbuilding construction.

Thus, nursing trees and the work of the trees keeper would mean a lot more than simply felling trees or gathering wood to fulfil the duty of supplying the sticks that were demanded for the royal shipyards and the royal noble houses, and preventing others from doing so.

STICKS FOR THE ROYAL SERVICE – A DOUBLE FUNCTION: THE NAVY AND THE REST

Landscapes have changed continually since the dawn of times for nature is dynamic. Human intervention has produced minor as well as major changes on the surface of the Earth. In the long run natural resources such as water and forest were vital for the survival of peasant communities and they have been systematically explored across the World.

Among other authors Denis Woronoff analysed the evolution of consumption and the uses given to products provided by the forest, from the 12th century to the 19th century showing the importance of the woodwork products in manufacturing and industrial activities.

This author places forest as a major source of raw-material supply in agrarian societies, while supporting a wide range of economic activities such as: wood-making for agricultural tools, lands fencing, shipbuilding and housing construction, water works (dams and bridges), and in the 19th century, the production of charcoal to supply high ovens in France.

The woodland goods would supply farming activities, housing construction, agrarian logistics and tools, transports or timber and other wooden products for shipbuilding. The access to them would mainly depend on local availability or access through trade and transportation.

Considering the above, the variety of uses given to woodland crafted goods, and the gradual increase of the population it would require presumably intensified management of forest locally, in order to grant increasing consumption of the forests, in the long run. This would happen in France as well as in Portugal, Spain or in any region depending on natural resources uses, extraction, management, and renewal.

Taking then into account the wide range of activities that woodlands involved, and moreover in Portugal with the need to maintain the fleet in order to keep the spice route regular, the abundance of trees, their scarcity and the possibility of woodlands renewal became a matter of increasing political attention for the Portuguese monarchs throughout the 15th and 16th centuries in the Royal woods and beyond.

Figure 2. Sticks for fencing and (hypothetically) hoe cables (Source: Tiles from the Municipal Archive of Braga. Photo from Cristina Joanaz de Melo).

Logs, branches, fodder and stick would be managed and selected to be cut and crafted for specific purposes. That is to say those trees were shaped from their birth to a functional purpose: for timber, wood, sticks, boat floor, roofs, fencing, bridging. How do we know and/or infer this?

Confronting the archive material on the request of 'sticks' for the royal service namely for masts, wooden boards for boat hulls, or wooden boards for the floor, ceilings, hoe cables, or fencing together with the images, as figure 2 (page 8) shows, tiles of the 18th century in the place of the bishop in the city of Braga, nowadays archive from the Braga District and from the University of Minho, in figure 2, we might visualize how trees could have been pruned for their functional purposes as requested- stick for fencing or for cables for farming tools.

The records produced from 1583 to 1833 by the extensive body of officers of the Royal forests, from the keepers to the judges and clerks and notaries, archived in the bureau of the royal preserves, do picture a very strong knowledge on the mastering of the technique of taming and shaping trees.

That information is visible in the requirements from the royal shipyards to be supplied with goods from the forests. Requests for forest resources would be made for centuries to the Major Forest keeper as the following example shows:

'The Queen My Lady, is whiling that you pass the necessary orders under which the cuts of sticks in the pine tree woods of the Preserve of Alcácer do Sal [in Sado river, south from Tagus River, figure1, page 4] must be carried out by the interim forest keeper Joaquim Soares Serrão, according to the list attached (...)' in the 27th of November of 1778, in the archive of the Royal preserves. This list would include:

- 28 sticks for the cover of the deck with 33 feet long, 13 inches wide, 14 inches thick;
- 28 Cans? for the blurs and Welding and Castle of the same length of 32 feet, 12 inches thick and 11 inches wide and loin up 9 inches;
- 28 sticks for the cover of the deck of the ship with 30 feet long, 13 inches thick, 14 inches wide and loin up ten inches;
- 18 Cans? for the blurs and Welding for the same [ship]of 28 feet long, 12 inches thick and 11 inches wide and loin up 9 inches;
- 100 and a half cans for the same decks with15 feet long, 13 inches wide, 14 inches thick.

These sticks must be such that make court (cross) and are free from samago [fungi?] as much as they can be and without branches by the heart and also the fillet[log] evenly. The thickness of these sticks and cans means facing the mouth sticks above and widths means facing mouth the band'.

Equivalent orders were given to the officers of the royal forests responsible for the supply of wood and timber for the royal house as well as for the noble houses of the Queens and the Princes. Added to these licenses were given to the people living inside the parks and hunting preserves for felling trees, branches (for construction or woodcraft activities and agricultural tools), fencing pigs nurseries, gathering stick for farming tools or firewood and burnt charcoal.

Those records do provide an insight not only into the species of trees that were required to be cut and used for their function as pine trees or cork trees, in boats or elsewhere, but also into the accurate wisdom of managing trees years and decades ahead for a wide range of purposes.

Therefore, the trees to be fallen down would be accurately selected, woods would be managed and trees shaped, pollard or pruned according to a purpose.

As the records of the Royal parks and woodlands bureau prove, the master of the woodcraft works of the royal shipyards as well as the keepers of the royal forests would have an accurate awareness of which forest species would be adequate for different purposes.

One might consider that wood supply, forest management and woodcraft industry became strategic to sustain building industries and war affairs, as well as territorial control over the seas. Mastering the forests and controlling trees management were thus areas of internal as well of external political interest.

CONCLUSIONS

What is being strongly suggested in this approach is that the development of specific policies to guarantee the monopoly of shipbuilding as well as the permanent supply of wood for shipyards would intensively contribute not only for the preservation of woodlands but for their renewal, at least in the 16th and 17th centuries Portugal.

It is crucial to understand that the ran out of timber for several types of consumption went along not only with the discoveries overseas but also with the increase of the population and that was a gradual process.

If the royal navy required timber and it strengthened the role of the royal forests bureau and its social impact over the territory, the forest management was essential to grant future supply of increasing resource consumption: timber, quite difficult to replace in the short run. Therefore the technical know-how of trees management not only was required but was crucial for this enterprise mostly in the 16th and 17th centuries in Portugal.

The intertwining of an early perception of an expected future scarcity of timber as raw-material for shipbuilding together with the acquired skill for woodlands management helped to strengthen the king's effective and symbolic power over all the social bodies such as noblemen, clergy, craft-men, among others, spread across the territory. A knowledge that somehow lasted after the Liberal Portuguese Revolution expressed under the maintenance of the same service for timber production.

SOURCES AND BIBLIOGRAPHY

SOURCES

Arquivo Histórico Ministério do Equipamento, Planeamento e Ordenamento do Território /ex- Ministério das Obras Públicas.

Montaria Mor do Reino, séries 1 a 40.

SÉRIES DO NÚCLEO DOCUMENTAL DA MMR

1-Livros de Registo de Correspondência - registo das entradas e sumários da correspondência sem qualquer tipo de organização1583-1833; 2-Copiadores de correspondência sobre transgressões, pareceres e outros documentos 1777-1821 e 1724-1833; 3-Registo do pessoal das reais coutadas de Salvaterra de Magos; 4-Registo dos monteiros a cavalo e moços do monte, suas armas e documentos a eles respeitantes; 5-Abecedário dos ofícios das coutadas; 6-Registo de despesas e receitas com os oficiais da montaria; 7-Índice alfabético das terras portuguesas; 8-Regimentos, provisões e documentos sobre a administração-1605 até séc. XIX; 9-Ordens reais e avisos da Secretaria de Estado dos Negócios do Reino 1596-1721; 10-Avisos da Secretaria de Estado dos Negócios do Reino sobre petições e perdões (ligação com o núcleo nº 2)- 1738-1833-; 11-Ordens Reais, Avisos da Secretaria de Estado do Reino e Petições Relativos à Falcoaria de Salvaterra de Magos- 1756-1806; 12-Editais; 13-Certidões de publicação de editais -1758- 1810; 14-Relação de Servidores e oficiais da Montaria (em relação com o núcleo 4) - 1732-1818; 15-Pedidos de emprego a informar pelas câmaras dos concelhos e certidões de pagamento de ordenados aos oficiais das coutadas-1770-1833; 16-Correspondência de servidores e petições (relatórios dos oficiais das montarias, correspondência sobre a gestão dos recursos e alguns -1583-1833 processos crime); 17-Processos (Licenças para: cortes de madeiras, paus e rama das copas das árvores; apanha de lenha, matos e cepa; realização de queimadas, carvoarias e utilização das pastagens) - 1722-1883; 18-Relações de requerimentos Provindos de Despacho Real (O núcleo nº 2- registo das transgressões- contém parte destes requerimentos e as respostas dos Monteiros Mores) -1828-1833; 19-Corridas -em váras coutadas-1777-1786; 20-Corridas na coutada de Almeirim-1780-1786; 21-Corridas na coutada de Benavente; 22-Corridas na coutada de Coruche 1780-1786; 23-Corridas na coutada de Muja; 24-Corridas na coutada do Pinheiro; 25-Corridas na coutada de Salvaterra; 26-Corridas na coutada de Samora e Belmonte; 27-Corridas na coutada de Santarém - 1775-1789; -Regimento de 1775; -Mapa das Montarias de Santarém de 1777; -Correspondência sobre rossas, queimadas e conversão de terrenos para agricultura nas coutadas de Almeirim e Santarém entre 1775 e 1777; 28-Relação de batedores- 1770-1786; 29-Relação de montarias em coutadas; 30-Documentos sobre licenças para caçar - 1763-1828; 31-Documentos relativos a inspecção das matas e bosques do Reino e Relatórios das Provedorias, Comarcas e Corregedorias de1808; 32-Relações de servidores a remunerar; 33-Cartas de emprazamento do Prazo do Rolim-1786-; 34-Autos de diligência feito pelo Desembargador Luís Vieira – 1617; 35-Documentos recebidos e expedidos pelo juiz das coutadas do reino, desembargador António de Freitas Branco1683-1710; 36-Embargos a nomeações de servidores; 37-Testemunhos e Instrumentos Sumários; 38-Devassas, livramento de culpa e processos crime (contém por ordem cronológica, documentos compreendidos entre 1702 e 1817. Estes processos, na sua totalidade 40, estão divididos em três maços, contendo cada um balizas cronológicas precisas. O primeiro vai de 1702 a 1754 e contém 12 processos; o segundo de 1758 a 1778, 16 processos dos quais 6 referentes a 177e 1778; o terceiro e último, de 1779-1817, contém 12 processos.-1702-1817; 39 - Sentença de tombo, medição e demarcação -1761- (quinta no sítio de Rio Milho); 40-Sentenças cíveis de justificação.

BIBLIOTECA DA AJUDA

- Regimento da coutada de Lisboa 44VIII 61(nº1-a-b); - Regimento da coutada de Sintra 44 XIII 61nº2-a-i); - Regimento

da coutada de Benavente 44 XVIII 61(nº3-a-d); - Regimento da coutada de Muja 44 XIII 61(nº5 a e b); - Regimento da coutada de Óbidos 44 XIII(nº 5 e nº7a); - Regimento da coutada de Salvaterra de Magos 44 XIII (nº9 d); - Regimento da coutada de Coruche 44 XIII 61 (nº10); - Regimento da coutada de Santarém 44 XIII.

BIBLIOTECA NACIONAL DE LISBOA - SECÇÃO DE RESERVADOS

- Aviso de caçadores e caça. Ordenado por el Doctor Nuñez de Avenduño: Letrado de don Yñigo Lopez de Mendonça tercero deste nombre, Duque del Infantado com nuevas Adiciones, 1593 - Res. 758 // 2; - *Descripção das coutadas e casas de campo dos príncipes de Portugal in Miscelânea*, Res. - Cod. 10768, fol. 215vº-217, s/d; - *Monteiro Mor* - Res. - Cx 27, nº 105; - *Regimento da Coutada de Muja* - Res. - cod. 1796, fol. 356; - *Regimento da Coutada de Salvaterra de Magos* - Res-cod. 7667; - *Regimento dos Monteiros Mores (1751)* - Res. - Cx. 31, nº 4.

BIBLIOGRAPHY

CARDIM, P. (1998) – Centralização política e estado na Recente Historiografia sobre o Portugal de Antigo Regime, *Nação e Defesa,* Nº87, Outono 98, 2ª série, Instituto de Defesa Nacional, Lisboa, pp. 129-158.

CARDIM, P. (2001) – Religião e Ordem Social em torno dos Fundamentos Católicos do Sistema Político do Antigo Regime, *separata da Revista de História das Ideias*, vol. 22, Faculdade de Letras, Coimbra, pp. 133-174.

CORVOL, A (1997) – *L'Homme aux Bois. Histoire des Relations del l'Homme et de la Forêt XVIIe-XXe Siècle,* L'Harmatin, Paris.

CORVOL, A. (2010) – *Histoire de la Chasse*, Paris.

COSTA, M. L. (1997) – *Naus e Galeões na Ribeira de Lisboa*, Patrimónia, Cascais.

CURTO, D. R (1994) – *A cultura Política em Portugal (1578-1642). Comportamentos, Ritos e Negócios*, Tese de Doutoramento em Sociologia Histórica apresentada à Faculdade de Ciências Sociais e Humanas da Universidade Nova de Lisboa, Lisboa.

CURTO, D. R. (2013) – Conclusões: Nobreza Manuelina e seus descendentes, *D. Álvaro da Costa e a Sua Descendência, séculos XV-XVII: Poder, Arte e Devoção*, Coord. Maria Lurdes Rosa, CIEM – Instituto de Estudos Medievais, CHAM – Centro de Estudos de Além-Mar, Caminhos Romanos, Lisboa, pp. 343-359.

DEVY-VARETTA, N. (1986) – Para uma Geografia Histórica da Floresta Portuguesa: do Declínio das Matas Medievais à Política Florestal do Renascimento (séc. XV e XVI), Leaflet of the *Revista da Faculdade de Letras* – Geografia, I série, vol. I, pp. 5-37.

DEVY-VARETTA, N (1985) – Para uma Geografia Histórica da Floresta Portuguesa: as Matas Medievais e a 'Coutada Velha' do Rei, *Revista da Faculdade de Letras*, I série, vol. I, pp. 47-67.

FREEMAN, M. (1997) – Plebs or predators? Deer-stealing in Whichwood Forest, Oxfordshire, in the eighteenth and nineteenth centuries' in *Social History*, vol. 21, no. 1, January.

GRASSBY, R. (1997) – The decline of falconry in early modern England, *Past & Present*, no. 157, Oxford University Press, Oxford.

JAMES, N.D. G., [1981] 1990 – *A History of English Forestry*, Basil Blackwell, Oxford.

LABRADOR ARROYO, F. (2009) – *La Casa Real en Portugal (1580-1621)*, Ediciones Polifemo, Madrid.

LIDDIARD, R. (edit by) (2007) – The Medieval Park, New Perspectives, Windgather Press.

LOPES ONTIVEROS, A. (1991) – *Agricultura y Sociedad*, nº 58 (Enero- Marzo 1991) pp. 113-145.

LOPES ONTIVEROS, A. (1991) – Algunos Aspectos de la Evolución de la Caza en España, *Agricultura y Sociedad*, no. 58, January-March, pp 173-213.

MALTEZ, J. A. (1998) – O Estado e as Instituições, *Nova História de Portugal, Direcção de Joel Serrão e A. H. De Oliveira Marques, Portugal do Renascimento à Crise Dinástica*, Coord. João José Alves Dias, Editorial Presença, Lisboa, pp. 337-412.

MELO, C. J. *Mimeo*, Diana's torments: forests and hunting as a tool for social and political control in the Modern Age, *Working & Walking in the Footsteps of Ghosts: Part 2 - The History of Management'*, Wildtrack Publishing, Sheffield, ISBN reference - 978-1-904098-54-6

MELO, C. J. Mimeo, *Royal: Preserves within 1777-1824: Privilege, Power, management and Conflict,* Wildtrack Publishing, Sheffield, ISBN number 978-1-904098-54-6

NEVES, C. M. B. (1980-1991) – *História Florestal, Aquícola e Cinegética*, 6 vols., Ministério da Agricultura e Pescas – Direcção-Geral das Florestas, Lisboa.

PAIVA, J. P. P. (2012) – Um corpo entre outros corpos sociais: o clero, *Revista de História das Ideias*, vol. 33, pp. 165-182.

PEREIRA, J. C. (1998) – A estrutura Social e o Seu Devir, *Nova História de Portugal, Direcção de Joel Serrão e A. H. De Oliveira Marques, Portugal do Renascimento à Crise Dinástica*, Coord, João José Alves Dias, Editorial Presença, Lisboa, pp. 277-336.

RILEY, C. G. (1988) – *Sobre a Caça Medieval*, Universidade de Coimbra, Imprensa da Universidade, Coimbra.

RÚBIO ARAGONÉZ, M. J. (1996) – *La Caza y la Casa Real*, Badajoz, Ayuntamiento de Badajoz.

SALVADORI, P. (1996) – *La Chasse Sous l'Ancien Régime*, Fayard, Paris.

SHCHAMA, S. (1995) – *Landscape and Memory*, Knopf, New York.

THOMPSON, E. P. [1969]1990 – *Wigs and Hunters*, London, Penguin.

VIEIRA, J. N. (1995) – Falemos da Nossa História Florestal, *Mediterrâneo*, nº7, Instituto Mediterrânico da Universidade Nova de Lisboa, Lisboa.

WAQUET, J.-C. (1978) – *Les Grands maitres des Aux et Forêts de France. De 1669 a la Révolution*, Genève.

WORONOFF, D. (1990) – *Forges et Forêts*, Paris.

WORONOFF, D. (1994) – *Histoire de l'Industrie en France: du XVI Siecle a nos Jours*, Seuil, Paris.

THE ARMADAS' WARS IN THE IBERIAN NORTHERN ATLANTIC, A CHANCE FOR FORSEA-DISCOVERY PROJECT

Miguel San Claudio Santa Cruz

IN THE EUROPEAN FINISTERRE, IN THE PATH OF CIVILIZATIONS

The Iberian Peninsula is located in the edge of the continent, in the foremost southwest end, this is the last continental land in the far west of Europe.

This situation inserts the Iberian Peninsula, in its Portuguese – Galician façade, in the most important communication way that the human kind has known: the north Atlantic trade route. This path links the south of Europe with the north, and from here to any other part of the world.

So, any continental power that pretends to dominate the sea, will try to dominate this vital link that cross front off Iberian Peninsula. Here this line is jugulated to surround the continental mainland. This is the reason because so many fleets were stablished around the Finisterre cape in war times, or the reason to stablish one of the most important Spanish naval bases in Ferrol, Galicia.

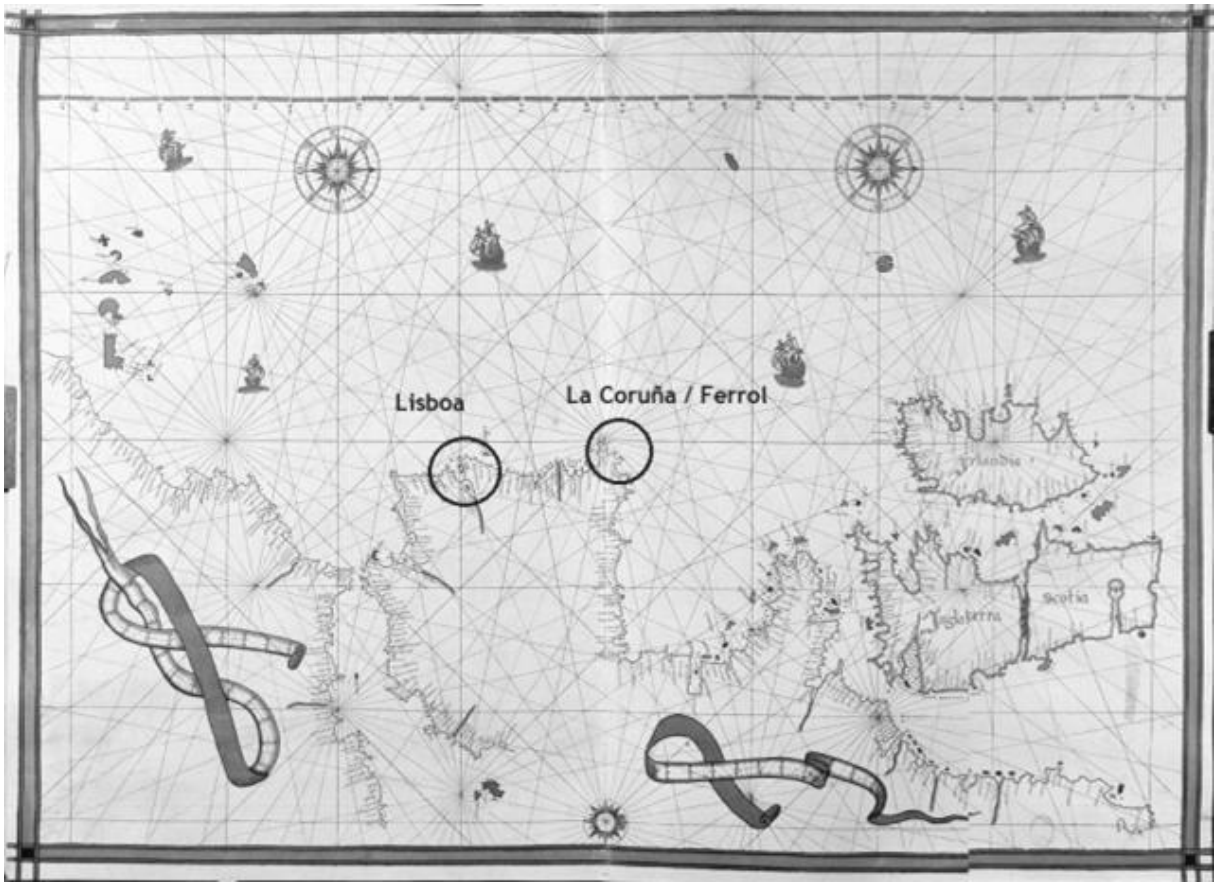


Figure 1. Iberian Peninsula dominates the sea, sailing from or to North Europe (Joan Martines, Carta portulana del Océano Atlántico Nororiental, Messina 1587).

The first of the political power strong enough to impose a real dominion over the sea in this part of the world, was Rome. This civilization stablished some centre to control the traffic around Iberia in the route to the cities and posts in the Biscay bay, around British Channel and back to the south of Iberian Peninsula and to Mediterranean sea.

Rome situated such centres in Lisbon, Porto (Portugal) and La Coruña in Spain. All of them were important ports of call with significant facilities –the lighthouse known as tower of Hercules, UNESCO Cultural Heritage, is still at work in La Coruña – and even with an imperial bureaucracy as show us the remain epigraphy in those cities.

This first attempt to control the sea from the mainland disappears after the Roman fall. The next serious attempt to control the traffic and threats that come from the sea, appears after the unification of the two last independent kingdoms that remained in the Iberian Peninsula: Spain and Portugal. In 1580, Philip the second seems to be the head of the most powerful empire in the world.

The Philippine government will use the Portuguese and Galician territory, close to the North Atlantic sea route, as a line front against the powers that, from Northern Europe, threaded the Empire in Europe and far away.

So, from Lisbon, Ferrol and La Coruña, will part the Armadas sent by the Philippine monarchy, trying to open a new front to the protestant coalition to distract the military efforts from Flanders to the Irish and Great Britain islands.

The most important crown ports in the Atlantic were Lisbon, Baiona, Ferrol and La Coruña. Of course Lisbon was very far away in importance from the other three, but its position is relatively far away from the principal fighting scene in the Atlantic. Baiona was a small but strong fortified place in the south of Galicia, a nice refuge port for the navigation on this coast. La Coruña, another important fortified city was place of the king's government in the kingdom of Galicia, the Capitan General and the government of the kingdom was here.

Ferrol is a nice natural port easy to defend, and was in this moment chose to keep the fleets before the Biscay gulf crossing.

From the Iberian North west end: Finisterre, to the gate of the British Channel, a sail boat could make this way in almost four days with the appropriate winds.

In all this area, around Biscay gulf, the winds are principally southerlies in winter time, changing to northeasterly in summer time. Summer time is the most appropriate season to cross the not always friendly gulf of Biscay, but in this season the winds are from northeast. This seasonal winds distribution explains the difficulties to send Armadas from the south to the north and explains the facility to the northern potencies to organize attacks against the Iberian Peninsula using the fair winds coming from the North.

In summer time the winds helped the sailing from northern Europe, the answer from Iberia may wait for winter – autumn season, to find accurate and sustained winds to sail the opposite course, but increasing the risk of find bad weather.

ARMADAS' WARS

From the last years of XV century we assist to different attacks from northern countries against the Atlantic coasts of Iberia. In 1475, Casenave Colon leaded an assault to the fortified port of La Coruña. In 1544 a French Armada stormed some small ports in the Atlantic front of Galicia which provoked the strong reaction of an Armada, under the command of Alvaro de Bazán the older, in a heavy naval battle, marked as the first modern naval battle in the world History. This battle finished with the french flagship sunk in some place of Muros inlet.

1588 ARMADA

From the Iberian coasts also came the reactions against the northern potencies. The most famous of those was 1588s Armada, that was signified, following protestant propaganda, as the most important military operation at sea before Trafalgar.

Before and after this attempt to change the English government, were some others attempts to send some Armadas to disembark both in Ireland or Great Britain.

The response to the 1588 Armada, from the protestant side, came across the Gulf of Biscay on May 1589, and ran catastrophic after the English defeat at Lisbon. This attempt to restore the kingdom of Portugal

under Don Antonio, prior of Crato, and with draconian conditions in pay of English support, was named in Spanish sources as Contra Armada.

Later in 1590 another Spanish Armada disembarked some troops in Ireland mainland. These troops, under command of Juan del Águila, re embarked soon after don't find the support of Catholic Irish fighting against the protestant queen of England.

The next attempt to put an expeditionary Army on Ireland, was the 1596s Armada. Instead of 1588 Armada, here we assist to an essential difference. In 1588 Lisbon was chosen as the departure port, in 1596 the selected port was Ferrol, in Galicia, much more northern than Lisbon, so closer to Ireland and England.

Lisbon appears in this second attempt as the principal port of preparation to supply and send ships, men and provisions to Ferrol, where the whole Armada was concentred. From this northern port easily the fleet could reach the coasts of the western European isles.

But Ferrol, and its hinterland has no the resources to supply the crews and troops embarked for so huge Armadas. So, these resources must come from the Portuguese kingdom capital.

This communication between Lisbon and the new port chosen was, of course, by sea. In October 1596 a fleet formed with around 100 sails left Lisbon to Ferrol carrying troops, money, and military equipment. This Armada was surprised by a SW fierce gale that made the ships drifted to the East and trapped them in the arch of Finisterre cape. Despite some of them drop their anchors[1], the strong wind dragged them to the coast. This night, October 28, around 25 ships were lost between Corcubión and Finisterre.

Figure 2. The San Anton wrecksite (image Google Earth).

ARMADAS' WARS WRECKS

THE WRECK OF SAN ANTON A GREAT ARMADA'S SURVIVOR?

In the works before a general dredge in the port of La Coruña, was documented a significant concentration of material dated in 16th century last years. This site is, very close to the local archaeological Museum in the castle of San Anton. This fortress saw relevant action against 1589 English attack.

Here, in an area about 50 by 100 m, were discovered several complete botijas (Spanish olive jars) and a lot of botijas sherds. This type of "media arroba" botijas was dated in the end of 16th Century.

We have notices of similar objects recovered accidentally, or illegally retrieved, and keep in particular collections, sold out in antiquaries, and some of them found the way to the Archaeological Museum.

In the same place we recover a complete "espada Española ropera de lazo": Spanish rapier sword, a type of sword coherent with that chronology.

Nearby, a bronze gun was retrieved in the mid-20th century. The description of it could correspond with a piece of artillery dated in same period.

Despite the fact that no shipwreck structure was found till know, we make a survey in this place each year due the movable sand. Could be possibly that some timber remains below the sand that covers this entire site.

The reason for this presence of same chronology items may be due the loss of one ship, perhaps one survivor from the Great Armada of 1588.

After the retreat of 1588 Armada around the British Islands, the most of the fleet was able to reach the peninsular ports, between them La Coruña. As we saw before, one of the Atlantic most important ports in the Iberian Monarchy.

The response of the English monarchy to the 1588 Iberian attack was to improvise a fleet that allows taking an advance in the strong punishment that England believed, in this moment, definitive against the Iberian sea superiority.

The command of this naval counter-attack fell on Sir Francis Drake (1540 -1595) in what was clearly a mistake to fall a naval military command on a character

whose mind never evolved, having emerged from the simple piracy, later privateering.

Ground operations were conducted by Sir John Norreys (1547-1597). Their first action was to put La Coruña under siege, despite the orders received to attack Santander.

During the finally defeated operations against that town, in the harbour, all the ships that found refuge on it were put in fire to avoid her capture by the enemy.

In La Coruña, following Thomas Fenner, an Englishman witness of the campaign: 'We found in the harbour two galleys, which fled to Ferrol; the St John, a galleon of Portugal which was vice-admiral in the army into England, a ship of great force, with fifty – two pieces of brass planted in her. Upon the taking of the base town they committed her to fire. Northwinstanding, we saved the metal of the ordnance. A Biscayan ship of a thousand tons, some brass, some iron. A hulk of six hundred tons, some brass, some iron. One other great ship upon the careen. One other vessel laden with pikes, pike heads, muskets and calivers; with divers other small vessels and boats.'[2]

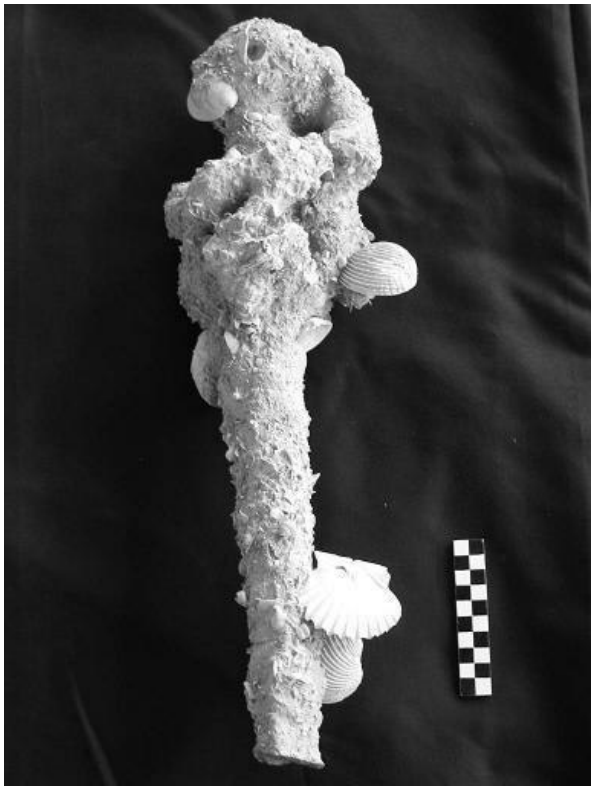


Figure 3. Spanish rapier sword from San Antón wreck (photo by M. San Claudio).

	type	displacement	origin
Sanson	Hulk	500 tons	German
San Bartolomé	Galleon	976 tons	Spanish
San Bernardo	Galleon	352 tons	Portuguese
San Juan	Galleon	1050tons	Portuguese

The Biscayan ship may be the galleon *San Bartolomé*; the *San Bernardo* was the ship on careen, *Sansón* maybe the hulk, and about the hulk mentioned, that seems not to be part of the 1588 Armada, we have no name.

The *Sanson,* Thomas Fenner called hulk, as many other ships of the Armada, had been requisitioned or rented to Germans owners. The news of the wreck in La Coruña are inconclusive, there is even the possibility that she was captured by the English.

The *San Bartolomé*, framed in the Square of Andalusia, was burned by his own crew.

The *San Bernardo*, in the Portugal squad at the time of the attack was in hull without artillery, news of his shipwreck are inconclusive. It had been built in 1586 in Portugal.

The galleon *San Juan* from Portugal, was the Almiranta in 1588 Armada, built in 1586, carried 46 pieces of artillery, all bronze.

Our hypothesis is that if a wreck lies in the place where was documented so many pottery and other objects from the last years of 16th century, it could be the remains of the galleon *San Bartolomé* from the Andalusian Squadron. Further investigations could prove it.

1589 CONTRA ARMADA

After the retreat of the Spanish 1588 Armada, was the chance for England. This kingdom sends a strong naval force to take advantage of the supposed weakness of the Iberian kingdoms. The first objective was destroy all surviving vessels from the expedition in the ports at north of Iberian Peninsula. Most of them were at anchor in Santander. So the orders of storm that port were clear. Despite that, the idea of a great plunder opportunity on La Coruña, win the minds of the English fleet leaders, closer to take economical advantage, instead complain the strategic task of the expedition.

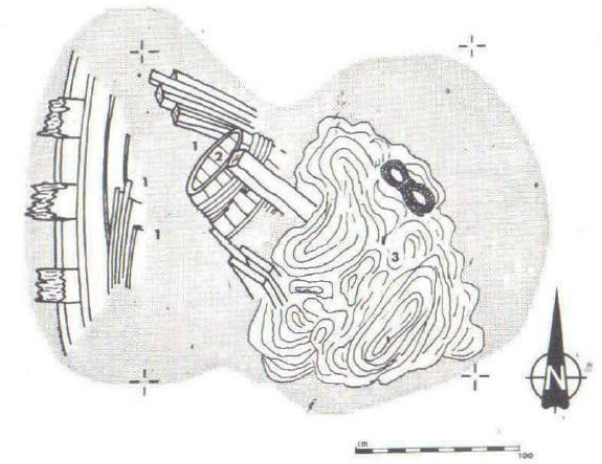


Figura 4. Wreck on Barra beach (by Antonio de la Peña).

After failed at La Coruña, in May 26, the enemy fleet anchored in Peniche, kingdom of Portugal. After disembark the troops, the English command realized that the adhesions to the cause of Prior de Crato were no so enthusiastic as the pretending said. The siege of Lisbon was out of discussion and the opposition against the presence of the invasion army was getting fierce opposition. Soon, re-embark the troops appears as the only way of salvation.

Several Spanish vessels started to skirmish the retreat fleet. Four large vessels were burnt or sunk joint to several smaller ones before the fleet gets fair winds, which barely give a change to set sail to the north. A final attempt was done to capture any of the Azores islands, but even this objective was far of the capacities of a fleet in very bad situation.

The most of the vessels were with most of their crews disease, dying a great amount of men each day, both crew and troops. Many of the ships were undermanned, and several of them must be scuttled because there were not men enough.

Most of survivors ship entered in Vigo bay due the contraries winds, which blows against the English interests to reach Great Britain.

Here, after several attempts of get some plunder to reduce the losses of the adventure's investors, the English Armada will see the loss of several other vessels.

The change in the course of wind, from north to southwest, gave an opportunity to the English fleet to leave Vigo and start the journey up the Galician Coast of Death and, crossing the Bay of Biscay, reach England.

But all in that Armada seems in the hands of chaos. Insufficient, malnourished and sick crews could not prevent the loss of several vessels maneuver out of the Vigo bay.

On July 2, 1589 the southwest wind, causing two of the ships were dragged to the north coast of the Vigo bay, near Cangas. They ran aground and being at the mercy of the residents to burn the two boats and rescue some Spanish prisoners on board both ships.

They were a flyboat, her owner named Hawkins, and the captain Docwra's ship. The only captain Docwra we were able to find among the components of the failed expedition, was an army officer listed as died from disease.

The next day, July 3, another English ship ran aground against the Cíes islands. That day and the morning of the next Norreys worked on salvage their artillery. At last he put in fire the wreck.

If we pay attention to the news we have about find of shipwrecks in the area of Cangas and Cies Islands in the last years, there are three points that could be related to the lost ships of Drake and Norreys Armada of 1589.

In 1983 and 1984 local Archaeology Group "Alfredo García Alen", dug, in Nerga beach, Cangas, the remains of a wooden ship that could be coherent with English 1589 Contra Armada.

In this wreck was documented abundant constructive timber. Furthermore there were presents numerous objects, including elements of standing rigging, ropes, a barrel of salted pork, lead shots, ceramic tobacco pipes, etc.

Among the items of daily use it was included a "espabilavelas" or candle scissors, in which it is represented an image of emperor Charles the fifth.

Dating featured by researchers for this site is from the late sixteenth or early seventeenth Century.

The second site of interest, in the north shore of Vigo bay, was located near Salaíños point, between Cangas and the beach of Barra. In this place, in the 90s, four cast iron pieces of artillery were found.

These two sites can be coincident with the historical information about Hawkins flyboat, and captain Docwra's ship.

About the wreck cited in Cies Islands. On the south of Rodas beach, near das Vellas point - also known as punta dos cañóns[3] - we know, the presence of a wooden ship in this place. Several oral information reference it.

Sometime, in the 60's of last century, hunters located at low tide, near that point on Rodas beach two bronze cannons. Earlier, in the same area, during the dismantling of the British steamship *Samwater*, sunk in 1947 on Cabalo point. There workers recovered several pieces of artillery at this place.

These and other sources give many details about the status and location of the wreck, part of which is sometimes exposed in the sandy bottom.

If this was the vessel from which Norreys tried to rescue artillery, the presence of bronze artillery, as well as efforts to rescue it, suggest the importance of the ship.

1596 ARMADA

After the 1596 English attack on Cádiz, was clear that some measure must be taken against the easy position of Isabel, managing war efforts against the peninsular kingdoms from sea protection.

A plan to disembark an expeditionary army in Ireland could help to distract the English war effort, and also give satisfaction to the claims of Irish and English Catholics refugees in Spain.

This plans needed an Armada could carry troops and equipment to the north. As we saw before, this is something easier to say than to do. The fleet first must join together, warships, transports and troops. To afford this task was chosen the port of Ferrol, due its easy defence and privileged situation to reach the coasts of North Europe. So the ships loaded with troops, equipment and supplies may come from Lisbon, to Ferrol and from this last port get any opportunity to cross the Biscay gulf.

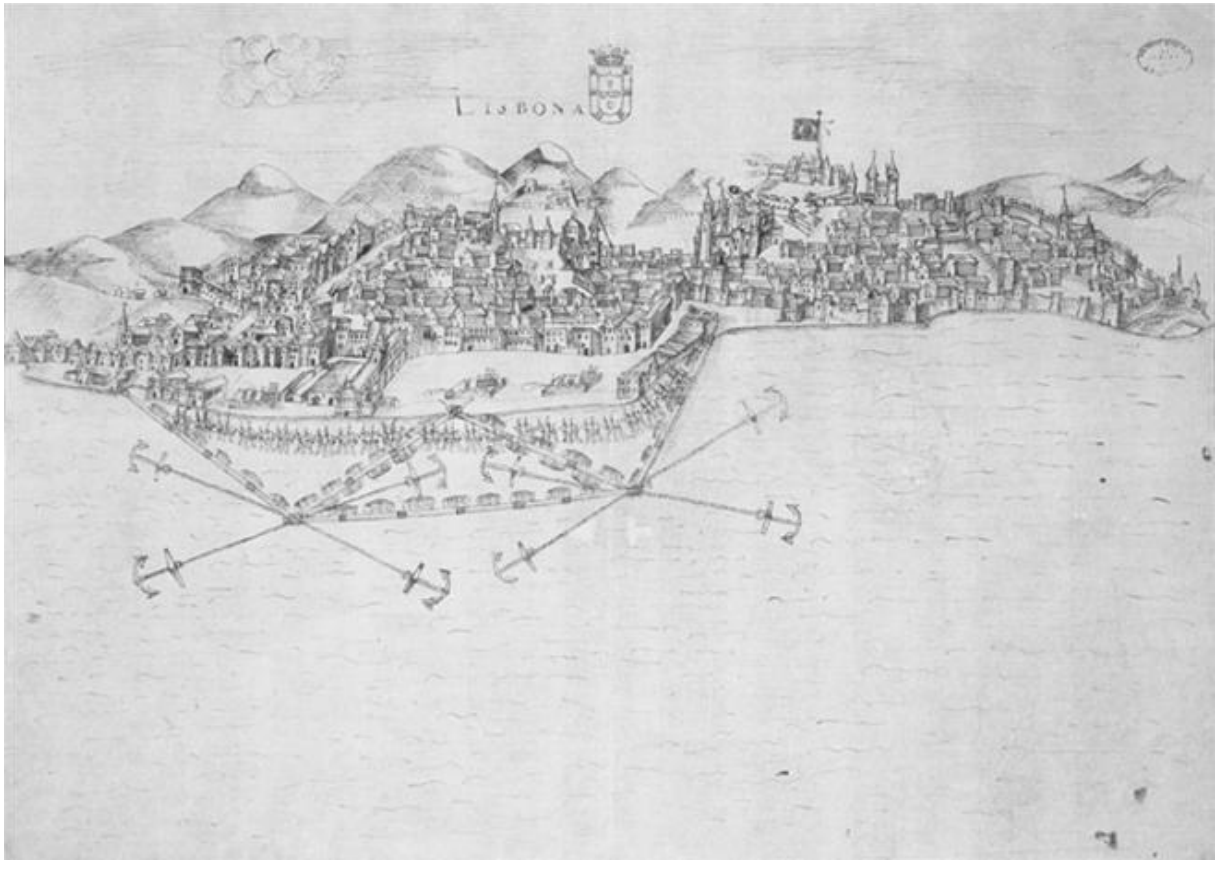


Figure 5. 1596 Armada at Lisbon, plan for its defence (Pedro de Ivella, Plano de defesa da frota ibérica surta no porto de Lisboa, 1596) AGI, Indiferente 1110, 27.10//Mapas y Planos, P-EUROPA_AFRICA,4, microfilm C-7420. (Courtesy Alexandre Monteiro).

But the sailing northward from Lisbon thru the Atlantic side of Iberia also needs favourable winds, blowing from South to West. Not yet to October the fleet was ready to sail to Ferrol. This Armada was put under Martin de Padilla's command.

Leaving Lisbon, close to Finisterre cape, in the Galician Coast of Death, the fleet was caught in a south westerly gale.

Along the Galician coast, the sea streams joined to winds coming from South West, displaces the ships to the east, this phenomenon caused a huge number of sea disasters in that dangerous coast.

In the night of October 28, about 100 sails from the 1596 Armada, coming from Lisbon, were caught, in the open mouth of Corcubion bay. The ships were sailing directly against the coast, propelled by a strong wind from their stern. Their commanders probably believed to be several miles to the west, as some relates of that night seems to probe.

About 25 or 28 ships were lost that day causing about 2.000 people lost.

We know the name of most of the shipwrecked, their characteristics, crew and troops carried.

Moreover we found, in Cape Finisterre nearby, some shipwrecks identified as came from this Armada. All of them appears clearly transport equipment, supplies and material to use in an expeditionary Army.

Name	Type	Tons	Owner/captain	Origen	Crew	Troops	drowned
Santiago el Mayor y San Felipe	Galleon	900	King		91	239	307
La Esperanza		120	King	Portugal	28	48	6
San Pedro y Santiago	Galleon		King	Portugal			
Unknown	Galizabra	350	King	Portugal			
Nuestra Señora de la Anunciada	Galleon	1000	Pedro de Ivella	Italian	90	160	243
San Girolamo (San Jerónimo, Capitana de Ivella)	Galleón	1200	Pedro de Ivella	Italian	118	406	140
Santa Cruz	Galizabra	80			20	30	10
Ángel	Hulk	200	Jacumbelum		22	122	54
Ángel Gabriel	Hulk	350	Paulo Viera	Portugal?	24	150	174
Morión	Hulk	300			24	104	4
Jonás el Grande	Hulk	300					
David	Hulk	400	Pedro Frías		26	187	163
Charrúa de Octer	Hulk	80	Octer		14	31	24
Saetía Marsellesa	Hulk	90		Marseille	20	40	20
Ángel	Hulk	200	Henrique Fenis		19	85	57
Sansón el Pequeño	Hulk	300					
Santiago	Hulk	160	Pedro Lines		25	137	2
San Pedro	Hulk	250		Sevilla	20	120	7
Santiago	Hulk	200		Terceira, Açores Islands	15	71	56
Mezmán	Hulk	200			20	106	114
El Domingo	Hulk	60		Ireland			
El Francés	Patache?	50		Sables D'olonne	12	22	34

Figure 6. Spanish and Portuguese coins from *San Girolamo* wreck recovered in 2008 (photo by M. San Claudio).

THE GALLEON *SAN GIROLAMO*

The wreck found in Punta do Diñeiro (Money Point) was identified as the galleon *San Girolamo* (San Jerónimo), built in the Naples Atarazanas (military shipyards) by Pedro Veneciano. This ship was the flagship of Pedro de Ibella Ohmuchievich Gargurich and Bogascinovich, a Dalmatian nobleman, lord of Visiecenich and Osmine. This vessel was one of the biggest warships in 1596 Armada.

Pedro de Ibella (or Iveglia, or Ivella) signed a contract (asiento) with Philip the Second in order to provide warships to the crown. Following this agreement Ibella armed 12 warships.

Onboard *San Girolamo* was carried the money to pay the expedition expenses. Even today, habitually is easy to find some silver Spanish or Portuguese coins scattered in the wrecksite.

This wreck is alternative cover and uncover by a sandbank displaced along the coast by storms. Local fishermen said, that sometimes the sand uncovers a great amount of timber.

In the year 1987 Zaragoza University lead an archaeological survey on this wreck recovering a great amount of silver coins and documenting some timber. In that year the sand apparently was several meters below current level.

From that year, the wreck remains apparently under sand, although the last year some timber was again visible.

PUNTA RESTELOS WRECK; GALLEON SANTA MARIA DE LA ANUNCIADA?

On Restelos Point, in Corcubion sinus, was located a huge shipwreck belonging to 1596 Armada. This shipwreck was known from a long time, suffering some plunder. On this site lies an interesting group of cannons composed by two bronze pedreros and an English iron cast gun, two more iron cast guns and one apparently wrought iron "bombarda" cannon.

In this site, also a rocky coast with sand bank lying below water, the sand alternately discovers items from the wreck as cargo and wide variety of military and medical equipment. Sometimes, and due the action of the sea over the structure of the covered ship, some planks, beams, and pieces of timber are scattered around the site.

In 2007, looting on this shipwreck was detected by Spanish police, Guardia Civil, and reported to the cultural authorities. Then, the Galician Regional Government supported a preliminary archaeological survey in Punta Restelos shipwreck in order to document the archaeological remains.

The initial archaeological assessment allowed the team of archaeologists to record the visible remains of the shipwreck as well as to recover those artifacts which were in danger of disappearing.

Some of the timber, recovered scattered and destroyed due the mechanical action of the sea, were recovered and analysed. Probably there may be much more timber under the sand.

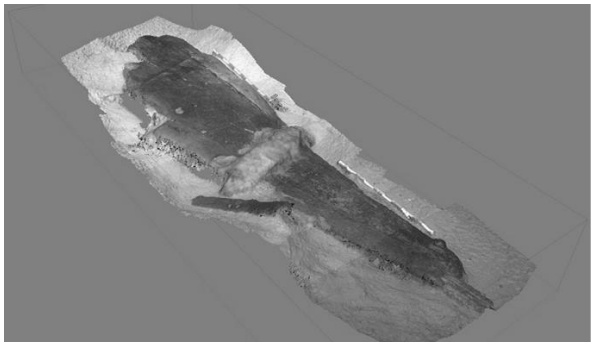


Figure 7. Rudder on Punta Restelos wreck (José Luis Casabán).

Figure 8. Planks of the galleon Santa María de la Anunciada on wrecksite (photo by M. San Claudio).

1597 ARMADA

After the 1596 Armada's disaster in Finisterre, the plans in fight the English on their own land was not discarded. The next year a new Armada was ready to sail. On this moment the Armada reach cape Lizard, bautin this moment contrary strong winds pulled back the fleet again to Iberian Peninsula, despite some ships reached their objectives, disembarked troops, and re embarked them when was evident that the main of the Armada was blown back.

All the vessels reached north ports of Spain, but there some of them seems to be about 11, were sunk in different ways.

One of them could be the large shipwreck located in Ribadeo inlet. This site was found during dredge operations in which it was exposed. Some preliminary work documented the presence of a large ship: 32m long and about 10 m width, with a chronology about the end of 16th century, and a possibly Iberian origin or at the service of Iberian Empire.

Some work on dendrochronology was made on this wreck with no conclusive results in the frame of ForSEAdiscovery.

The wreck is almost complete from stern to bow, around her flotation line. It conserves part of her lower deck and part of inner compartments, with some bulks still on place, at least one of them, below lower deck.

Plans are made to further works on this site.

CONCLUSIONS

Due the special situation of Galicia, close to the most used communication way that the human race, this coasts possess a wide panoramic on Maritime History thru the thousands of maritime disgraces on this rough sea.

This opportunity could be use in the ForSEAdiscovery project, allow the opportunity to develop an underwater archaeology project.

This project could be of great interest in an area of huge importance in Maritime History, that surprising has not dedicated enough efforts to underwater archaeology.

So, we believe this could be a great opportunity for both sides.

BIBLIOGRAFIA

BELLO DIÉGUEZ, J. M., (Co). 1991. *Ciudad y torre, Roma y la Ilustración en la Coruña*. Ayto. de La Coruña, La Coruña.

CASADO SOTO, J. L., 1988. *Los barcos españoles del siglo XVI y la gran armada de 1588*. San Martín, Madrid.

CEREZO MARTÍNEZ, R., 1989. *Las Armadas de Felipe II*. San Martín, Madrid.

CERVERA PERY, J., 1982. *La estrategia naval del imperio.* San Martín, Madrid.

FERNÁNDEZ OCHOA, C., MORILLO CERDÁN, A., 1994. *De Brigantium a Oiasso. Una aproximación al estudio de los enclaves marítimos cantábricos en época romana*. Foro, Madrid.

GONZÁLEZ LÓPEZ, E., 1985. *Las fronteras Atlánticas de Galicia*. Ediciós do Castro, Sada.

GORROCHATEGUI SANTOS, L., 2011. *Contra Armada. La mayor catástrofe naval de la historia de Inglaterra*. Ministerio de Defensa. Ministerio de defensa. Madrid.

HIDALGO CUÑARRO, J.M., SOTELO SOLANA, J. C., 1985. Apuntes para la carta arqueológica de la ría de Vigo. VI Congreso Internacional de Arqueología Submarina, Cartagena 1982. Ministerio de Cultura, Madrid.

MANUEL MARTIN BUENO. Catálogo exposición. Costa da Morte: Atopamo-la historia. Vigo 1989.

MANUEL MARTIN BUENO. Excavación subacuática no cabo de Cée, Finisterrae 87. Arqueoloxía, Informes 1, campaña 1987. Xunta de Galicia, La Coruña 1989.

PATIÑO GÓMEZ, R., 2002. *Catalogación de yacimientos arqueológicos submarinos en las costas gallegas*. RP edicións, Vigo.

PEÑA SANTOS, A de la. Primeras prospecciones arqueológicas subacuáticas en el litoral de la provincia de la Pontevedra. *Pontevedra Arqueológica*, Nº 1. Pp. 205-238. Grupo de Arqueología Afredo García Alén. Pontevedra.

SAAVEDRA VAZQUEZ, M. C., 1989. *María Pita y la defensa de La Coruña en 1589*. Galicia Editorial, La Coruña.

SAN CLAUDIO SANTA CRUZ, M., 2003. Brigantium y la navegación romana en el Atlántico Norte. Catálogo de la Exposición: *EL PUERTO DE GIJÓN EN LA ANTIGÜEDAD. Comercio y navegación romana en el Cantábrico*. Gijón.

TOFIÑO DE SAN MIGUEL, V., 1789. *Derrotero de las costas de España en el Océano Atlántico y de las islas Azores o Terceras*... Vda de Ibarra, Madrid.

TORRES FALCÃO DA FONSECA, L. J., 2005. *A esquadra ilírica no mar oceano (1595-1598)*. Dissertação de Mestrado em História dos Descobrimentos e da Expansão, Universidade de Lisboa.

[1] As documented Underwater.
[2] WERNHAM, R. B. (ed.), 1988. Pág. 143.
[3] Cannons point.

'*RESUCITANDO LA GUERRA DE LA MAR*': THE TIMBER SUPPLY AS A POLITICAL PROBLEM IN THE COURT OF LISBON (1617-1622)[1]

Koldo Trápaga Monchet
(IAP-UNL/IULCE)

ABSTRACT

In April 1617, in times of the problematic political articulation of the Portuguese kingdom within the Catholic Monarchy, Don Diego de Silva, marquis of Alenquer and count of Salinas, made his entry in the court of Lisbon as the new *alter ego* of Philip III. The beginning of the Thirty Years War and the active participation of the court of Madrid led to the strengthening of the naval squadrons of the Monarchy. The objective of this article is to give an approximation to the way the royal forests of the Portuguese Kingdom were used to remodel the naval power of the fleets of the *Consulado* and the Eastern Indies.

"Cuando el marqués de Alenquer entró a gobernar este reino había más de diez años que no se había hecho armada para la guarda de la costa, antes se había quitado el tercio que solía haber en esta ciudad para las ocasiones que se podían ofrecer […] Y a este compás fue lo más años de su gobierno, resucitando la guerra de la mar de manera que resultó de ello tal aumento en todas las rentas reales."

(Dadson, 1991, p. 58)

This is the beginning of a panegyric on Don Diego de Silva y Mendoza, in which the military virtues of a viceroy who tried to guarantee the defence and the well-being of the subjects of the Kingdom of Portugal were praised. The author dramatized on purpose the serious circumstances of the Lusitanian kingdom and the Royal Treasury when the Marquis of Alenquer substituted the archbishop of Lisbon. This way he highlighted the achievements of his lord, while referring to the traditional idea of the "decadence" of the Hispanic Monarchy during the reign of Philip III. The extraordinary display of resources of the Portuguese kingdom, from which the whole Monarchy took advantage had been the consequence of the personality and the efficiency of the count of Salinas. From our point of view, the cause of this impressive capacity of mobilization was related to the ideological and political transformation of the Monarchy during the transition between the reigns of Philip II and Philip III (Martínez Millán, 2003, pp. 11-38; 2008, "Introducción", pp. 25-302), which is hardly compatible with the crisis of the Monarchy.

At the beginning of April 1617, Don Diego de Silva y Mendoza, Count of Salinas and Marquis of Alenquer, member of a Castilian-Portuguese noble family and president of the Council of Portugal since 1611, made his entry in the Court of Lisbon as the *alter ego* of King Philip III[2]. This nobleman had the confidence of the Duke of Lerma for having written a document in which he supported the reduction of the existing differences between the Crowns of Portugal and Castile. The memorial formed part of his political performance in the Court of Lisbon, being the reconstruction and strengthening of the fleets of the Kingdom of Portugal one of the most important legacies which he left to his successor.

The count had fallen out with the *cabildo* of Lisbon, the council of Portugal which was under the control of his enemy the Duke of Villahermosa and a considerable percentage of the Portuguese elites (Dadson, 1991, pp. 28-31). These confrontations were in part the consequence of the imperative and arbitrary measures of the Count of Salinas, but they mainly responded to a much deeper cause which was the crisis which affected the political structure of the kingdom since the middle of the 1590s (Labrador Arroyo, 2011, pp. 38-45). On the other hand, the governing activities of the Marquis of Alenquer were strongly conditioned by the context of the Catholic

Monarchy and the consequences of its entrance in the Thirty Years War.

1. The Thirty Years War and the Catholic Monarchy

In 1618 the famous defenestration in the imperial city of Prague and the battle of the White Mountain took place. These two events were the origin of one of the major conflicts on the Old Continent, which affected the biggest part of its territories (Parker, 1998). In the case of the Catholic Monarchy the conflict went on until 1659, the year in which Don Luis de Haro and Cardinal Mazarin signed the Peace of the Pyrenees. The Catholic Monarchy was from the beginning involved in the conflict, a process which was related to the change of the factions in the court of Madrid.

The other geographical territory which was an important source of preoccupation for the court of Madrid was the Low Countries. Since the end of the second half of the decade of 1610, the courts of Brussels and Madrid were carrying out the project of territorial reversion. This had success because of an effective use of patronage by Philip III and Philip IV (Esteban Estríngana, 2008, pp. 59-88; 2010a, pp. 261-304; 2010b, pp. 59-88). The Archduke Albert passed away on 13 July 1621, the year in which also the Twelve Years' Truce, signed by the Catholic Monarchy and the Dutch Republic, ended. This meant that Flanders turned into another scene of war.

In the court of Madrid the Duke of Lerma fell from grace, and was exiled in 1618. He was substituted as favourite by the Duke of Uceda, who was supported by confessor Aliaga. The control of foreign affairs was in the hands of Baltasar de Zúñiga (González Cuerva, 2011, pp. 386-394, 401-449). However, it was not until the death of Philip III in March 1621 when an important change took place in the configuration of the factions. The "palatial affairs" changed from one day to another. The chronicler Gil González de Ávila reflected this masterly:

"Esto es muy cierto en la muerte de los grandes Príncipes, que todo se muda. Unos crecen y enriquecen, cuando no pensaban en ello; unos alegres festejan la fortuna presente, que los honra; otros lloran lo que acaban de perder; unos son adorados, porque mandan; y otros tenidos en poco, porque se les acabó el mando" (Benigno, 1994, p. 109).

In the new governmental circles the terms "reform" or "reformation" were continuously used in the justifying rhetoric of the political performance at the beginning of the reign of Philip IV, which was reflected in the reallocation of resources to the army and the fleet of the Catholic King (Elliott, 2004, pp. 114-161; Stradling, 1988, p. 75).

With the ascendency to the throne of Philip IV, Don Baltasar became the king's favourite until his death in 1622. During this year, the nobleman continued to be in charge of foreign affairs, while the control of the person and the household of the King were in the hands of his nephew, the Count-Duke of Olivares:

"gozaba [the Count-Duke Olivares] de una gran presencia pública, pero poca relevancia política. El conde se encargaría de la difícil tarea de asegurar el amor y confianza del Rey, base sobre la cual se apoyaba Zúñiga para ostentar sus amplísimos poderes. La formación diplomática de don Baltasar explicaría por qué eligió esta fórmula discreta, que le permitía desempeñar un trabajo político no inferior al de Lerma pero sin su sobreexposición pública. Por ello, no ambicionaba ejercer personalmente una privanza" (González Cuerva, 2012, pp. 459-478, the note in p. 464).

2. The royal journey of Lisbon of 1619

These transformations had their consequences for the court of Lisbon. The structural problems of the kingdom of Portugal since the middle of the 1590s required the presence of the Catholic King. The appointment of Archduke Albert as governor of Flanders in 1595 meant that Philip II had to do without one of the essential elements which supported the governance of the Portuguese kingdom: the presence of a member of the royal family as *alter ego*. The succeeding viceroys were only aristocrats, which provoked the absence of the Portuguese nobility of the Court of Lisbon. Don Cristóbal de Moura, viceroy since January 1600 (Martínez Hernández, 2010, p. 31) was well aware of his transcendence and asked on several occasions for the presence of the sovereign. The frustrated journey of 1602-1603 left numerous pressing issues unresolved, as they required the presence of King Philip III (Labrador Arroyo, 2013, pp. 413-434). This explains in part the stormy relation between the Marquis of Salinas and the Portuguese elites.

Some of these received with scepticism the letter sent by Philip III to the Marquis of Alenquer in March

1619 in which he announced the royal journey to the kingdom of Portugal (Silva, 1987, p. 224), although it was in general received with enthusiasm by the Portuguese natives (Labrador Arroyo, 2006, pp. 255, 256). In the Court of Madrid, two factions presented different opinions on the convenience of the royal journey. On the one hand, the group of the Duke of Uceda and the confessor Aliaga were in favour of the journey as they thought it would improve their position at court, and on the other hand, Don Baltasar de Zúñiga did not see it would be of any advantage, as he was more preoccupied with the succession in the Holy Roman Empire. Nevertheless it was in the Lusitanian Kingdom that Don Baltasar would consolidate his position (González Cuerva, 2011, pp. 404-410). Philip III headed for Lisbon in the presence of the queen, the prince and his sister the infanta. Once there, he made on occasions the mistake of letting himself to be served in the style of the Castilian household, instead of adopting the Portuguese customs. As a consequence, the Portuguese nobles and elites felt themselves displaced in their own territory (Labrador Arroyo, 2006, pp. 259-276).

The new factions which emerged with the ascendency to the throne of the young Philip IV had repercussions for the Count of Salinas. On 24 April 1621 an anonymous person addressed a letter to King Philip IV titled *"Papel Importantísimo al servicio de Su Majestad y a bien de los vasallos de Portugal. Para ver Su Majestad Católica cuya conciencia se encarga"* (Dadson, 1991, 28 ff.). Actually, the memory was an allegation against the Marquis of Alenquer: *"El miserable y lastimoso estado en que el Marqués de Alenquer tiene este reino de Portugal, la destrucción y desamparo de la hacienda real, la ruina de la justicia…"*. The count also had his flatterers. One of them wrote an apologetic work (cited at the beginning of this article) defending the virtues and praising the political governance of the Portuguese viceroyalty. Curiously, both constructed good part of their argumentations around a concrete event and all which it brought with it: the armament of six ships for the defence of the Eastern Indies in 1620-1622. In the words of the detractor, the idea came from Don Diego with the objective of ingratiating himself with the King. The panegyric writer, on the contrary, indicated that Philip III had ordered several times *'to dispatch six galleons immediately to India with whatever men he could find on board'*. These ships, however, never left the port (Dadson, 1991, pp. 35-38).

During the four years he remained in Lisbon, Don Diego de Silva y Mendoza imposed several taxes and economic measures which had as a consequence a general increase of the fiscal pressure to defray the expenses of the military conflict. An important part of the foreseen tax collection was allocated to the construction, the maintenance and the reparation of the ships of the royal fleet of Portugal, although the economic provisions were not the only resources applied. The secretary of the viceroy issued numerous decrees to the *montero mor* of the kingdom to allow the felling of the trees of the *coutadas* and *matas* of the King. Indeed, timber was an essential raw material for resizing the naval power of the Monarchy in Portugal.

3. The reactivation of the squadrons of the kingdom of Portugal

Some authors have demonstrated that the royal treasury of Portugal was almost exhausted, so that Don Diego de Silva nearly had any leeway to restore the fleet of the kingdom (Gaillard, 1982, pp. 254, 255). However, returning to our panegyric writer, in his first year of government the Castilian aristocrat managed to gather up to three different fleets (Dadson, 1991, p. 58; Gaillard, 1982, pp. 272-278). This was no exceptional or isolated measure, as the Marquis of Alenter had left Madrid with the disposition to reactivate the Portuguese fleet. Therefore he requested Philip III *"licencia para fabricar alli dos galeras para el remolco de las naos"* (Gaillard, 1982, p. 269, abril de 1617[3]).

Among them was the plan to refloat the *Armada do Consulado*, whose origin went back to the end of the sixteenth century when Philip II decided to introduce a tax in the consulate, which mounted to three percent of the *alfandegas* for the construction of an armada of twelve galleons in order to assure commerce, the Portuguese coasts and the escort of the ships which came from the Eastern Indies. The project was retaken by King Philip III at the end of 1617 (Ibid., pp. 274-277) and, apparently, formed part of a program which was not limited only to the Lusitanian kingdom. Between 1610 and 1617 the Armada del Mar Océano had overwintered in Lisbon, while the *asientos* for the provision of the ships were established at the Lisbon court (García García, 1996, pp. 169-172). In 1618, on the contrary, the fleet was transferred to the city of Cádiz, which was logical if we take in account the intentions of the monarch to construct on the *ribera de las naos* the six galleons of the *Armada do Consulado*.

Therefore the chartering of the three armadas in 1617 was not an exceptional measure, and during the following years the requests of the *alter ego* and the royal mandates followed with great assiduity. This was reflected in the documents sent to the *montero mor* and the contracting of the *asientos* with private persons in the court of Lisbon.

3.1. *COUTADAS* AND *MATAS* OF THE KING: THE TIMBER SUPPLY IN THE COURT OF LISBON

"su Majestad ordenó al Marqués que solo, sin dependencia de ministro ni tribunal alguno, procurase despachar seis galeones a la India con la gente que pudiese llevar, valiéndose de todos los efectos que hubiese y con su industria pudiese alcanzar"

(Dadson, 1991, p. 59)

In consequence of this decree, the viceroy issued several orders to look for funds so as to be able to comply with the royal mandate. In a junta that was created, which means that the *Conselho da Fazenda* did not have any control over it, the *veedor da fazenda* of India, Luis de Silva, informed on behalf of the marquis of Alenquer about the lack of funds *"[la] falta que hauia de dineiro prompto para se continuar a fabrica das naos e carreto de madeiras"* (AHU, CU, Reinho, caixa 3, doc. 44). Don Diego de Silva needed an enormous amount of money to finish the ships that were built on the dockyards of Lisbon. The Council of Treasury made up a document of the amounts of money that had been allocated to "fretes de madeiras". This document broke down 22 items of a total amount of 700.348 *reis*. Apart from that, the total costs of the preparations amounted to 2.000.000 *reis* (Ibid., draft paper). The document included a sworn statement of Luis Fegueredo regarding the *"sobreiros que ha nos almoxarifados"* of the Lusitanian kingdom and that, probably, were going to be used by the *armada* that was being built on the dockyards of Lisbon.

The timber, its supply and transport, were one of the main concerns of the count of Salinas, and became a political necessity of the Monarchy. On 26 September 1621 Simao Alves de Casto, a clerk of Leiria, issued a certificate for the extraction of 2040 *paos* for the building of two ships for the Indies (AHUV, CU, Reinho, Caixa 3/46). By a letter of 7 October 1621, the King ordered the viceroy to reserve the funds of the persons condemned by the Inquisition for the preparation of an *armada de Socorro* for the Eastern Indies (Gaillard, 1982, p. 361), making use of ordinary and extraordinary records.

A	B
Ponte de Lima	19.152
Mencoruo	1.200.721
Miranda	30.495
Porto	9.058
Villareal	71.313
Guimaraes	30.257
Lameguo	33.879
Coimbra	207.230
Aveiro	63.756
Goarda	36.167
Castello Bianco	861.379
Pinhel	50.000
Viseu	4.886
Leiria	95.151
Tomar	27.812
Santarem	252.151
Abrantes	127.912
Sintra	444.281
Termo de Lisboa	86.071
Torres Vedras	15.735
Évora	549
Elvas	58.497
Estremoz	16.409
Campodocripe	914.734
Beja	346.937
Portalegre	914
Algarve	3.3375.838
Setubal	992.497
Almadrabas	6.433.233 (reis)

Table 1. Almojarifazgos of the Kingdom of Portugal. Sources: AHU, CU, Reinho, Caixa 3/44.

The signing of *asientos* with private persons was another way of the Crown and the viceroys to assure themselves of the funding and provisions for the fleets. Joao de Almeida, *morador* of the town Pederneira and Matheo Nunes, of the town Peniche, agreed to build a *"cauarella na Riueira da Pederneira"* with license and mandate of the *conselho da Fazenda*. The *asentistas* had

bought and gathered all the material with the aim of finishing the work in the summer of 1622. However, they warned that maybe they would not comply with the deadlines as Jorge da Silva, *guarda mor* of the King, forbade the felling of trees. Therefore they asked the people who surrounded the viceroy for an order so that they could proceed with the felling of trees. The document was signed on day 26 and addressed to Jorge da Silva (AHU, CU, Reino, Caixa 3).

It was by no means an isolated order, they were continuously repeated. On 20 October, that is to say, a week before, the same Don Luis de Silva sent a note to the *Corregidor* of the city of Leiria to which he attached a letter of Don Jorge da Silva da Costa, so that they would allow felling trees in some of the pinewoods of the region (AHU, CU, Reino, Caixa 3). The timber would be delivered to the *feitor* Manuel Esteves Serrao. The concern of the ministers of the King got to the point that in November the Council Treasury prepared another document on the equipment that was necessary for *"a fabrica das madeiras para os Galeons e pera os naos [that] temos cometido a Leonardo Foes conforme as cartas de Sua Magestade"* (Ibid).

In January 1622, Manuel Esteues Serrao in charge of the timber transport, sent a ship to Lisbon to Antonio Machado in order to load *"neste porto* [Lisboa] *madeira para apresto das naos da Inda"* (Ibid). In April, the treasurer of the stores was ordered to send an amount for the equipment of a galleon that was being built in the town of Peniche, with the aim of sending it to Lisbon and to *"seruir na desta armada"*.

A substantial part of this highly valued raw material came from the forest resources and was used for the fleet of the Indies of 1622 that was being brought together in Lisbon. The *coutadas* and *matas* were forests which were not only used for hunting activities. The detailed and extensive regulations which were established since the fifteenth century by the Portuguese monarchs give us an idea of the importance attributed to the *coutadas* and *matas*. They were considered as geographical spaces through which the timber supply for the naval construction was guaranteed, and they kept this monopoly until the end of the Old Regime (Melo, 2000). Their protection corresponded to the officials of the *montero mor*, reason why the secretary of Palace issued orders for the *montero mor*. These orders were normally accompanied by documents signed by the *veedores* and suppliers of the fleet, in which the amount of timber needed for military goals were detailed. This means that they had a precise idea of the way in which the trees were going to be felled.

On 4 August 1621 Luis da Silva signed in Lisbon an order addressed to the *montero mor* so that *"conforme a huma relaçao do prouedor dos Almazens se mandara cortar nas luas de janeiro e feureiro cinco mil e oitozentos [paos] para as naos, que este ano se fazem e renouos"* (BAMOP, MOR, 9). Luis de Silva also said that during the month of August 500 *paos* had to be felled in Alcácer do Sal and another 200 in Benavente *"alem doutros que ha de cortar fora de coutadas"*. Therefore the King's ministers had the authority to enter in private forests. They were incited to act with speed as *"a necessidade de dita madeira e muita"*.

On other occasions the state of the works on the dockyards of the kingdom were specified in detail. For example, in December the Council of Regency incited the *montero mor* through secretary Francisco de Abreu to give the necessary allowances to cut the *"madeira de souaro"* detailed in the two documents *"que com este se uso presentara assinados per Manoel de Cullos escriao dos Almazens de Guinea"* to *"a obra das duas naos nouas que estao no estaleiro* [of Lisbon]*, e renouos da Nao Conçeipcao que o anno de seis*[cientos] *e veinte e tres (como o fauor de Dios, hao de ir per a India"*. In 22, the destination of the timber was specified:

"Eu el Rey. Faço saber a vos meu monteiro mor que per aconcerto e renouo dos sete Galioens da Armada desta corona que o anno que vem hao de sair em guarda da costa, he neçessario cortarse a madeira do souaro declarada no Rol [relation] que com este se uos presentara assinado por Maonoel de Cubellos escriuao dos Almazens de Guine e India que hora serue de Prouedor delelles, na uilla de Abrantes e seu distrito. Pello que uso mando que a pessoa que este vos presentar deis toda a orden e fauor neçessario pera que a dita maderira se corte nesta lua ano de do mes de janeiro proximo que vem" (Ibid).

In the following months constantly appeared new orders to finish the building of the ships that were prepared for the fleet of the Indies. However, in November 1622 the raw material came from the region of the river Tajo *"e nas mais partes que ficarem mais comodo […] para poder breuemente estar nesta çidade"*, because in Lisbon the works had been stopped.

The before mentioned fleet was made up, neither more nor less, of eight ships and two *pataches*, and by the King's order five galleons, an *urca*, two ships and three *pataches* were prepared:

"Galleao mia capitaina
Galeo San Andreo Almirante
Galeao Concepcao
Galeao San Joseph
Galeo San Simao
Urca Caridade
O navio Rosario
O navio que se ha de fretar (250 toneladas)
Dos pataxos
Outro pataxo" (AHU, CO, Reino, caixa 3/62)[4].

It was foreseen that the crew would consist of 1477 men, distributed in the following way:

"147 oficiales
264 marineros
260 grumetes
36 pares
145 bombarderos
852 "somas"[5].

In April the galleons *Capitana*, *San Antonio, San Diego* were ready *and "aspera os galoens Misericordia, Concepcao e San Joseph e dos pataxeros, e dous pataxes mais"*. That is to say a fleet was prepared which consisted of more than half a dozen of galleons and smaller ships of less tonnage whose main task was to ensure the protection of the ships that came from the Easter Indies in 1623. The project that had been started in 1617 in the court of Madrid was finished despite the change of factions. The marquis of Alenquer finished with relatively success the flotation of an imposing fleet that was used in the Thirty Years War.

In the tables here under show an approximation to the timber coming from the *coutadas* and *matas* for the King which were used in the building and reparation of ships that remained in the dockyards of the kingdom (mainly Lisbon) between 1617 and 1622. In them we specify the origin of the raw material, the amount, the species of trees and where it was used for: the building of two new fleets. This was a project that would be difficult to carry out if the causes of the crisis of the Monarchy were the consequence of economic factors.

Year	Tree and amount of timber	Origin	Used for	Fleet
1618	1500 *paos* of stone pine	Alcacer do Sal	To build new ships and the renewal of another one	
1618	1500 *paos* of pine; 3000 *paos*; Timber for 200 lateral stern planks	Abrantes (Santarém), Coruche, Coruche	To build two new ships	*Consulado* fleet
1620	Cork tree and pine; 2600 *paos* for a new ship 3000 *paos* for repairing old ones	Alcader do Sal *Ribatejo* area Abrantes (Santarém)	To build two new ships and the renewal of other which were in Tajo river.	
1620	600 *paos* of stone pine from Abrantes 220 *paos* of stone pine from Alcacar do Sal	600 chunks in Abrantes; Private properties in Alcacer do Sal	To repair and renew the galleons of the *Consulado* and the ships which were in the Tajo river	*Consulado* fleet of 1621
1620	Cork tree 400 stern planks of stone pine	Areas of Santarém, Ribateijo	Stern planks: 160 to renew, 240 for two new ships	Inda fleet or *Armada da Inda* of 1621
1621	10 *paos* for frames (*cadernaes*)	Mugem	Ship *Salome* which was built in Mugem	
1621	2400 *paos* of pine	King's pine forest and privates if neccesary	To build and repair ships	*Armada da Inda* of 1622
	In total: 5800 500 *paos* in Alcacer do Sal; 200 in Benavente; 300 *paos* from other areas	Alcacer do Sal, Benavente	For the construction and renewal of ships	*Armada da Inda* of 1623

Table 2. Sources: AHU, CU, Reino, Caixa 3; BAMOP, MOR, 9.

BIBLIOGRAPHY

BENIGNO, F. (1994) – *La sombra del rey. Validos y lucha política en la España del siglo XVII*, Alianza, Madrid.

DADSON, T. (1991) – Conflicting views of the Last Spanish Viceroy of Portugal (1617-1621): Diego de Silva y Mendoza, Count of Salinas and Marquis of Alenquer, *Portuguese Studies*, 7, pp. 29-60.

DADSON, T. (2011) – *Diego de Silva y Mendoza, poeta y político en la Corte de Felipe III*, Universidad de Granada, Granada.

ELLIOTT, J. H. (2004) – *El conde-duque de Olivares. El político en una época de decadencia*, Crítica, Barcelona, 2004.

ESTEBAN ESTRÍNGANA, A. (2008) – Los estados de Flandes. Reversión territorial de las provinciales leales (1598-1623), MARTÍNEZ MILLÁN, J. et VISCEGLIA, M. A. (dirs.): *La Monarquía de Felipe III. Los Reinos*, Fundación Mapfre, Madrid, vol. III, pp. 589-682.

ESTEBAN ESTRÍNGANA, A. (2010) – Agregación de territorios e integración de sus élites. Flandes y la Monarquía de Felipe III (1598-1621), *Studia Histórica, Historia Moderna*, 32, pp. 261-304.

ESTEBAN ESTRÍNGANA, A. (2010) – Élites flamencas y patronazgo real: gestionar recursos y negociar expectativas en la Monarquía de Felipe IV (1621-1630), en *Espacio, tiempo y forma*, 23, pp. 59-88.

GAILLARD, C. (1982) – *Le Portugal sous Philippe III D'Espagne. L'action de Diego de Silva y Mendoza*, Université des Langués et Lettres de Grenoble, Grenoble.

GONZÁLEZ CUERVA, R. (2012) – *Baltasar de Zúñiga. Una encrucijada de la Monarquía Hispana (1561-1622)*, Polifemo, Madrid.

LABRADOR ARROYO, F. (2006) – *La casa real portuguesa de Felipe II y Felipe III: la articulación del reino a través de la integración de las élites de poder (1580-1621)*, Tesis doctoral de la Universidad Autónoma de Madrid, Madrid.

LABRADOR ARROYO, F. (2010) – *La casa real en Portugal (1580-1621)*, Polifemo, Madrid.

LABRADOR ARROYO, F. (2011) – A função integradora da Casa Real portuguesa de D. João I a D. Filipe I (1385-1598), MARTÍNEZ HERNÁNDEZ, S. (dir.): *Governo, política e representações do poder no Portugal Habsburgo e nos seus territórios ultramarinos (1581-1640)*, CHAM, Lisboa, pp. 21-44.

LABRADOR ARROYO, F. (2013) – A Jornada real de 1602-1603. Um projecto político frustrado, CARDIM, P.; COSTA, L. F.; et SOARES DA CUNHA, M.: *Portugal na Monarquia Hispânica. Dinâmicas de integração e conflito*, vários, Lisboa, 2013.

MARTÍNEZ HERNÁNDEZ, S. (2010) – "Ya no hay Rey sin Privado. Cristóbal de Moura, un modelo de privanza en el Siglo de los Validos", *Libros de la Corte.es*, 2, pp. 21-37.

MARTÍNEZ MILLÁN, J. (2003) – La crisis del "partido castellano" y la transformación de la Monarquía Hispana en el cambio de reinado de Felipe II a Felipe III, *Cuadernos de Historia Moderna*, 2, pp. 11-38.

MARTÍNEZ MILLÁN, J. (2008) – "Introducción", MARTÍNEZ MILLÁN, J.; VISCEGLIA, M. A. (dirs.): *La Monarquía de Felipe III: la casa del rey*, Fundación Mapfre, Madrid, vol. I.

MELO, C. J. De (2000) – *Coutadas Reais (1777-1824). Privilégio, Poder, Gestao e Conflito*, Montepio Geral, Lisboa.

PARKER, G. (1998) – *The thirty years' war*, Routledge, London and New York.

SILVA, F. da (1987) – A viagem de Filipe III a Portugal: itinerários e problemática, *Revista de Ciências Históricas*, 2, 223-260.

STRADLING, R. A. (1988) – *Felipe IV y el gobierno de España: 1621-1665*, Cátedra, Madrid.

---

[1] This article is part of the project *"ForSEADiscovery Forest resources for Iberian Empires: Ecology and Globalization in the Age of Discovery (16th-18th)"* (PITN-GA-2013-607545). Abbreviations used: AHU = Arquivo Histórico Ultramarino, CU = Conselho Ultramarino; BAMOP = Biblioteca e Arquivo de Ministério de Obras Publicas, MOR = Monteiro mor do reino

[2] Trevor Dadson analysed in several publications the figure of the poet and politician the Count of Salinas. However, we refer above all to DADSON, T. J. (2011) – *Diego de Silva y Mendoza, poeta y político en la Corte de Felipe III*, Universidad de Granada, Granada.

[3] Gaillard considered this part of a much more ambitious plance of the viceroy to "lancer un programme de restructuration et de développement du patrimoine naval". GAILLARD, 1982, p. 269, for the general eprspective see p. 269-280.

[4] Draft of a document of the *Conselho da Fazenda* of 17 January 1622.

[5] 147 officers, 260 apprentices, 36 pairs ("pares"), 145 bombers, 852 "somas".

BOURBON NAVAL POLICY, FORESTRY AND TIMBER SUPPLY FOR SHIPBUILDING IN ANDALUCIA (1700-1759): BRIEF INTRODUCTORY RESEARCH NOTES

Ana Rita Trindade
Consejo Superior de Investigaciones Científicas (CSIC)

1. BOURBON NAVAL POLICY

In 1700, when Filipe V (1683-1746) ascended to the throne, the Spanish Navy was in a very difficult situation and dealt with a series of major problems. During the late 17th century, the fleet of the Armada had suffered some destruction in military defeats against rival maritime powers such as Holland, England and France. By that year, the Spanish Armada had a few more than thirty vessels. The level of fleet destruction is amplified by the Spanish Succession war between 1702 and 1713, in episodes such as the Battle of Vigo, on the 23rd October of 1702, when an Anglo-Dutch squadron annihilated part of the *Carrera de Indias* (Indies run) fleet. These losses were very difficult to overcome and denounced the structural and circumstantial problems of the Spanish Navy.

In a situation of economic restraint, and lack of specialized shipbuilders, the Spanish Navy faced a technological gap that resulted in slow and heavy ships that could not compete with the modern ships of the line. Furthermore, the Spanish Navy lacked an efficient official permanent administration system, whether in terms of shipbuilding or military organization. When the ships were not imported, like a substantial part of the required raw material, such as timber, the *asientos* system prevailed, leaving the control of most of the process of shipbuilding to private hands. The military organization of the naval defence of the Spanish Empire was based on a complex and scattered squadron system, denominated by the regions in which operated, which often incorporated merchant ships and rented fleets, due to the lack of specialized war ships (Coombes, 2008, 218-220; Diego Garcia, 2002, 18; Merino Navarro, 1981, 18; Quintero Gonzalez, 2002, 688).

The period of the reins of Felipe V and Fernando VI (1713-1759) corresponds to the beginning of the Bourbon Dynasty and is characterized by a series of deep political, military, administrative and economical reorganization, the so-called Bourbon Reforms, in which the reemergence of the Spanish naval power is included as an absolute strategic objective. The milestones of the Bourbon naval policy reflect the French cultural and political influence brought by Filipe V and his administrative corpus, headed by Jean Orry (1652-1719), a disciple of Jean Baptiste Colbert (1619-1683). The fostering of shipbuilding, which had the war and merchant fleet increase as an objective, was not only a matter of quantity, but also a matter of quality. The efforts towards a technological and scientific breakthrough in ship design and shipbuilding methods and infrastructures, with the contribution of specialized technical staff, must be seen as a response to an existing gap with a connection to the emerging movement of the Enlightenment. The ideological principles of Mercantilism, such as self-sufficiency, based on a strong agricultural and manufactural basis, as well protectionism, in order to reduce the dependence from abroad, inspired the construction of arsenals and refurbishment of shipyards which would directly managed by the State, as well as the development of the activities that produced the raw materials and components that were essential to shipbuilding. That was the case of timber resources. The creation of a truly national fleet and Armada would not be complete without a reformation of the Navy state administration towards a more centralized, territorialized and complex character, incorporating highly qualified and pragmatic statesman, similar to the French model. The main strategic objectives were related to ancient military and commercial concerns: revitalization of the overseas trade, and strengthening of the Atlantic power in order to maintain the monopoly of the American trade, defending it from the rival powers, such as England, Holland and France; control of strategic areas such as the Caribbean Sea, the west Mediterranean

Sea, and the strait of Gibraltar. (Bordeje Morenos, 1989, 8-15; Coombes, 2008, 220-223; Crespo Solana, 2001, 63-69; Diego Garcia, 2002, 21-22; Salgado Alba, 1989, 38).

After the end of the Succession War, established by the Treaty of Utrecht in 1713, the new scenario created the conditions to a more effective implementation of the measures that would reorganize the Spanish Navy, for which the rein of Felipe V was especially productive. Bernardo Tinajero de la Escalera supervised a royal commission created to assess the Spanish Navy needs. One of the first measures to outcome from its activity was the abolition of the squadron system, by the Royal Decree of the 14th of February 1714, giving way to the foundation of a Royal Armada, that would become a war fleet completely independent from the merchant navy. Soon after, the Navy Secretariat was created on November the 30th, alongside with Treasury, State, amongst others, following the French administration model. Tinajero de la Escalera was nominated Secretary. Even though this institution would be merged with the Secretary of War in 1717, to be autonomous again in 1721, the strategic importance of Navy would be enshrined as a central organism, throughout the 18th century. The following years are marked by decisive actions and figures that would prepare the ground for the achievements that were to take place in the second half of the 18th century. On the 18th of January 1717, the nomination of José Patiño Rosales as General Intendant of Navy gave a great impulse to this sector, especially in Andalusia, as explained in the following point. As the Secretary of Navy, on the 5th of July 1726, Patiño was responsible for the creation of the Maritime Departments, a truly institutional breakthrough of this period which would set the territorial framework of the action of the Navy. Each one of the three Departments corresponded to a part of the Spanish maritime foreland and was designated by its administrative capital. Therefore, the Department of Ferrol controlled the north seaside from Portugal to the French frontier, the Department of Cartagena administrated the East coast from France to Murcia, as well as the Baleares islands and, finally, the territory from Portugal to Almeria and the Canarias Islands, fell under the jurisdiction of Cadiz. Each Department was divided in Maritime Provinces. The Departments were the institutional instruments of a kind of 'centralized decentralization' (Diego Garcia, 2002, 25) with amplified powers on war, communication and commercial issues. Shipbuilding and ship reparation were inseparable activities from those functions, which led to the construction of an Arsenal in each one of the Departments in order to achieve a more rational and effective system of production that would replace the old and rudimentary shipyards.

After the death of Patiño in 1736, D. Zenon de Somodevilla, the Marquis of Ensenada (1707-1781), who would become Prime Minister in 1743, was the major character that gave a great impulse on the sector, following the policy of Patiño. The short-lived English inspired Admiralty (1737-1748), of which he was the Secretary, was an institution created under the rule of Somodevilla on the 14th of March 1737. It was headed by the Prince D. Filipe and its power overlapped the functions of the Navy Secretariat. In this period, juridical advances were consolidated with the promulgation of legislation such as the Ordinances of Arsenals in December 12th 1737, the General Ordinances of the Armada, 1748, and, in the same year, Ordinances for the Conservation and growth of woodlands, which will be further presented (Coombes, 2008, 222; Diego Garcia, 2002, 19-25; Martínez Ruiz, 1996, 11-14; Merino Navarro, 1981, 18, 24-25; Quintero Gonzalez, 2002, 689).

2. THE EMERGENCE OF CADIZ AND THE ARSENAL OF LA CARRACA

To a great extent, José Patiño is responsible for the rise of Cadiz over Seville, as the new maritime centre of Andalusia in the 18th century, within the context created by the institutional reformation of Navy. Nevertheless, the emergence of this role was felt by the Spanish Crown since the second half of the 17th century, with the support of wealthy traders, mariners, as well as the local political and military authorities. Above other motives behind the attraction of Cadiz, were its geographical and geomorphological conditions. Its large bay served as a natural harbour which permitted a direct entrance into the city, which had promoted an ancient tradition of cosmopolitism and dynamism. Seville, on the contrary, was accessed up the river Guadalquivir, after the dangerous transposition of the bar of Sanlucar de Barrameda. The increasingly larger merchant ships had even more difficulties at sailing these tortuous waters. Furthermore, the Cadiz bay was naturally defensive by both providing protection from storms and from enemy attacks, due to the presence of small islands. From the point of view of the defence of the region, Cadiz was strategically situated in a way which permitted the control over the entrance of

the Mediterranean Sea, the African coast, as well as the frontier with the Portuguese territory.

The establishment of the prominent position of Cadiz had an institutional and infrastructural dimension, to which Patiño contributed very actively as he ascended politically. After being nominated both General Intendant of Navy and President of the Spanish House of Trade in 1717, Patiño transferred these institutions to Cadiz and then founded here the Midshipmen Academy, turning the city, formally, into the economic and military centre of the Overseas Trade and the Carrera de Indias. As the State Secretary of Navy and Indies, in 1726, Patiño established Cadiz as the head of one of the tree Maritime Departments, as explained above, which constitutes the ultimate administrative legitimization of power. (Solana, 1994-1995, 35-47; Crespo Solana, 2001, 64-69, 74-75; Quintero Gonzalez, 2002, 689-692; Quintero Gonzalez, 2005, 525).

All these institutional transformations needed to be accompanied by an enhancement of the maritime infrastructures of the bay, at defensive, port and shipbuilding levels. While the walls and structures of the of the Port of Santa Maria were being refurbished, a complete reformation of the shipbuilding facilities was being made, since the fostering of this sector was an absolute priority for the House of Trade and the Navy Intendancy in Cadiz. Cadiz already had a tradition on this activity, especially, on the reparation and fairing of vessels, for which existed structures such as the Real Carenero del Puente de Suazo (royal fairing center), El Puntal, El Trocadero, and La Carraca, which constructions date back to the 16th century. In Puntal, a shipyard of smaller dimensions that would complement La Carraca, was finished in 1726, and its activity began soon after. (Crespo Solana, 1994-1995, 37; Crespo Solana, 2001, 67, 76; Quintero Gonzalez, 2002, 702)

The conversion of Cadiz into the capital of a Maritime Department demanded the creation of an Arsenal, as a modern industrial complex following the English and French models, that could serve as the naval base of the Armada, technologically suited for the building of the new 60-70 guns ships of the line and frigates, the war machines of the Armada developed by Antonio de Gaztañeta in Spain. In the absence of the document that promulgates its construction, the date of its beginning remains on doubt. The earliest reference appears in a 1748 testament of the guard of the general warehouse of the Armada, which alludes to the date of the 1st of July 1717 as the beginning of the construction of the arsenal, what would make of it the oldest arsenal of Spain. The edification works lasted several years and finished in 1785. (Quintero Gonzalez, 2002, 691-692, 696, 701; Quintero Gonzalez, 2005, 525, 527).

On a first phase, the shipbuilding activity was shared between the shipyard of Puntales. and the arsenal of La Carraca. The base structure was built in Puntales and then was finished in La Carraca. The first product of this system was the 60 gun ship of the line Hercules, launched in 1729. In the 1736, after the death of Patiño, the arsenal had already the capacity to build small vessels. From the late 1730s to early 1750s, the activity of shipbuilding decays, due to the transfer of attention to the arsenals of the other departments, as well as some accidents such a fire and collapse of some structures. After that, even in a situation of economic restraint, a great impulse was given, as a result of the action of Don Zenon Somodevilla, and the introduction of English shipbuilding technics and technicians. Although, in the period under consideration, around 21 vessels were built for the Armada in La Carraca, and two more in Puntales, the main activity of that Arsenal would be fairing and other reparation works, especially during periods of conflict, leaving the Carenero of Puente Suazo in a secondary position, as established by the Ordinances of the 1st of July 1721. This tendency intensified in the second half of the 18th century, when the shipbuilding activity of this arsenal was transferred to La Habana, in Cuba. A scarcity of timber, after a period of intensive exploitation may be behind this downturn, as presented in the following point (Quintero Gonzalez, 2002, 703- 706; Quintero Gonzalez, 2005, 527-531; Manera Regueyra, 1981, 414-525; Diego García, 2002, 33-34).

The first shipbuilding system to be implemented in the complex La Carraca – Puntales was a hybrid model which combined the Spanish tradition developed by António de Gaztañeta and the French influence. The 1729 60 gun ship of the line *Hercules* was a result of this system. The French master shipbuilder Ciprian Autran (1697 - ?) who, since 1733, directed these operations in Cadiz, had the opportunity to develop this system on just some smaller vessels. (Quintero Gonzalez, 2005, 528-529). In the 1750s, the English model would be the dominant system, after the espionage engagements of Jorge Juan y Santacilia (1713-1773), a naval engineer sent to England in 1746 by Don Zenon de Somodevilla in order to take

contact with the most modern shipbuilding techniques, and bring them back to Spain along with master shipbuilders, such as the Irish Mathew Mullan. The first experiment of this model in Cadiz was the 74 gun ship of the line *Africa III*, launched in 1752. As far as the matter of the use of timber is concerned, the implementers of this system claimed a bigger economy of material. Nevertheless, the implementation of this system proved to have fragilities in the Spanish context, which led to the reunion of a shipbuilder's board in Cadiz, in 1754, in order to discuss technic affairs, which resulted on the reintroduction of some Spanish features. (Quintero Gonzalez, 2005, 529; Diego Garcia, 2002, 28-29).

3. BOUBON FORESTY POLICY AND TIMBER SUPPLY MANAGEMENT IN ANDALUSIA

The perception of the crisis in the Spanish Navy at the beginning of the Bourbon Dynasty was parallel to the same notion in what concerned timber supply for shipbuilding purposes, which lack of effectiveness was seen as one of the causes of that scenario.

Following both a secular tradition and the protectionist policy that inspired the action of the new dynasty, a renewed attention to the national forests can be seen in the legislation produced during the first half of the 18th century, in order to promote the conservation and reforestation after years of excessive felling, which led to the exhaustion of resources, as well as the assessment and exploitation of lesser known territories of potential interest (Urteaga, 1987, 117, 126 -127; Pezzi Cristobal, 2001, 584; Quintero Gonzalez, 2005, 387).

The launching of the forestry police of Felipe V began in the first years of his rein, with legislative endeavours such as the 2nd of January 1708, decree *Cuidado de Corregidores y Justicias en la conservación y aumento de los montes y plantios generals* ('Chief magistrates and justice care of the conservation and growth of woodlands and plantations'). But, in coordination with the measures taken towards the reorganization of Navy, the biggest legislative effort of this reign was concentrated in the years soon after the creation of the Navy Secretariat in 1714. Thus, on the 3rd of May 1716 was promulgated the *Observancia de las leyes y autos acordados que tratan del plantío de montes* (Observance of the agreed laws and acts concerning the plantation of woodlands), followed by the Conservacion *de montes y plantíos para la fábrica de navios dentro de los limites de su construcción (Conservation of woodlands* and plantations for shipbuilding within the limits of its construction, 8th of July 1717), *Visitas de Montes que tengan aguas vertientes al mar, y disposición de conducirse las maderas a los astilleros* (Visits to the woodlands with waters that flow into the sea and the instructions for its transport to the shipyards, 14th of December 1719). The 1st of May 1723 *Ordenanzas de Arsenales* (Ordinances of Arsenals) focus again in the question of the visits to the woodlands, regulating on the personnel in charge of the different stages of the process. With the creation of the three Maritime Departments in 1726, vast portions of forest territory fell under the jurisdiction of Navy (Urteaga, 1987, 128; Pezzi Cristobal, 2001, 588; Martinez Gonzalez, 2013, 8; Martinez Gonzalez, 2014, 575-576).

O the 31st of January 1748, the *Ordenanzas para la conservación y aumento de los montes de marina* (Ordinances for the conservation and growth of the Navy woodlands) set the frame of the management of the Spanish timber resources, until the fall of Don Zenon Somodevilla in 1754. Nevertheless, this consisted of the main legislative endeavours of the period concerning forestry for shipbuilding purposes until the end of the 18th century. This legislation establishes this sector as truly *raison d'Etat*. Therefore, the woodlands that fell under the jurisdiction of Navy were directly controlled by the State, which power overlapped local authorities and private property. Those woodlands were the ones that were located within 25 leagues from the coast, or those in the hinterland that were located near navigable rivers, such as the case of Segura de la Sierra, and, according to its location, depended on each Maritime Department, which intendant represented the maximum authority, who delegated power on the ministries of the ports. According to the delimitation established by the Ordinances, the Maritime Department of Cadiz included the maritime provinces of Ayamonte, Cadiz, Sevilla, Sanlúcar de Barrameda, Malaga, Motril, Sierra de Segura, de Mojacar, Vera and Velez of the Kingdom of Granada. In a vast range of themes, the Ordinances regulated the elaboration of inventories of the woodlands, specifying the use of land, property, location, state of the road links as well as further inspections conducted by the navy ministers of each navy province accompanied by shipbuilders and clerks. In what technical terms concerned, this legislation indicated the types of wood that were suited to the crafting of specific pieces, was well as

methods of plantation in order to achieve the needed form. Replantation was a key question, and, therefore, the Ordinances regulated on the creation of tree nurseries, as well as the obligation of villagers to replant trees. The imposed obligations and constraints placed the Navy in a very privileged position: the prices of oaks for private shipbuilders cost twice compared to those reserved for the crown; whenever the villagers needed to cut some tree, they had to write a request to the Nay intendant, that would be subject to authorization, in a complex bureaucratic process; the sale of wood outside of the Spanish territory was prohibited; the disrespect for the Ordinances implied coercive measures, such as fines and punishments (Quintero Gonzalez, 2005, 388-390; Martinez Gonzalez, 2014, 588-599; Lopez Arandia, 2012, 24-27; Pezzi Cristobal, 2001, 584).

By monopolizing great quantities of the best timber at the best price for the Navy, including in its jurisdiction woodlands under the control of privates and villages, the Ordinances were the embodiment of an enlightened despotism policy that collided with secular traditions of private and popular exploitation of forest resources, such as raw material for construction, fuel for domestic and industrial purposes, fodder for animals, as well as the use of land for agricultural and husbandry purposes. In a context of population increase, this conflict of interests, combined with a complex and ineffective administrative machinery, made the observance of this legislation very difficult, which, naturally, held up the success of the whole program. At the end of the period under consideration, the Navy dealt with a situation of scarcity of this raw material due to the excessive rhythm of felling that could not be accompanied by the re-plantations and growth of trees. The unpopular Ordinances were more actively applied while Don Zenon Somodevilla was in power, but after his fall, in 1754, this legislation was somehow neglected (Urteaga, 1987, 117, 126-129, 131; Pezzi Cristobal, 2001, 584; Quintero Gonzalez, 2005, 391).

More than a "floating woodland" (Aranda y Anton, 1990), for the great amount of timber required in its construction, each ship can be seen as a map of the strategy of the management of natural resources reflecting the exploitation of the peninsular and overseas territory, as well as the economic relations of Spain, for the variety of species and provenances of the timber applied in the construction of the different parts.

Each part demanded material with specific technological features that could be found in different types of timber. Structural elements such as keel, post and frames demanded dense and naturally curvilinear wood and were more commonly built out of oak, but ash trees could also be applied. Tall and rectilinear trees such as pines were used to construct planking and masts, which could be also made out of fir trees. Beech, wall nut tree, poplar, alder, holm oaks were other species used in shipbuilding.

These were all species which the peninsular territory could provide: the forests of Cantabria were a source of oak supply, pines grew in the forests of Tortosa and lately, the woodlands of Segura de la Sierra, became an intensively exploited area in the quest for this resource. The tallest and straightest species of Pines used in the assemblage of masts were a traditional importation from the Baltic region, due to the diminutive abundance of trees with these features within the peninsular territory. For the construction of some of the structural pieces that were particularly exposed, such as the keel, sternpost, transom, or keelson, were used very dense and resistant woods imported from the Caribbean and Gulf of Mexico regions, such as guayacan, acaná, ocuge, sabicú, cedar and mahogany trees. This one was also a favourite for rudders and other pieces that were subject to constant friction, such as pumps, beams or wedges (Quintero Gonzalez, 2006, 60-61).

During the period under consideration, this brief and generic account on the species, provenance and use of timber on shipbuilding was the supply model followed, in a rough sense, by the arsenal of La Carraca and Puntales shipyard (Quintero Gonzalez, 2005, 393-440; 453-455). The singularity of the situation of each maritime department resulted from the priority given to the forests located in the surrounding region as the main source of timber supply, which was the traditional strategy pursued by the earliest shipyards (Merino Navarro, 1978, 33).

The known documental evidences of the timber supply for the shipbuilding and fairing centres of Cadiz in the first third of the 18th century are very scarce, due to the diminutive activity of that complex, which was at a very early stage of functioning. During these years, the supply was not systematic and was arranged on provisory and precarious solutions, according to the opportunities that emerged, because the potential of forests of the Andalusian territory was not well acknowledged and the traditional sources of timber from other regions were

showing signs of some exhaustion. The majority of the wood was sent to the Real Carenero of Puente Suazo for fairing purposes. Pines and holm oaks from Cartaya (Huelva) were sent here for planking. In the late 1720s, the construction of the ship of the line *Hercules* demanded timber from Jimena (Gibraltar), Malaga, and Cartaya (Huelva), as well as timber from other Spanish regions like Tortosa (Catalonia). In the early 1730s, besides the forests of the Niebla County, other forests outside Andalusia contributed with timber, such as oaks and wall nut trees from La Graña (Galicia), wall nut trees and ash trees from San Sebastian (Basque Country), pines from Mallorca, as well as imported timber from Havana and "wood from the north", probably the Baltic region (Quintero Gonzalez, 2005, 393-396; 435).

In 1734, José Patiño orders a report on the existing timber stocks at Cadiz as well as visitations to the woodlands of Malaga and Campo de Gibraltar following the suggestion of the master shipbuilder Ciprian Autran, what is seen as the first systematizing endeavour. From this expedition resulted an inventory of the species of trees, potential types of pieces made out them, sizes, locations, and distance to rivers and docks, in order to be transported to Cadiz. This first visit conducted by Filipe de Ansa was followed by the reassessment of the jurisdiction of Malaga by Ciprian Autran, which resulted in an even more detailed report on about 30 000 trees including oaks, ash trees, and fir trees in Alfarnate, Alhama, Vélez, Algatusín, Benaluría, Cortes, Casares, Jimena. A contract with the *assientist* Juan Navarro was made in order to transport the timber from Malaga to Cadiz. This was also the year in which began to arrive the first pine wood from Segura de la Sierra, which specific case will be presented furthermore (Quintero Gonzalez, 2005, 397-406, 417, 453).

Until the end of the first half of the century, the regional timber supply began to be systematic, and Aljarafe, Jerez, Ubrique, El Bosque, Grazalema, Montefrío, Archidona, Gama, Antequera, were added to the list of locations of important sources, after expeditions in 1748. Nevertheless, this regional supply was complemented by importations, due to periods of scarcity and the demands of specific timbers for the construction of certain pieces, whether from the Baltic region, for which was signed an *asiento* with Carlos José Lasarte, in 1739, or America, for which was promulgated an instruction on the felling and transport of cedar from Cuba, in 10th May 1745. (Quintero Gonzalez, 2005, 406-416; 419-431, 454).

The decade of the 1750s was marked by some exhaustion of the woodlands located nearby Cadiz, after some years of severe felling, although the visits to other woodlands in Andalusia were undertaken in order to identify new raw material. To make the situation even more fragile, the administration dealt with some internal debility, corruption, conflicts with the villagers and local authorities, especially soon after the promulgation of the Ordinances. While the demands of timber from other regions continue, such as oaks from Guarnizo, Pines from Riga were imported to the assemblage of masters. The attention began to turn into the forests of Segura de la Sierra, which exploitation became more intensive (Quintero Gonzalez, 2005, 431-437, 455; Baudot Monroy, 2013, 313-227).

Segura de la Sierra becomes one of main sources of timber supply in Andalusia, and here will be presented as a paradigmatic example to illustrate the operative chain of this process. It is located at the northern frontier of Andalusia with Castilla-La Mancha, and is a large forest area, mainly constituted by pines, mostly the variety Pinus Nigra. It had been exploited for shipbuilding purposes in previous times, although this practice had become less common in the decades immediately before its establishment as a maritime province. The intensive State exploitation emerged in 1733, with the construction of the Royal Tobacco Factory in Seville, which process, including the raw material supply, was controlled by the Royal Treasury. The Navy was aware of his situation and, in 1734, Patiño reached an agreement with the Treasury, which resulted in the delivery of 8000 pines for shipbuilding, and, in 1735, this relation was formalized by the Royal Decree of the 1st of May, which established the superintendent of the Royal Factory as the main responsible. In 1748, by the Ordinance of the 31st of January, Segura de la Sierra is established as a maritime province, which mountainsides facing the Guadalquivir and Segura rivers directions would, respectively, belong to the Maritime Departments of Cadiz and Cartagena. Although Segura de la Sierra was located far from the coast, its atypical establishment as a maritime province is symptomatic of its importance as on the greatest regional sources of timber, which would attenuate this chronical shortage (Quintero Gonzalez, 2005, 417-419; Merino Navarro, 1978, 34-39; Lopez Arandia, 2012, 13-71).

The operative chain from the forest to shipyard began with the visit to the territory in order to select and mark the potential trees according to its size, shape and

conservation, by the liner. Under the supervision of this officer, the loggers, locally called *hacheros*, cut the trees between January and March, and immediately prepared the drying by removing the bark. The logs rested in piles until summer in order to loose the resin. Pines were dispatched to river flotation. During summer, with the help from pairs of oxen, the timber was dragged to the mouth of Trujala river, in the Gualdalimar river, which is an affluent of the river Gualdalquivir. The flotations initiated during the rainy months in order to guarantee the existence of a flow that would allow the flotation. Due to the narrow nature of these rivers, the logs flotated in spare parts and were controlled by the *gancheros*. These man were transported on the logs, and controlled them with a hook (*gancho*). The logs were transported to Seville by flotation, and then would be dispatched to Cadiz by road. (Merino Navarro, 1978, 34-39; Quintero Gonzalez, 2005, 417; Vigueras Gonzalez, 2002, 55-92; Lopez Arandia, 2012, 36-57)

BIBLIOGRAPHY

ARANDA y ANTON, G. de (1990) – *Los Bosque s flotantes. Historia de un roble en el siglo XVIII*, ICONA, Madrid.

BAUDOT MONROY, M. (2013) – Barcos para el Rey. Julián de Arriaga, la madera y la construcción naval (1752-1759), *La Armada española en el siglo XVIII: Ciencia, hombres y barcos*, Sílex, Madrid, 297-320.

BORDEJE MORENOS, F. (1989) – El poder marítimo en la concepción política del Marques de la Ensenada, *La Marina de la Ilustración*, *Ciclo de conferencias - Noviembre de 1988*, Cuadernos Monográficos del instituto de Historia y Cultura NAVAL, N.2, Madrid.

COOMBES, J. B. (2008) – Spanish shipbuilding in the Eighteenth Century: The Album of the Marques de la Victoria, *Edge of Empire: Proceedings of the Symposium "Edge of Empire"*, SHA2006, Caleidoscópio, Casal de Cambra, 215-234.

CRESPO SOLANA, A. (1994-1995) – La acción de José Patiño en Cádiz y los proyectos navales de la Corona del siglo XVIII. *Trocadero*, N. 6-7, 35-50.

CRESPO SOLANA, A. (2001) – El comercio y la Armada de la Monarquía: la Casa de Contratación y la Intendencia de Marina en Cádiz (1717-1750), Cuadernos Monográficos del Instituto de Historia y Cultura Naval 39, Madrid, 63-78.

DIEGO GARCÍA, E. de (2002) – Estructuras de la organización naval: departamentos y arsenales peninsulares, *Cuadernos Monográficos del Instituto de Historia y Cultura Naval* 41, Madrid, 15-39.

LÓPEZ ARANDIA, M. A. (2012) – Maderas del Rey. Aprovechamientos madereros en la provincia marítima de Segura de la Sierra, en Araque, E. y Moya, E.: *Aprovechamientos madereros en los montes jiennenses (Siglos XVIII- XX).* Jaén. Publicaciones de la Universidad de Jaén, 13-71.

MARTÍNEZ GONZALÉZ, A. J. (2013) – Bosques y política naval Atlántica: las reformas normativas e institucionales de José Patiño (1717-1736), *Revista Hispano Americana*, n. 3, Real Academia Hiapano Americana de Ciencias, Artes y Letras.

MARTÍNEZ GONZALÉZ, A. J. (2014) – La elaboración de la Ordenanza de Montes de Marina, de 31 de enero de 1748, base de la política oceánica de la monarquía durante el siglo XVIII, *Anuario de estudios Americanos*, Volumen 71, N. 2, Julio-Diciembre, Sevilla, Escuela de Estudios Hispano-Americanos, CSIC, 571-602.

MARTÍNEZ RUIZ, E. (1996) – El Marqués de la Victoria y la política naval española*, Cuadernos Monográficos del Instituto de Historia y Cultura Naval* 28, Madrid, 7-20.

MERINO NAVARRO, J. P. (1978) – La marina en los Montes de Segura de la Sierra (1734-1820). *Actas del I Congreso de Historia de Andalucía. Andalucía Moderna. Siglo XVIII*. Tomo II, Córdoba, 33-39.

MERINO NAVARRO, J. P. (1981) – *La armada española en el siglo XVIII*, Madrid, Fundación Universitaria Española.

MANERA REGUEYRA, E. (1981) – *El buque en la Armada Española*, Sílex, Madrid.

SALGADO ALBA, F. (1989) – Ideas Estratégicas de la Marina de la Ilustración", *La Marina de la Ilustración, Ciclo de conferencias - Noviembre de 1988*, *Cuadernos Monográficos del instituto de Historia y Cultura Naval*, N.2, Madrid, 33-48.

PEZZI CRISTOBAL, P. (2001) – Proteger para producir: La política forestal de los Borbones españoles, *Baetica: Estudios de arte, geografía e historia,* 23, Málaga, 583-596.

QUINTERO GONZÁLEZ, J. (2002) – La Carraca: un arsenal para la política naval de Felipe V, *Felipe V de Borbón 1701-1746: actas del Congreso de San Fernando (Cádiz) de 27 de noviembre a 1 de diciembre de 2000*, Universidad de Córdoba-Fundación Municipal de Cultura del Ayuntamiento de San Fernando, 685-707.

QUINTERO GONZÁLEZ, J. (2005) – *La Carraca: el primer arsenal ilustrado español (1717-1776)*, Ministerio De Defensa, Madrid.

QUINTERO GONZÁLEZ, J. (2006) – La Carraca y La Habana. Aproximación al intercambio de pertrechos entre arsenales, *Revista de Historia Naval,* 93, Madrid, 57-65.

VIGUERAS GONZÁLEZ, M. (2002) – *El transporte de madera por flotación y carretería, desde los bosques de Sierra de Segura hasta Sevilla y los arsenales de La Carraca (Cádiz) y Cartagena, durante los siglos XVIII y XIX (1734-1833)*, Madrid, Puertos del Estado.

URTEAGA, L. (1987) – *La tierra esquilmada. Ideas sobre la conservación de la naturaleza en la cultura española del siglo XVIII*, Barcelona / Madrid, Ediciones del Serval / CSIC.

PORTUGAL AND NORTH ATLANTIC TRADE: COMMODITIES, SHIPS AND PEOPLE

Tânia Manuel Casimiro
Instituto de Arqueologia e Paleociências da Universidade Nova de Lisboa. Bolsa Pós-doc FCT

Abstract

The analysis of 17th-century Portuguese and English port books has offered documentary evidence of trade between certain Portuguese ports, Newfoundland, Ireland and England. Especially from 1640 onwards, commodities such as wine, sugar, olive oil and even pottery, together with other products less frequently mentioned, were shipped to these different locations. Some have been confirmed archaeologically. The records of the Portuguese ports suggest that salt cod fish and fish oil were the only goods returned from Newfoundland to Portugal. From England and Ireland cloth and wool were the most frequent. This paper will consider which products were being sent from Portugal to Newfoundland, England and Ireland, their quantities, agents, and transport.

Resumo

A análise de documentação alfandegária portuguesa e inglesa forneceu informações acerca do comércio entre alguns portos portugueses, a Terra Nova, Inglaterra e Irlanda. Ainda que alguns documentos possam ser atribuídos ainda ao século XVI é a segunda metade do século XVII a mais rica em termos de evidências. Bens tais como vinho, açúcar, azeite e mesmo cerâmica, juntamente com outros produtos com menos expressão saíam dos portos portugueses em direcção a diferentes destinos. Alguns destes produtos foram já identificados em contexto arqueológico. Da Terra Nova vinha bacalhau e das Ilhas Britânicas sobretudo têxteis. Este estudo vai considerar alguns dos produtos enviados de Portugal para a Terra Nova, Inglaterra e Irlanda, quantidades, agentes e tipos de barcos onde eram transportados.

INTRODUCTION

In the 17th century, many ships arrived in Portuguese ports each year from Newfoundland, England and less from Ireland, according to documentary evidence existing in Porto, Figueira da Foz, Lisbon and Faro. The documents used in this paper are the ones that actually record the imports and exports to and from Portugal for these English territories during the 17th and 18th centuries. In this sense Customs records or Port books, Health visitors and Inquisition records were the analysed sources. In Portugal the consulted archives are located in Porto, Figueira da Foz and Lisbon while the National Archives in London were the ones recorded in foreign territories.

Though the major focus of this research is essentially commodities the nature of the documents permitted to understand the type of vessels involved in such commerce as well as the name of ship captains and the traders on the ports. This is a huge amount of information however one of the most interesting is the type of ships involved in this trade: while ships, fragatas, patachos, penque, barca, lancha and sumacas cross the Atlantic bergantins, and charruas are, in addition, recorded involved in the north European trade.

The nationality of the crew and captains is, in these documents, always the same of the ship's flag. Most of them, in the ships that were considered for this paper are in fact English, followed by the Portuguese, and just a few Irish. Once in a while English merchants, especially from London, arriving at that city from Portugal and unloading their ship's cargo present names such as Isaac Alvarez, Jeronimo Lopez, Fernando Mercado, Antonio da Costa, among others… Portuguese Jew merchants that lived in London but not in Portugal due to their religion

(Woolf, 1975). The commodities traded by these man will be mentioned later.

IMPORTS INTO PORTUGAL

Despite the substantial number of vessels, the documents are clear about unique product of North America import trade: the only commodities brought into Portugal from Newfoundland were cod fish or cod liver oil. The evidence survives in several types of documents. Customs books from Figueira da Foz, for example, show that in 1672 cod was bought at 2000 *reais* per *quintal* (60 kg) (AHFF/Alfândega/Lv.4/fl.6). Ships from Newfoundland correspond in the 18th century to 22% of the total English flag ships entering Porto (Cardoso, 2002: 236). From England and Ireland the number of ships is huge, especially from London.

In times of epidemic or plague, every port had a commission that visited vessels from other countries, in order to see if there were any evidences of disease that would require the crew to remain on the ship during their stay. These visits produced a record, *Visitas de Saúde*, in which the health inspectors state the name of the ship, the master, country of origin and cargo. Although this system was used in several Portuguese cities, the records survive only for Porto and Viana do Castelo (and the latter has them only for the 18th century) (Abreu-Ferreira, 2003). In Porto, the first ship from the Newfoundland fishery was recorded in 1598, when the *Santa Maria*, an English vessel, arrived with cod. The *Visitas* books there continued into the early 18th century. In fact, from 1704 to late that century English ships were, by far, the highest number to enter Porto with 4562 vessels recorded. Dutch and German merchants are the second and third most frequent nationalities with only about 400 vessels for the entire century (Cardoso, 2002, 228). From Newfoundland the imported goods mentioned are exclusively cod and cod liver oil: the cod in three varieties *bacalhau* (cod), *bacalhau de pasta* (wet or green cod) and *bacalhau de vento* (dried cod). The ships were mostly English, although a French vessel was recorded in 1599 (Ferreira, 1977). From England and Ireland cloth, wool and iron were the major goods, although some wood for ship construction was also recorded (Cardoso, 2002: 230).

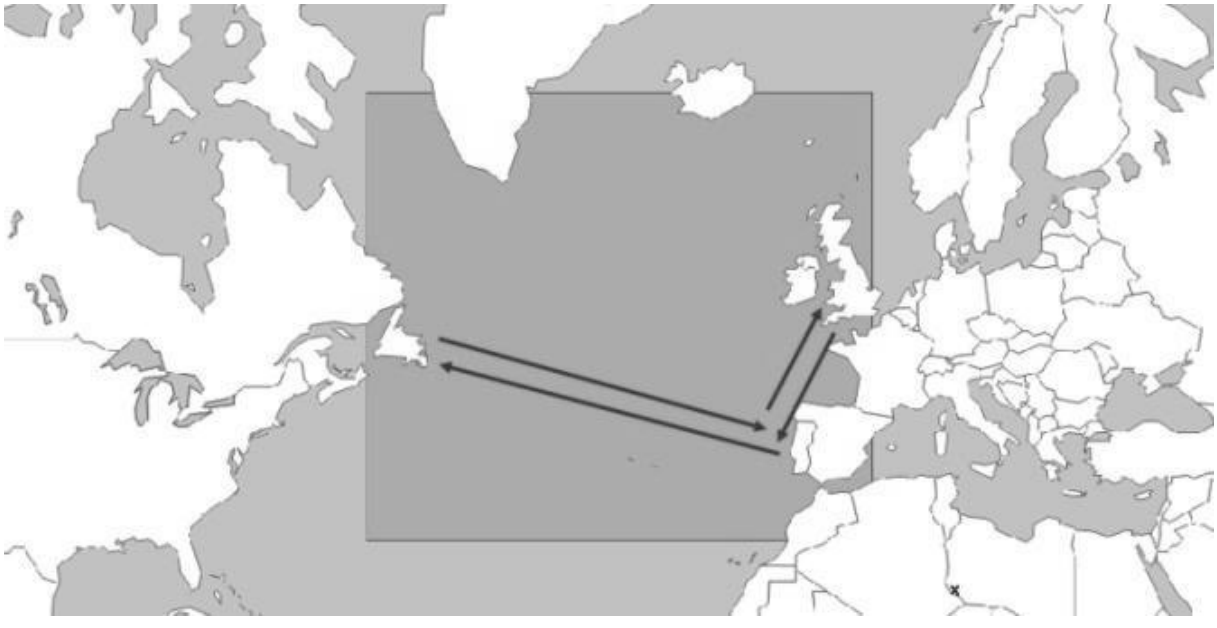


Figure 1. Atlantic trade movements United Kingdom/Ireland-Portugal-Newfoundland.

Another source of evidence survives in the records of visits by the Inquisition. All vessels arriving in Portugal from countries where the official faith was not Roman Catholic were visited by a commission to determine if there were any illegal books or images on board and if there was any intention to make those enter Portuguese territory. The Inquisition visitors had a book of records stating the names of the ship, master, and crew and sometimes of the goods transported. These books survive in Lisbon and Faro. The latter was a southern port operating at a small scale but, even there, some ships are recorded as bringing cod fish from Newfoundland, especially in the second half of the 17th century. We have no idea of what commodities were sent in return to Newfoundland but Faro had only a narrow range of products for export: figs, almonds, tuna and salt (Rau, 1954). Between 1642 and 1684, the Lisbon Inquisition recorded 73 vessels arriving from Newfoundland carrying only one item: cod (Rau, 1954).

Many authors have dedicated their studies to trade and trade contacts between Portugal and the British Isles (Shaw, 1998). The products sent to this destination will be mentioned later, although just a scarce variety entered Portugal.

FROM PORTUGAL TO NEWFOUNDLAND

Only one or two imports were brought into Portugal from Newfoundland. However, ships leaving the country towards Newfoundland were laden with all types of products. The evidence for this trade, discussed here, is based exclusively on data from Porto (Casimiro, 2013). The *Livro de arrecadação da portagem e redízima do Cabido da Sé do Porto* (Arquivo Distrital do Porto) registered several ships taken products towards the English colony. These books were produced by the church that since the 1517 charter had the right to collect taxes from some exports, by land and by sea (Cruz, 1940:22).

The news of exports from Porto in the 17th century towards Newfoundland only survive from 1667 onwards, which does not mean that goods from Portugal were not taking earlier, since the archaeological record has shown Portuguese pottery in Newfoundland contexts from at least the 1630s (Stoddart, 2000). For this paper, the Porto records were analysed up to 1705 but it is quite possible records of similar exports continue during the 18th century. A gap exists between 1706 and 1712.

In the period examined, between 1667 and 1705, 112 ships were recorded as setting sail for Newfoundland. Although these ships departed from Porto the records show that most of them were not Portuguese, nor their captains. The vessels were mostly English: 51 belonged to the port of London; 24 to Topsham; 3 each to Bristol, Plymouth and Barnstaple; and just one each to Dartmouth, Hull, Poole and Galway in Ireland. For sixteen vessels no port of origin was recorded and two are said simply to have come from England. Only two Portuguese ships are recorded, one from Porto and the other from Figueira da Foz. In a single case, an English vessel, Robert Court master, had come to Porto from Saint-Malo, in Brittany. In general, the ships leaving Porto went directly to Newfoundland but, sometimes, they called at Madeira or Terceira or Fayal in the Azores, quite possibly loading export products at these Atlantic islands as well.

Figure 2. Portuguese faience bowl found in Ferryland (Newfoundland).

From these 112 ships only one was destined to Placentia in French Newfoundland taking the same commodities others took to the English fisheries: salt, wine, aqua vitae, vinegar, lead, sugar and clothes (ADP/CABIDO/Lv.182/1694/fl.24v).

The predominance of English ships involved in such trade is clearly related to the presence of many English merchants in Porto (Shaw, 1998: 6) and the fact that this city is perfectly located when considering the North Atlantic trade, leading many of them to establish their business in this city (Barros, 2006: 52); second the

absence of Portugal in the Newfoundland-Europe trade networks. Portuguese ships and merchants were apart from the cod trade supported essentially by English merchants who loaded their ships in England and Portugal and took them to Newfoundland and got back to Portugal filled with cod and cod liver oil. The absence of Portugal from this trading system may somehow be related to decay of Portuguese merchants' presence in the international commerce a consequence of the 16th century Jewish flee to Northern Europe (Barros, 2006).

Salt was the most common good exported from Porto to Newfoundland. It was an essential input for curing cod, the largest and indeed predominant industry in Newfoundland, in the period. During the period of 1667-1705, just about 6132 tonnes of salt are recorded in shipments from Porto to Newfoundland. Some of this salt must have come from Aveiro, where the closest *salinas* were located. However, other places in the Portugal likely shipped salt to Newfoundland as well, including Figueira da Foz and Setúbal, where production was well established and where cod was imported from Newfoundland (Rau, 1951). Despite these amounts much more salt than the one recorded here was taken into Newfoundland by English merchants. According to L.M.E. Shaw "vessels began returning to England by the end of the year, sometimes loaded by Portuguese salt to take to Newfoundland in the Spring." (Shaw, 1998, 35)

Wine and other alcoholic drinks were the second largest export from Portugal towards Newfoundland. For example, in 1673, the *Santana*, master Joshua José Afonso (possibly a Portuguese *marrano*) came from Bristol and then went to Newfoundland with 10 *moios* of salt, 8 barrels of wine, 20 barrels of flour and 6 barrels of aqua vitae (ADP/CABIDO/Lv.156/fl.13v). The export of wines and spirits was to be expected, considering that these were among the most important products of northern Portugal. The records state that aged, red, white and green wine were the varieties shipped. Preference seems to have been given to aged and red, followed by green wine, with less than 20 barrels of white wine recorded in shipments of the period. Vinegar, which derives of course from wine, was also a frequent export. Besides wine, aqua vitae was also shipped in large volumes. Contemporaries observed that wine and spirits were consumed in large quantities by fishermen and settlers in Newfoundland, which was known even in England for its consumption of drink and tobacco (Pope, 2004: 401-406). Although most of the latter came from the English colonies in America, the Porto records show that at least 10000 kg of tobacco was sent from Portugal to Newfoundland (ADP/CABIDO/Lv.181/1693/fl.19) Both alcohol and tobacco worked as social catalysts helping fisherman to 'deal with the difficulties of living in crowded conditions, close to the scene of production, and far from their own homes' (Pope, 2004: 350).

After salt and wine, the largest category of traded goods was foodstuffs. Olive oil was frequently taken. This commodity was shipped in the pottery containers that historical archaeologists call olive jars. *Botijas*, as they were known in the period, came in different sizes. They are commonly found in archaeological excavations on English sites in Newfoundland, for example at Cupids, Ferryland and the St John's waterfront. They are clearly of Portuguese origin, made with the same clay as a range of red earthenware (*louça vermelha*) objects (Newstead, 2013). In the second half of the 17th century Porto export records refer to more than 8000 jars of olive oil, shipped to Newfoundland.

Figure 3. Portuguese olive jar found in Newfoundland.

Sugar was frequently taken to the fishery in both white and dark varieties, usually in baskets or bags (ADP/CABIDO, Lv. 182/1694/ fl. 27). Other sweets were also shipped and several litres of molasses were recorded.

Fruits and vegetables such as peas, beans, chick-peas, lupin-seeds, olives, berries, red currents, raisins, dried plums, chestnuts, almonds, garlic and onions were all exported to Newfoundland. Almost a ton of cocoa from Maranhão in Brazil was taken to Newfoundland in a single shipment in 1703 ADP/CABIDO, Lv. 189/ fl. 31v). The most imported fruits were oranges and lemons, including 'china' or sweet oranges, sour oranges, sour lemons, salted lemons and even 150 kg of lemon peel. Citrus fruits were also obviously in great demand in England, for nearly every ship headed to London from Porto took some on board.

Porto also shipped plainer food. About 1000 kg of flour was recorded, destined to make bread, as well as quantities of hardtack, the dried bread consumed on ships and used by fishing crews. Meat was also shipped to Newfoundland - most of it salted, the documents mentioning smoked ham, salted pork and beef.

Cloth was another frequent export from Porto to Newfoundland. Ships took linen (including ordinary linen and linen waste) canvas, Dutch canvas and French canvas, as well as silk waste, taffeta and sack cloth (ADP/CABIDO, Lv. 182/ fl.27/ ADP/CABIDO, Lv. 183/ fl.8). Wool was clearly imported from England. These items were used to make cloths, sails for ships and bags to keep goods. Even though Newfoundlanders doubtless made many of their own clothes, some clothing went there already made and the export records mention items such as shirts, skirts, long pants, drawers and socks for men, women and children, as well as *Galicia* socks, which must have been of a special quality. ADP/CABIDO, Lv. 180/ fl.36v) Dressing accessories were also exported and we find in the records 714 hats, 200 pairs of shoes and 15 inner soles - all remaining important Portuguese manufactures today. Complementing these outfits with a few accessories, the export registers also record two hunting bags and two sword belts. Even more curious is the export of twelve eye patches and one sunshade, although we have no idea about the size or material of this item. The export of sumac shows that cloth was not necessarily used in its original colour, since this plant was used as a dye to give a reddish tone to clothes. Would this have been used in Newfoundland or might it have been destined as a re-export, perhaps to New England? Could this have been used to dye sails?

Supporting the fish industry, tar and pitch were necessary in the repair and conservation of ships. Cork could be used as thermal isolation but, in the context of the fishery, was likely mostly destined to become floats for fishing nets (ADP/CABIDO, Lv. 181/ fl.18). Cod was the most important product taken from the sea and was normally taken by hook and line. The export of twelve seines shows that other species were fished, of smaller size, using different techniques, perhaps for bait.

Most of the goods shipped from Porto to Newfoundland in the later decades of the 17th century can only be identified through written sources. However, some things, particularly pottery, have also been identified in the archaeological record. According to the Porto records, at least 20,000 ceramic vessels were shipped to Newfoundland aboard English ships, in the late 17th century. Much of the tin-glazed ware may have come from Villa Nova, on the south bench of the Douro River across from Porto, while Aveiro was a likely source for red earthenwares. But either ware could have other origins, since it was not uncommon for to pottery brought from Lisbon to be shipped from Porto (Barbosa, Casimiro and Manaia, 2009; Leão, 1999). In 1670 the *Agnes*, of Topsham, Robert Lloyd master, took to *Terra Nova* 28 pipes of oil, 4 cars of Aveiro ware and 3600 Villa Nova ware objects and 770 metres of flax sail cloth (ADP/CABIDO, Lv. 155/ fl.12v).

Although these were the most frequent imports, the records show others, such as iron barrel hoops for repair, nails, ammunition, lead bars, Biscay iron, wax or tallow candles (ADP/CABIDO, Lv. 179/ fl.31v) paper, soap and an interesting piece of furniture. In 1692, the *John* of London loaded a sixteen drawer cabinet in dark wood for Newfoundland (*hum contador de dezasseis gavetas de pau preto*) ADP/CABIDO, Lv. 180/ fl.36v

Vessels were normally loaded for Newfoundland by local dealers in Porto. Most of the individuals dealing in the English and Newfoundland trade were Englishmen living there. There are no records of a ship taking only one product to Newfoundland. The voyage of the *Flying Oak* in 1693 is typical. Samuel Weston, master, took salt, cork, tallow and wax candles, smoked hams, white sugar, mature wine, 122 *botijas* filled with olive oil, aqua vitae

and Algarve raisins to Newfoundland. ADP/CABIDO, Lv. 181/ fl.18

FROM PORTUGAL TO THE BRITISH ISLES

Wine was clearly the most frequent product exported into the British Isles. Ships were loaded with this commodities in several Portuguese ports (Shaw, 1998; Cardoso, 2005) In fact some of the port books existing in some English cities are exclusively dedicated to wine imports and Portuguese cities occupy a very important place in such trade. One should never forget that in 1703 the Methuen treaty permitted that Portuguese wines did not pay entrance taxes in England.

Other products are also recorded in large quantities such as olive oil and salt and discussed by several authors. The aforementioned *Livro do Cabido da Sé do Porto*, reveals at least 50 ships taking goods to Ireland in the second half of the 17th century. Leaving Porto these would set sail towards Dublin, Cork, Limerick, Waterford, and Belfast. The traded goods are not that different from the ones shipped into England. As an example in 1703 the ship Amizade, Master Thomas Thomas sets sail to Dublin with wine, dried plums, sumac, salt, oranges and lemons (ADP/CABIDO/Lv. 189/, fl. 10). Other products are registered in these records such as olive oil, sugar, vinegar, onions, cork and tobacco or even pottery. This last product has been archaeologically identified (Casimiro, 2011).

The same categories of goods were sent to England though in larger quantities. These are frequently referred in many publications. In this sense, when reading the English port books the author looked for the rarer goods, the ones arriving occasionally from Portugal to English ports. Pottery is probably one of the only items surviving in the archaeological record and quite easy to distinguish from other European or Eastern productions. Such trade is recorded not only in Portugal books, but also in English ones with designations such as *Portuguese earthenware* or *Portuguese white ware.* Such trade has been confirmed archaeologically both in England, Ireland but also Wales and Scotland (Casimiro, 2011). Although only one tile has been, so far, identified in archaeological excavations, port books reveal the entrance of many of these pottery squares to cover walls.

In 1675 William Dollawood arrives in London in his Ship William Taylor with a cargo of elephant tusks and whale bones (E190/64/1 fl.7). In that same year Gomes Rodrigues brings to London pearls and diamonds (E190/64/1 fl.224). Late that year Fran Dopavia loads four small wooden cabinets in Lisbon. Peculiar items are constantly send to England such as jewelry, glass, artificial flowers, ivory fan sticks. Lisbon seems to re-export other European and Eastern goods. In 1675 Bernanrd Gambill brings from Lisbon eight brass lamps and nine boxes plain Venice Gloves (E190/64/1 fl.169), and although sometimes the origin is not mentioned one can imagine that these are foreign productions such as the Theorbo, an Italian music instrument which entered London in late 17th century on board a ship from Lisbon (E190/131/1). Other interesting items are recorded during the entire 17th century such as spices (pepper, ginger, cinnamon) alabaster images, amber feathers, bezoar stones, coral and crystal beads, horn and ivory combs, laces, tapestry, among others (Woolf, 1975).

Although Lisbon was in fact the most important city trading into England others are recorded such as Faro, exporting mostly fruit (figs, raisins and almonds), and olive oil or Figueira da Foz which exported wine, brandy, and olive oil (Rocha, 1954). Porto, besides de enormous amounts of wine, salt and food stuffs, such as fruit and olive also sends pottery (Casimiro, 2011).

Figure 4. Portuguese faience bowl found in Exter (England).

DISCUSSION

The commodities sent from Portugal to Newfoundland strongly suggest that Portugal was supplying much more than a fishery. Although some of the goods exported to Newfoundland were essential to shipboard or, like salt, necessary for the fishing industry, others were commodities used in everyday life, including more than a few luxury items. It is the author's belief that, although the majority of this trade was made by English ships, all of these products were being consumed in the New World although some of them could have been re-exported from Newfoundland to New England.

Salt was in fact the largest import, fundamental in the maintenance of cod industry, followed by drinks and food. Alcoholic drinks, namely wine and *aqua vitae* are the second largest import. As mentioned, the large consumption of wine at Newfoundland was socially understandable as a way of cushioning the hard conditions of life typical in the fishery. Food items were especially things settlers could not produce themselves, such as olive oil, sugar, oranges, lemons, peas, beans and olives.

The exports from Portugal demonstrate that some transformative industry must have existed in Newfoundland in the later 17th century. Cloth and clothes were an important trade item. Woman would likely be responsible for sewing clothes for the inhabitants. Some items were also exported ready-made, such as skirts, shirts, and underwear for men, women and children. The export of twelve eye patches might suggest that accidents were common enough. Bars of lead and Biscay iron were exported to Newfoundland as raw materials, where smiths would transform iron and lead into objects needed for repairs or simply normal operations, for example, lead sinkers for the fishery.

Pottery was not produced in Newfoundland until the 20th century, so in the 17th century every vessel had to be imported. A large amount of the pottery in use seems to have been imported from Portugal. In the 17th century, Portuguese potters were supplying everyday and decorative vessels for Newfoundland homes in Cupids and Ferryland. Portuguese redwares are also quite frequent in other fishing stations and even in several shipwrecks along the coast of Newfoundland. Through Portugal, Newfoundland thus acquired products from other places in the world: from Brazil, Maranhão cocoa and furniture made with exotic tropical wood but also from Spain, clothes from Galicia and iron from Biscay.

Although the documentary evidence survives only from Porto, Newfoundland must have received supplies from other cities in Portugal, especially Lisbon, where ships arrived from the fishery carrying salt cod to supply the biggest city in the country.

Lisbon was in fact one of the major exporting ports from Portugal. No port books are known before late 18th century although much information has been found outside Portugal, and for the purpose of this paper in the London Port books. The trade with England and Ireland cannot be compared with the one with Newfoundland. This was in fact a triangular trade. Ships would leave England towards Portugal carrying cloth, wool and iron. Once these products were sold the ships were loaded with all type of commodities destined to supply the fisheries, from basic stuff to luxury items that would transform a severe territory in a more civilized country. In Newfoundland captains would fill their ship's holds with cod and set sail to Portugal. When arriving in the different Portuguese cities the ships would leave again to the British Isles filled with wine, sugar, olive oil, oranges, lemons and other fruits. However there was always a small space in the ships for more peculiar commodities that would supply other type of demand, from diamonds to musical instruments.

REFERENCES

ABREU-FERREIRA, D. (2003) – The English mercantile community in seventeenth-century Porto: a case study of early Newfoundland trade, *Newfoundland Studies,* 19(1), pp. 132-152.

BARBOSA, T.; CASIMIRO, T. e MANAIA, R. (2009) – A household pottery group from Aveiro (Portugal), *Medieval Ceramics*, 37, pp. 119-136.

BARROS, A. (2006) – Oligarquia política e elite económica no Porto, *Estudos em homenagem ao Professor Doutor José Amadeu Coelho Dias*, pp. 49-69, Faculdade de Letras da Universidade do Porto, Porto.

CARDOSO, A. (2002) – Subsídios para a História da Barra do Douro, in *O Litoral em perspectiva histórica*, Porto: Faculdade de Letras, pp. 225-245

CARDOSO, A. (2005) – Os mercadores Ingleses do Porto e os Mercados Atlântico e Mediterrânico (Séc. XVIII), *Actas dos VIII Congresso da Associación Española de Historia Económica*, Santiago de Compostela.

CASIMIRO, T.M. (2011) – *Portuguese Faience in England and Ireland*, British Archaeological Reports, Oxbow Books, Oxford.

CASIMIRO, T.M. (2013) – From Portugal to Newfoundland in the 17th century: supplying a European colony or provisioning a fishery?, *Exploring Atlantic Transactions*, pp. 224-232, Boydell Brewer, Suffolk.

CRUZ, A. (1940) – *Forais Manuelinos da Cidade e Termo do Porto existentes no Arquivo Municipal*, Arquivo Municipal, Porto.

FERREIRA, J. A. (1977) – *Visitas de saúde às embarcações entradas na barra do Douro nos séculos XVI e XVII*, Câmara Municipal. Gabinete de História da Cidade, Porto.

LEÃO, M. (1999) – *A Cerâmica em Vila Nova de Gaia*, Fundação Manuel Leão, Vila Nova de Gaia.

NEWSTEAD, S. (2013) – Merida no More: Portuguese Redware in Newfoundland, *Exploring Atlantic Transactions*, pp. 140-151, Boydell Brewer, Suffolk.

POPE, P. (2004) – *Fish into Wine: The Newfoundland Plantation in the Seventeenth Century*, University of North Carolina Press, Chapel Hill, NC.

STODDART, E. (2000) – *Seventeenth century tin-glaze earthenware from Ferryland, Newfoundland* (MA Thesis, Anthropology, memorial University of Newfoundland).

RAU, V. (1951) – *A Exploração e o Comércio do Sal de Setúbal: Estudo de História Económica*, s.n., Lisboa.

RAU, V. (1954) – Subsídios para o estudo do movimento dos portos de Faro e Lisboa durante o século XVII, *Anais*, Academia Portuguesa da História, II série, vol. 5, pp. 199-277.

ROCHA, A. S. (1954) – *História, Topografia e Etnografia: Materiais para a História da Figueira nos Séculos XVII e XVIII*, s.n., Figueira da Foz.

SHAW, L. (1998) – *The Anglo-Portuguese Alliance and the English Merchants in Portugal*, Ashgate, London.

WOOLF, M. (1975) – Foreign trade of London Jews in the Seventeenth Century, *Transactions of the Jewish Historical Society of England*, vol. XXIV, pp. 38-58.

Unplished references

Livro de arrecadação da portagem e redízima do Cabido da Sé do Porto, Arquivo Distrital do Porto.

Livros da Alfândega da Figueira da Foz, Arquivo Municipal da Figueira da Foz.

London Port Books, National Archives, Kew Gardens, London

ABBREVIATIONS

ADP – Arquivo Distrital do Porto

AHFF – Arquivo Histórico Figueira da Foz

PORTUGUESE INDIA ROUTE SHIPWRECKS

Filipe Castro
Ship Reconstruction Laboratory, Texas A&M University, 105 Anthropology Bld., College Station 77843-4352, USA (fvcastro@tamu.edu)

ABSTRACT

The India Route was one of the longest commercial routes of the sixteenth century, and the Portuguese 'naus' designed and built to sail it were among the best and largest ships of their time. Perhaps less than 250 Portuguese Indiamen were lost from 1498 to 1640, and many were found and burned soon after the wrecking event, to recover the expensive iron fastenings. This paper addresses the significance of oceangoing construction in the context of Europe's history of science and ideas.

INTRODUCTION

The development of larger and sturdier ships during the fifteenth century allowed the exploration and expansion of the World and contributed to the spread of the Renaissance in Europe. Beginning in the fourteenth century, the exploration of the Atlantic Ocean led to the eventual mapping of the entire planet and to an explosion of commerce, warfare, and migration, sometimes inspired by the search for power and wealth, at other times by curiosity and imagination. The consequences of this European expansion were immeasurable. The long cycle of cultural divergence that had started in the Palaeolithic through migration, isolation, and adaptation of small populations to different ecological niches was reversed, and a new era of convergence began, bringing peoples and cultures together, and allowing the creation of an encompassing image of the world for the first time (Fernandez-Armesto 2006).

The European Renaissance is partly a consequence of the geographical explorations of the late fourteenth and early fifteenth centuries. Ships united distant peoples and acquainted remote and formerly isolated cultures with radically different ways of living, belief systems, and worldviews. The cultural impact of European explorations and discoveries was enormous (Levenson 2007). Granted, the results were sometimes dramatic, as they frequently are when civilizations clash (Zinn 1980). Ships transported disease carriers such as flies, lice, cockroaches, rats, and rat fleas. Humans also carried bacteria and viruses, sometimes harmless to the populations that had been exposed to them for centuries, and deadly to the populations that had never before been in contact with a new disease.

Violence was a constant in this period. Expansion of commerce brought about new economic theories and new power strategies that triggered wars, invasions, occupations, and enslavement of new populations, initiating a new cycle of slavery – this time from Africa to Europe and America – that would endure for almost five centuries. Initiated by the Portuguese and the Genoese in the mid-fifteenth century, the expansion of the African slave trade into Europe and the Americas lasted until the end of the nineteenth century, ending with the abolition of slavery in 1888 in Brazil, a former Portuguese colony where almost 45 percent of the current population claims African roots.

Slave trade has been present on all inhabited continents, including Africa, since pre-history. Two factors made the modern era transcontinental slave trade and indentured servitude a rather different affair: a) the volume of people kidnapped and sold, or enticed into effective slave labour as indentured labourers; and b) an amazing and unprecedented miscegenation of people and cultures. It is impossible to conceive of South, Central, or North American present cultures without the African and European contributions. Cultural convergence is perhaps the most important consequence of the European expansion, and ships were the vectors of that convergence.

THE INDIA ROUTE

The round-trip voyage between Lisbon to Goa and Cochin – known as the *Carreira da Índia* or India Route – developed during the first half of the sixteenth century. Every year around the end of March, a fleet left Lisbon for India, bringing back an important share of the Far-East trade approximately 18 months later, in September of the following year. With German and Italian financial backing, Portuguese merchants dominated this commerce unchallenged until the 1560s. A series of demographic, political, economic, and technological factors, compounded with the cultural movement known as the Counter Reformation, determined a slow decadence of the Portuguese trading networks around the world, and eventually led to the loss of the country's independence, in 1580.

The India Route started in 1500, following more than a century of maritime commerce and exploration along the western coast of Africa. In 1487, a small Portuguese fleet under the command of Bartolomeu Dias reached the Cape of Good Hope at the southern tip of Africa. A decade later in 1498, Vasco da Gama arrived at Calicut, on the Indian subcontinent, and introduced a fast and comparatively inexpensive maritime route from Europe to the Far-Eastern markets. The round trip lasted less than two years, and towards the end of the sixteenth century each Indiaman carried enough pepper to load a caravan with more than two thousand camels.

The commercial advantages of the maritime route over the land routes were obvious, and a number of important trade products converged in Lisbon, including spices, silks, fine cottons, precious stones, exotic artefacts and animals, and many other goods under the designation of "drugs", comprising a large array of rare Asian and African products, from dye woods to perfumes. From 1500 onwards, the maritime route to India became a regular path for Portuguese ships. During the first decade of the sixteenth century, the Portuguese crown designed and implemented a ruthless plan to establish its commercial interests in the Persian Gulf, annihilate Ottoman power, and control the spice trade into Europe. Fortresses, strongholds and commercial factories were built along the eastern coast of Africa, in the Gulf, and in India, and naval fleets were permanently deployed (Pissarra 2001).

Shortly before the middle of the century, Portuguese ships sailed regularly to Japan, and ten years later the Portuguese established a factory in Macao. Considering that the population of Portugal hovered around one million people, Portuguese commercial expansion was fast and effective. The importance of oceangoing ships in the 16th century cannot be understated. As Magalhões Godinho wrote, before the end of the century Portuguese soldiers, merchants, and adventurers could be found throughout Asia, married to local women, living in the Moluccas, Timor, Bengal and Pegu. Some served under the Great Mogul, others visited Mali and Gao, the capitals of gold, or ventured along the Zambezi River, reaching Great Zimbabwe and exploring the interior of the African continent. As a direct result of the development of the India *nau* treaties were signed with several African nations, and expeditions sent out from the Angolan coast into the interior of the continent. Portuguese convents were built in Basra and Persia, and Portuguese men accompanied Venetian and Armenian merchants in the caravans that went from Basra to Tripoli and Aleppo (Godinho 1991). In South America, sugar factories populated the Brazilian coast and parties of explorers called *bandeiras* explored the jungle as far as Potosí and up the Amazon River. Spanish oceangoing ships were equally important, establishing an empire from the Mediterranean to the Molucas: Spanish ships carried silver from Acapulco to Manila, and silk and porcelain on the long and dangerous return trips from Manila to Acapulco. Every year French, Spanish and Portuguese ships dropped their fishing nets on the codfish banks of Newfoundland. Portuguese merchants carried sugar from the Atlantic Islands and Brazil to Venice, and fish to Chios and Constantinople. And Portuguese ships transported African slaves from Guinea and Angola to Brazil, and after profiting from the unification of the crowns of Portugal and Spain in 1580, to the Antilles and other Spanish ports in the New World, returning home with gold and silver (Godinho 1991).

In spite of its geographical position, in the sixteenth century Lisbon became a rich and cosmopolitan city. With a population of around one hundred thousand, it was praised for its exotic shops and rich palaces. Royal control over the Asian trade was exerted directly from the royal household, through the *Casa da Índia*, housed next to the Royal Palace, and through the adjacent shipyard – the *Ribeira das Naus*, or *Ribeira de Lisboa* – which included naval yards and a series of warehouses, a foundry, and a powder factory (Fonseca 1990). Here the king's vessels were built, rigged, and equipped by a large number of employees, organized according to their different skills and responsibilities, and supervised by a team of officials

and masters of each of the specialized trades. All of the necessary fittings for the ships, such as cables, sails, masts, and spars were stored in warehouses and maintained in good order. Guns were stored in the warehouse adjacent to the foundry, situated on the east side of the royal palace. The *Ribeira das Naus* was probably one of the largest commercial institutions in sixteenth century Europe, employing fifteen hundred men at one time (Boyajian 1993). Other shipyards were established on the Indian Continent, in Goa, Cochin, Bassein, and Daman. During the sixteenth century, Goa's shipyard was the largest in Portuguese Asia.

SHIPS

Portuguese Indiamen were described in 1575 by the Spanish author Jhoan Escalante de Mendoza as "in all stronger than any others, as it is required for their job" (Mendoza 1575). In fact, long trips require large vessels and large vessels should require sturdy structures. This is not, however, what we have observed in the archaeological record. The only Portuguese Indiamen excavated by archaeologists – the Pepper Wreck and the Oranjemund shipwreck – impress us with the lightness of their scantlings. The weight of the hull of the reconstructed Pepper Wreck – probably the *Nossa Senhora dos Mártires* from 1606 – accounts for one fourth of the ship's displacement, whereas the weight of the 1628 Swedish warship *Vasa's* hull accounts for approximately half of the displacement of the vessel. Though these ships seem to have been well engineered, we do not know much about them, as I will try to explain in the following pages.

Several types of ships sailed the India Route. Merchantmen seem to have been rigged with three masts and generally designated as *naus*. These were the work horses of the Asian trade, the small ones sometimes called *navios* or *navetas*. Two other types of ships with longer length to beam ratios were sent along with the merchantmen. These were galleons and caravels, and were likely four-masted ships. Galleons were rigged with square sails on the fore and main masts, and lateen sails on the mizzen and bonaventure masts. Caravels were rigged with square sails on the foremast and lateen sails on the main, mizzen, and bonaventure masts.

What we know about the development of these three basic ship types throughout the sixteenth century suggests the existence of a clear strategy in Lisbon, an effective system of reporting between the seamen and the shipbuilders, a progressive attitude towards innovation, and a good understanding of the tactical advantages of each type of ship – a number of galleys were shipped in the holds of *naus* from the very first decade of the sixteenth century and built in Asia for use in the war theatres.

Although ships seem to have been custom built for the India Route from the very beginning, starting with the ships of Vasco da Gama – for whom construction was supervised by Bartolomeu Dias – it is difficult to define the construction features that characterized an Iberian ship from the sixteenth and early seventeenth centuries. It is perhaps even more difficult to single out the specific characteristics of a ship built for the India Route. Ships were the result of a long conception process, which entailed many decisions regarding the financing, conceptualization, construction, and outfitting. Each ship was unique, and their shape and structure changed constantly over time. Availability of construction materials, skill and taste of the shipbuilders, as well as new information from recent voyages made their way into the ship's construction, as a drive for improvement seems to have been a constant incentive for change. In this context it is understandable how little we know about them. Before the Oranjemund Shipwreck partial excavation (Alves 2008 and 2009), only the Pepper Wreck had been excavated by archaeologists (Castro 2005a). From a list of 45 vessels, (see Table 1) so far only two have been excavated by archaeologists. In fact, very few ships from the sixteenth century have been excavated at all. Lack of interest or opportunity by archaeologists and a ruthless international market for antiquities resulted in the destruction of most Iberian shipwrecks by treasure hunters who abandoned the remains of the hulls after stripping the site of all artefacts of marketable value. Both the artefacts without high monetary value (but with significant scientific value) and the hull remains were destroyed in the process. After salvage works, all that is left are an occasional auction catalogue or a story in a glossy paper magazine, both full of unreferenced pictures and anecdotal stories that cannot be verified. Publications originating from treasure hunting ventures seldom add any information to our knowledge about the ships, their crews, their voyages, or the period to which they belong. Moreover, we only know of the shipwrecks whose artefacts are actually sold at advertised auctions. Nobody

knows how many ships have simply been erased from the archaeological record without publicity.

Because they are believed to house artefacts with market value, Iberian vessels seem to have suffered the largest share of treasure hunters' destructions, perhaps only matched by the Dutch Indiamen of the seventeenth and eighteenth centuries.

In this context, the excavation of one of four sixteenth century Basque galleons found in Red Bay, Canada and the raising of the remains of the Tudor warship *Mary Rose* in the United Kingdom greatly advanced our understanding of sixteenth century European ocean going vessels (Grenier et al. 2007; Marsden 2009). Paradoxically, these excavations have raised more questions than provided answers for the discussion: Can we define a regional type for the entire Iberian Peninsula in the sixteenth or seventeenth centuries? How different were the Iberian ships from the English, Danish, or French ocean-going ships of their time? How much did Portuguese and Spanish shipwrights change the original Mediterranean model and adapt it to the demands of the Atlantic Ocean? How different were the Spanish and the Portuguese ships? How different were the India Route ships from the average merchantmen that plied the routes of the Baltic or the Mediterranean?

All of these questions remain unanswered for the time being, although the sample of published shipwrecks from this period keeps growing. The study of the small hull remains of the Pepper Wreck has yielded information and allowed the development of a theoretical model that can be modified and completed as more archaeological information becomes available. Our understanding of the conception, construction, manning, and performance under sail of these ships has improved during the last decade. During the twentieth century historians have found, inventoried, studied, and published most of the important documents pertaining to these ships in Portugal and Spain (Domingues 2000, 13-58, and 2004; Duro 1996; Galdácano 1920; Maroto 1998; Rahn-Phillips 1987a and 1987b, 1993 and 2000).

Written sources and iconography have been studied and are available for reinterpretation in light of new archaeological discoveries. We hope that the twenty-first century will bring advancements in archaeology and yield new information that can be studied and interpreted against the documentary evidence. One day we will be able to recreate the life conditions on board these ships, model the spaces within which large and diverse crowds interacted, worked, and went about their days for months in a row, far away from the sight of land.

Many things will have to change before this can happen. Shipwrecks are almost completely unprotected worldwide. Looters, treasure hunters, dredge works, trawlers, and many other factors continuously affect the underwater cultural heritage, and archaeologists publish only a small fraction of the sites they dig, and thus destroy. In this context, nobody really knows how different the Portuguese ships of the sixteenth century were from the Spanish, English, or the French ships. Little is known of their performance, the sturdiness of their structures, the evolution of construction prices throughout the century, the operating costs (salaries, tons burden per sailor), or their durability. Wider questions, such as the role of each of these ship types in the geopolitical order, cannot be answered until we have archaeological data.

At Texas A&M University we are working on the fundamentals of ships with extensively preserved hull remains recently published – *Mary Rose*, *San Juan*, and *Vasa* – to gather data against which to test the plausibility of our reconstructions, which are often attempted from small portions of the ship's hulls, and therefore must be looked upon as educated guesses, rather than accurate reconstructions (Cederlund 2006; Grenier et al. 2007; Marsden 2009).

FLOATING CITIES

There is still much to be learned about shipboard life. Interesting areas of future research include cargo arrangements, the way in which space was managed during the voyage, as water and food were consumed and the barrels disassembled to make room for other activities, the maintenance of the armament, the appropriation of the living areas, and the daily routines during the six month long trips that never touched land. India *naus* were small floating cities, which towards the end of the sixteenth century would carry crews of 150 to 200 persons, of which approximately half were sailors and half were cabin boys. Each crew included a captain (*capitão*), who held ultimate authority over seamen and passengers; a clerk (*escrivão*), charged with the cargo and its whereabouts; a chaplain (*capelão*), to oversee religious matters; two pilots, (*piloto* and *sota-piloto*) responsible

for all matters related to navigation; and the seamen and ship's boys with their internal hierarchies. The sailors reported to the master (*mestre*) and the pilot to the boatswain (*contramestre*) and the boatswain's mate (*guardião*). The boatswain was responsible for the crew at the stern and the boatswain's mate at the bow. The auxiliary positions, such as the carpenters (*carpinteiro* e *carpinteiro sobressalente*), caulkers (*calafate* and *calafate sobressalente*), and a cooper (*tanoeiro*) were ready to fix everything that was broken. The crew was completed with a purser (*despenseiro*), who was in charge of food stores and stocks; a bailiff (*meirinho*) who took care of justice matters; a barber (*barbeiro*), charged with hair care and the blood-letting of the sick; and a constable (*condestável*) with his gunners (*bombardeiros*) and soldiers (*soldados*), who were in charge of the defence of the ship. Some officers were assisted by cabin boys or pages (*pagens*), generally charged with scrubbing and cleaning the ship, distributing meals, and cleaning up afterwards. Their numbers varied from vessel to vessel. According to Contente Domingues, the galleon *S. Bartolomeu* left for India in 1589 with 150 crewmen and 250 soldiers (Domingues 1998). Figueiredo Falcão mentions a crew of 124 people in 1607, and described their wages and benefits (Falcão 1607). On outbound voyages the number of soldiers could rise to around 50 or 60, and passengers with their servants and slaves would add perhaps another 150 people to the ship's population.

The ship was divided horizontally, having a hold and two or three decks above it. Much of the communal living took place on the weather deck, which was partially covered fore and aft with castles, the stern castle normally with two elevated pavements, and the forecastle with one. The quarterdeck, the space under the stern castle at the weather deck level, was called *tolda*, the pavement above it *alcáçova* – meaning 'castle' and generally reinforced and armed, constituting a stronghold should the ship be boarded – and the poop deck above it, *chapitéu*, which was generally not covered. In the bow, the area under the forecastle was called the *guarita* and the platform above it the *sobreguarita*. Documents suggest that the rich and powerful shared the after castle, namely the lodgings on the *tolda* and *alcáçova*, as well as the after area of the gun deck (*primeira coberta*), which was under the quarterdeck. The boxes and bales of their personal trade items which could not fit into these areas were stored near the main mast, while their livestock was stored abaft the mainmast, generally chicken and rabbits, in cages carefully piled and tied. The remaining area on the gun deck was occupied by the ship's boats, generally two, tied to a cradle under the main hatch, the smaller boat berthed inside the larger. The ship's boys would sleep on this deck in the area under the forecastle. Underneath the gun deck was the second deck (*segunda coberta*), where the lodging of the crew and soldiers was theoretically located, although on the inbound voyage they slept on the weather deck under the forecastle due to the amount of cargo brought to Portugal. To starboard and abaft the main hatch were the lodging and storage areas of the captain, master, pilot, second pilot, clerk, and purser. The corresponding area to the port side and a portion of the deck situated before these two areas were used for storage. The lodgings of the boatswain and boatswain's mate were located starboard near the bow, and those of the carpenters, caulkers, and cooper were located to port. At the bow, under the foremast, step slept the sailors and more ship's boys. The hold and the third deck, when it existed, were almost entirely occupied with cargo. On the return trip from India, holds were built on the lower deck, atop the ballast, which were carefully caulked and closed after being filled with peppercorns.

We know less about outbound voyages. Like the Oranjemund shipwreck, the Portuguese outbound ships found in Madagascar and the Seychelles – tentatively dated to the 1530s and 1589, respectively – carried unknown amounts of copper ingots, and almost certainly coins. However, since they were salvaged and looted, respectively, it is impossible to know how many and what type of ingots were found. In all three cases copper ingots with the inscribed Fugger mark were found and raised (Chiricure et al. 2010; Rosenfeld pers. comm. 2008; Blake and Green 1986). It is likely that outbound ships carried substantially more ballast than inbound ships. In the early seventeenth century complaints of large shallows created by the continuous offloading of ballast on the coastal front of Goa, India, are well known in the history of the Portuguese commercial empire (Barcellos 1898/99).

But next to nothing is known about the cargoes of the outbound ships. The study of the Oranjemund shipwreck artefacts was an important contribution to our knowledge (Chirikure et al. 2010). Inbound ships were loaded to the gunnels with merchandises from Asia. As it has been written elsewhere, in 1554 the *nau S. Bento* was not only packed solid with merchandise under the main deck, but *"brought seventy-two boxes and five*

barrels piled on the weather deck, and had such an amount of boxes and bales here that its height equalled the castles and poop deck." Sometimes the cargo would even hang outside the hull, over the channels, as occurred on the galleon *Santiago* in 1602. According to a witness, *"even outside the hull, on the bulwarks and channels, hanged bales and cabins, (…) in such a way that one could not operate the sails, and nobody could use the capstan for eighteen days"* (Castro 2005a).

STANDARDS

From the beginning of the sixteenth century, the state attempted to impose standards for stronger and more durable ships, and may have tried to extend the rules and designs in use in its Lisbon shipyards to all the shipwrights in the empire (Pissarra 2001). The systems of weights and measures were eventually unified, as the king consolidated his power throughout the country and won over the resistance of the larger feudal families. A standard for India Route ships was likely a good political instrument to implement new rules and increase the general quality of shipbuilding. Until this point, the great majority of shipyards were family businesses operating under old rules, traditions, and techniques transmitted orally through generations, and producing ships that could not always respond to the demand for strength imposed by the use of artillery.

The arduous journeys of India *naus* required much more stability and strength than the shorter North Atlantic and the Mediterranean routes. These new ships had to sail to India, where they were laden with pepper, cotton fabrics, spices, and other exotic merchandise, and then sail back to Portugal loaded with goods. In this trade, the most prized feature was space. Besides huge cargoes of spices and other Asian goods, the ships had to carry supplies for their large crews, passengers, and soldiers, spare sails, cables, anchors, masts, spars and other timbers, tools, artillery, and smaller weapons.

It is easy to understand the tendency towards increased size in the ships of the India Route, when Bartolomeu Dias' caravels were dismissed for being too small to withstand such a long trip around the Cape of Good Hope. The scarce data available suggests that the preferred tonnage for Indiamen was around 400 tons in the first quarter of the century (Costa 1997). A few *naus* have registered tonnages above that value, with 500, 600, or 700 tons, and smaller craft were sent along with the fleets, certainly with different functions, sometimes designated as *naus*, sometimes as *navios*, *navetas*, or galleons, and sometimes as *caravelas de armada* (Pissarra 2001). In the middle of the sixteenth century there was a push to increase size and a small number of ships with tonnages of 900 and even 1,000 tons were built. Perhaps larger ships were perceived to be more profitable for shipyard workers, contractors, suppliers, and merchants, who could increase their profits if the ships constructed were bigger.

The first really large India vessels did not prove advantageous, however. In spite of being highly praised, the three great galleons built in the 1550s wrecked one after the other on the east coast of Africa. First *S. João*, of 900 tons and built in 1550, was wrecked in 1552; then *S. Bento*, also of 900 tons and built in 1551, was wrecked in 1554. Finally *Garça*, rated at 1,000 tons and built in 1556, was lost in 1559. It seems that there was no consensus between the crown and the merchants as to what the ideal size of the India *naus* should be. Perhaps they grew too large before technology and experience permitted the required structural reinforcements, and legislation was issued by King Sebastian in 1571 that fixed the capacity of the ships built for the India Route between 300 and 450 tons (Costa 1997). Sebastian, the last king from the House of Avis, seems to have argued for smaller vessels for strictly financial reasons. Smaller ships were easier and cheaper to build and outfit for the voyage, easier to load, required smaller crews, and if they had to winter in Mozambique they incurred fewer expenses. There was no mention of lack of seaworthiness of the larger ships of 900 to 1,000 tons.

If Sebastian's law applied at all, however, it lasted less than a decade, because in 1580, following a manuscript he had written around 1570, Fernando Oliveira wrote in his shipbuilding treatise, *Livro da fábrica das naus*, that the best size for an India *nau* was 600 tons. The Avis dynasty fell in 1580, and the Portuguese crown was inherited, bought, and conquered by Philip II of Habsburg, who never resided in Portugal and did not show much desire to impose his will against that of the Portuguese aristocracy. Perhaps for lack of a firm policy, a period of turmoil followed in the India Route, characterized by heavy losses and a pronounced growth of the ship sizes. When *nau Madre de Deus* was surrendered to the British in 1592 by her captain, it was said to have a capacity of 1,600 tons.

It is probable that the ships of the early sixteenth century had capacities of around 400 tons, that in the middle of the century there was a drive to increase their size up to 900 tons, that in the third quarter of the century King Sebastian brought their tonnage down to around 450 tons, and that after 1580 their capacity rose above 1,000 tons. But it is impossible to say much more than this because the available data pertaining to the tonnage of ships leaving Lisbon bound for India during the period 1487-1604 represents less than 10 percent of the vessels. It does show that less than one percent of the vessels were smaller than 100 tons, 34 percent were between 100 and 300 tons, roughly 26 percent of the vessels had estimated capacities between 300 and 450 tons, and 40 percent were above 450 tons (Costa 1997). Only archaeology can help improve this image.

What did they look like? Iconography shows large fore and stern castles, large main courses (the lower sails of the main and foremasts), and almost no decoration. As the sixteenth century unfolded and the ship's capacity increased, castles were lowered and the differences in size between main and topsails diminished considerably. In the beginning of the sixteenth century iconographical sources show large main courses and small trapezoidal topsails on the main and foremasts. A century later this difference is less pronounced.

ARCHAEOLOGICAL RECORD

Few India Route shipwrecks have been found and fewer excavated or published. Extensive timber remains have been found on many sites, mostly in Nampula, Mozambique, but treasure hunters have destroyed or abandoned the hull remains to the elements after stripping the sites from artefacts with market value (Duarte 2012). The only published shipwreck of a group salvaged or surveyed by treasure hunters is known as IDM-003, and the report has virtually no value from an archaeological viewpoint. We have reliable archaeological information from only three sites: the Oranjemund and the Seychelles shipwrecks, and the Pepper Wreck.

THE ORANJEMUND SHIPWRECK

The Oranjemund shipwreck is an extremely interesting find and a unique opportunity to collect data pertaining to these ships' hulls, rigging, and cargo. There are almost no written descriptions of these vessels until the 1570s, and virtually no archaeological remains published.

Although only scant hull remains have been found thus far, there is no doubt that this shipwreck has been exposed and covered several times, and that its remains are scattered along the coast for at least 11 Km (Werz 2008). Moreover, Michael Alexander, the owner of a local supermarket at Oranjemund, was told by a former Namdeb helicopter pilot that there were remains of a wooden shipwreck with concretions several kilometres to the north of this site (Alexander pers. comm. 2008).

In any event, the finds excavated thus far are fascinating, although a site plan, sections, plans of each area with timber remains, and a timber catalogue were never published. At this stage we know that three clusters of timbers were found and excavated (Alves 2009). The first, designated St1, consisted of five sections of presumed first and second futtocks, still connected to hull planking on one side and ceiling planking on the other. The second cluster of timbers, St2, consisted of four sections of first and second futtocks connected to a shelf clamp and ceiling planking on one side, while the outer planking has been eroded on the outboard side. The third cluster of timber was not a coherent structure and has not yet been identified (Alves 2009).

Together with the timber scantlings (Table 2), one unique feature that has been seen in later texts and figures are the famous *dentes*, protrusions upon which the shelf clamps were placed. These have never been observed before in the archaeological record, the existence of which has sometimes been doubted by specialists (Alves 2009; Sousa 1590; Fernandez 1989 and 1995). The clamp featured a dovetail shaped mortise on its upper surface, likely cut to receive a deck beam. When levelled with a horizontal surface, the outer face of the clamp (butting up against the futtocks), showed an angle with the horizontal of approximately 70^{o}, giving an idea of the inclination of the futtocks at this level of the hull. If we consider the deck camber, this angle will be decreased by 2 or 3 degrees, arguing effectively, together with the lack of longitudinal fastenings between the futtocks, for its positioning at the level of the lower deck.

Scant as they are, the data pertaining to this ship's structure are tremendously important in the context of what is known about Portuguese shipbuilding in the fifteenth and sixteenth centuries. Although Portugal has a long maritime history and comprehensive research began

over a century ago, we do not know much about the way in which ships were conceived, built, and sailed. Serious archival studies started in the decade that preceded the commemoration of the 400th anniversary of the discovery of a maritime route to India by Vasco da Gama in 1498 and continued throughout the twentieth century. The body of knowledge produced is excellent but we still do not have a complete taxonomy of the ship's types and sizes, or a model for their origins and development. Archaeology has yielded an impressively small body of data, expressed in the Tables 2, 3, 4, 5, 6, and 7 below.

With our present knowledge it is impossible to establish a relationship between the dimensions of the scantlings and the capacities of the ships. For instance, the Cais do Sodré ship seems to have fairly light scantlings for its estimated keel length, while the Arade 1 vessel seems to have been heavily framed for its keel length (Castro et al. 2011). Given a larger sample selection of timber scantlings it will be possible to establish proportional relationships, such as those between the sided and moulded dimensions of the keel and frames and the ship's overall length and capacity. The ShipLAB is working on a database of dimensional relations that will hopefully help us understand and interpret ship remains such as those of the Oranjemund Shipwreck. As with the study of fragmented fossils in palaeontology, the study of small portions of ship hulls is paramount for the development of our understanding of the history of wooden shipbuilding.

Another interesting feature of the Oranjemund shipwreck site is the collection of rigging elements, which range from wooden blocks to what seems to be the top of the ship's mizzen mast. Further study will undoubtedly clarify the importance of these rigging pieces. The heart blocks found on this site have parallels with the *Mary Rose* shipwreck, dated to 1545, and the Arade 1 shipwreck, likely dating to the last quarter of the sixteenth century.

One last extremely exciting find is that of a barrel fragment. Another fragment has been found on the Aveiro A shipwreck. Barrels are tremendously important as their size directly relates to the ship's capacity and registered tonnage. The sizes of barrels were sometimes standardized in regions with intense trade relationships, as in the case of the French/Biscayne/English wine trade, or within countries, smaller regions, or even for specific trades. When it comes to attempting to understand the diversity of shapes and capacities of barrels, the confusion can be best described by the well-known story of Johannes Kepler's purchase of a number of wine barrels at Linz harbour and the way that their capacities were calculated by the salesman (Lowen 1999; Kepler 1615). In Portugal, it seems that the royal shipyards used standardized units that are fairly well-known to us. As weights and measures were always a royal matter, the advent of the modern state in the late fifteenth century brought about their standardization. In the shipyards the most important unit was the *tonelada*, the measure of capacity of every ship on which taxes and freight prices were fixed and charged. The word *tonelada* derives from *tonel*, the standard barrel with 6 *palmos de goa*, or 1 *rumo* (1.54 m) in height, and 4 *palmos de goa* (1.027 m) of *párea*, the designation in use for its maximum diameter. Each *tonel* contained two *pipas*, and each *pipa* two *quartos*. We do not know the diameters of the bases of any of these barrels, and the precise calculation of their volumes is therefore impossible. The volume occupied by each *tonel* varied between the space taken by the cylinder obtained by the expression:

$0.513^{2} \times \pi \times 1.54 = 1.275\ m^{3}$.

And the prism obtained by the expression:

$1.027^{2} \times 1.54 = 1.624\ m^{3}$.

The registered capacity of a ship was calculated by professionals with a set of arcs with the diameters of a *tonel*, a *pipa* and a *quarto*, who would determine how many *tonéis*, *pipas* and *quartos* would fit in each *rumo* of length of a ship. Tables of equivalence were used for heavier merchandise or materials that could not be stored in containers. In the early sixteenth century, 1 *tonelada* was the equivalent of 750 roof tiles, 500 sugar *formas*, 14 *quintais* of metal, or half of an animal and its food (Costa 1997).

The basic unit in use in the Portuguese shipyards was the *palmo de goa* (1 pg = 25.67 cm), which contained 7 *polegadas* (1 pol = 3.67 cm) and 14 dedos (1 d = 1.83 cm). The height of a barrel – 6 *palmos de goa* – was called *rumo* (1 r = 1.54 m), and half a *rumo* was called *goa* (1 g = 77 cm). There were also *palmos de vara* (1 pv = 22 cm), which contained each 6 *polegadas* and 12 *dedos*, and *varas* (1 v = 1.10 m), containing 5 *palmos de vara* each. Rigging measurements often refer to another unit, the *braça*, which measured 1.76 m. The study and publication of the dimensions of the barrels

found in Portuguese shipwrecks may help us substantially improve our understanding of these questions.

THE SEYCHELLES WRECK

In the 1970s, a group of 30 bronze guns was retrieved by local fishermen from the wreck site of a Portuguese vessel in Boudeuse Cay, Almirante Isles, Seychelles. In the 1990s the historian Patrick Lizé proposed a plausible identification for this site as D. João da Cunha's *Santo António*, lost in 1589 at that island. Surveyed in 1976 by Warren Blake and Jeremy Green, this wreck still contained a small portion of its bottom planking and framing in place, occupying an area of about 50 by 10 m (Blake and Green 1986). The hull planking was 9 cm thick, and the frames 17 cm sided and 18 cm molded. The planking was nailed to the frames with square iron nails. The caulking method was similar to that later found on the Pepper Wreck, or presumed *N. S. dos Mártires*, with lead straps 2.5-3cm wide and lead strings 5-6mm in diameter. The majority of the artefacts went into private collections, with a small part going to the Carnegie Museum in Victoria, Seychelles.

THE PEPPER WRECK

A small portion of an Indiaman's hull was found at São Julião da Barra, near Lisbon, in 1993. It has been tentatively identified as the *Nossa Senhora dos Mártires,* lost in 1606 after an eight-month voyage from India. The ship remains were excavated between 1996 and 2001 by Francisco Alves, director of the Portuguese agency for nautical and underwater archaeology, and myself, at the time a manager in the Portuguese ministry of culture and then a Ph.D. student at Texas A&M University. In cooperation with the Centre for Marine Technology and Engineering at the Instituto Superior Técnico, Lisbon, the Faculdade de Letras of the University of Lisbon, the Department of Visualization Sciences and the Centre for the Study of Digital Libraries at Texas A&M University, we developed a model, using the construction marks found on the surviving timbers and the known formulas for the construction of these ships, recorded in a handful of contemporary texts, contracts, and treatises on shipbuilding.

Based at the J. Richard Steffy Ship Reconstruction Laboratory in the Department of Anthropology at Texas A&M University (ShipLAB), the purpose of this reconstructed model was to create a hypothetical ship that could be used to test information gathered from other excavations or salvage operations. The plausibility of this model was analysed and refined through computer modelling. A physical model was tested in a tow tank. The second objective of this project is to use the models to identify the gaps in our knowledge of these sailing, transportation, and living machines. Thus far, we have studied the ships' conception, hull shape, construction sequence, internal space divisions, cargo distribution, rigging arrangements, intact stability, and sailing performance for a number of different cargo arrangements (Castro 2005b; Castro and Fonseca 2006; Santos et al. 2006 and 2007; Castro and Fonseca 2008; Castro 2009).

Taking into account the ship's departure from Lisbon and the six month voyage to Goa, we are now planning to analyse the ship's structural strength, develop plausible mechanisms of collapse, and test the routes described in coeval documents against what we know about the wind and current patterns in the Atlantic and Indian Oceans.

We are also working on a virtual model that may help us reconstruct the ship's interior space and understand the possible ways in which it was appropriated and used. An analysis of the environment and ventilation of the lower decks should help us understand the living conditions of people, animals, and cargo during the voyage and while in port. We are studying the composition of the crews, soldiers, and passengers, as well as the lists of victuals necessary for a six to eight month trip without reprovisioning, the cargos carried to and from Asia, the armament, and the equipment necessary to outfit a ship for such a voyage. Reconstructing life on board one of these ships is the ultimate goal of this project.

We are also attempting to determine the principles that ruled the conception of these ocean-going ships and their evolution throughout the sixteenth and early seventeenth centuries, the extent of the shipwright's knowledge, the ways in which knowledge was acquired and transmitted, and how innovation was perceived and implemented in the royal shipyards.

Another objective of this study that deserves mention is the evaluation of the ships' cost and the analysis of the economic efficiency of this portion of the Asian trade. As mentioned above, we believe that as data becomes

available in the future it will be interesting to compare these ships with other merchantmen of their time (Castro and Fonseca 2015).

CONCLUSIONS

One of the most interesting questions for the researcher at this stage is whether or not there is a unique ship type that can be identified as Portuguese, or even Iberian. Iconography suggests that Iberian ships shared similarities with their European and Mediterranean contemporaries. Three-mast, carvel-built ships do not seem very different in the Mediterranean, the Iberian Peninsula, and in the North Atlantic during the sixteenth century. There were, however, regional differences in units of measurement and in construction details.

The Portuguese ocean-going ships were different from the Catalonian ships, the Andalusian ships, and the ships built in the Basque country. Portuguese India *naus* were larger than all the other merchantmen of their time, designed for the six- to eight-month voyage to the Indian subcontinent, and this scale factor must have determined the need for specific structural features that we will certainly understand as more data from shipwrecks becomes available. The excavation, study, and publication of the Oranjemund shipwreck could be a precious contribution to this study. But a much larger body of archaeological data needs to be published if we are to understand what ranges of sizes and formats were designed and built, or bought and adapted, for the India Route.

The mere analysis of scantlings in relation to each ship's size and type is just the beginning of a much wider and deeper study, which will entail the analysis of contracts, treatises, and other texts on shipbuilding for the Portuguese India Route.

REFERENCES

ALVES, F. (2009) – *O Navio Português do Século XVI de Oranjemund, Namíbia. Relatório das missões realizadas pela equipa portuguesa em 2008 e 2009*. Trabalhos da DANS, 45. Lisboa: IGESPAR.

ALVES, F. and ALELUIA, M. (2008) – *Oranjemund Shipwreck Phase II field notes*, unpubl. field notes, Oranjemund.

ALVES, F., RIETH, E., and RODRIGUES, P. (2001) – The remains of a 14th century shipwreck at Corpo Santo, and of a shipyard at Praça do Município, Lisbon, Portugal. In Francisco Alves (ed.), *Proceedings of the International Symposium Archaeology of Medieval and Modern Ships of Iberian-Atlantic Tradition*, Instituto Português de Arqueologia, Lisbon.

ALVES, F., RIETH, E., RODRIGUES, P., ALELUIA, M., RODRIGO, R., and GARCIA, C. (2001) – The Hull Remains of Ria de Aveiro A, a Mid-15th Century Shipwreck from Portugal: a Preliminary Analysis. In Francisco Alves (ed.), *Proceedings of the International Symposium Archaeology of Medieval and Modern Ships of Iberian-Atlantic Tradition*, Instituto Português de Arqueologia, Lisbon.

ALVES, F., RODRIGUES, P., ALELUIA, M., RODRIGO, R., GARCIA, C., RIETH, E., and RICCARDI, E. (2001) – Ria de Aveiro A: a Shipwreck from Portugal Dating to the Mid-15th Century; a Preliminary Report. *International Journal of Nautical Archaeology* 30:1 12–36.

AMARAL, M. E. (1735) – Tratado das batalhas e sucessos do galeão Santiago. In Brito, B. G. de, *História Trágico-Marítima*, 2 vols, Oficina da Congregação do Oratorio, 1735/1736, Lisboa.

BARCELOS, C. S. (1898-1899) – Construcções de Naus em Lisboa e Goa para a Carreira da India no Começo do Século XVII. *Boletim da Sociedade de Geographia de Lisboa* 17:1.

BLAKE, W. and GREEN, J. (1986) – A mid-XVI century Portuguese wreck found in the Seychelles, *International Journal of Nautical Archaeology* 15.1:1-23.

BOYAJIAN, J. C. (1993) – *Portuguese Trade in Asia under the Habsburgs*, 1580-1640, John Hopkins University Press, London.

CASTRO, F. (2005a) – *The Pepper Wreck: A Portuguese Indiaman at the Mouth of the Tagus River*, Texas A&M University Press, College Station.

CASTRO, F. (2005b) – Rigging the Pepper Wreck. Part I: Masts and Yards. *International Journal of Nautical Archaeology* 34.1: 112-124.

CASTRO, F. (2006) – The Arade 1 shipwreck. A small ship at the mouth of the Arade River, Portugal. In Lucy Blue, Frederick Hocker, and Anton Englert (eds.), *Connected by the Sea. Proceedings of the 10th Symposium on Boat and Ship Archaeology*, Roskilde 2003 (ISBSA 10), Oxbow Books, Oxford: 300-305.

CASTRO, F. (2009) – Rigging the Pepper Wreck. Part II: Sails. *International Journal of Nautical Archaeology* 38.1: 105-115.

CASTRO, F. and FONSECA, N. (2006) – Sailing the Pepper Wreck: A Proposed Methodology to Understand an Early 17th-Century Portuguese Indiamen. *International Journal of Nautical Archaeology* 35.1: 97-103.

CASTRO, F. and FONSECA, N. (2008) – A bordo de uma nau da Índia, in Manuel Gracia Rivas (ed.), Actas de la 13.º Reunión Internacional de Historia de la Nautica y de la Hidrografía. *Cuadernos de Estudios Borjanos*, Centro de Estudios Borjanos, Borja: 50-51, 199-235.

CASTRO, F., and FONSECA, N. (2015) – The Pepper Wreck as a Case Study for the Portuguese India Route Ships, in Tripati, S., ed., *Shipwrecks around the World: Revelations of the Past*. New Delhi: Delta Book World, 2015.

CASTRO, F., YAMAFUNE, K., EGINTON, C., and DERRYBERRY, T. (2011) – The Cais do Sodré Shipwreck, in *International Journal of Nautical Archaeology* 40.2: 328-343.

CEDERLUND, C. O. (2006) – *Vasa I: The Archaeology of a Swedish Royal Ship of 1628*, Statens Maritima Museer, Stockholm.

CHIRIKURE, S., SINAMAI, A., GOAGOSES, E., MUBUSISI, M., and NODORO, W., (2010) – Maritime Archaeology and Trans-Oceanic Trade: A Case Study of the Oranjemund Shipwreck Cargo, Namibia, *Journal of Maritime Archaeology* 5:37-55.

COSTA, L. F. (1997) – *Naus e Galeões na Ribeira de Lisboa*, Patrimónia, Cascais.

DOMINGUES, F. C. (2000) – *Os Navios da Expansão*, Dissertação de Doutoramento em Historia da Expansão Portuguesa apresentada à Faculdade de Letras da Universidade de Lisboa, Faculdade de Letras da Universidade de Lisboa, Lisboa.

DOMINGUES, F. C. (2004) – *Os Navios do Mar Oceano*, Centro de História dos Descobrimentos, Lisboa.

DUARTE, R. T., (2012) – Maritime History in Mozambique and East Africa: The Urgent Need for the Proper Study and Preservation of Endangered Underwater Cultural Heritage, *Journal of Maritime Archaeology* 7.1: 63-86.

DURO, C. F. (1996) – *Disquisiciones Nauticas* (1880), Instituto de Historia y Cultura Naval, Madrid.

FALCÃO, L. F. (1859) – *Livro em que se Contem toda a Fazenda e Real Patrimonio dos Reinos de Portugal, India, e Ilhas Adjacentes e outras Particularidades*, ordenado por Luiz de Figueiredo Falcao, secretario de el rei Filippe II (1607), Imprensa Nacional, Lisboa.

FERNÁNDEZ-ARMESTO, F. (2006) – *Pathfinders: a Global History of Exploration*, Oxford University Press, Oxford.

FERNANDEZ, M. (1989) – *Livro de Traças de Carpintaria*, 1616 (Fac-simile), Academia de Marinha, Lisboa.

FERNANDEZ, M. (1995) – *Translation of Livro de Traças de Carpintaria*, Academia de Marinha, Lisboa.

FONSECA, H. A. (1990) – *Os Estaleiros da Ribeira da Nau*, Academia de Marinha, Lisboa.

GALDÁCANO, G. de A. (1920) – *La Arquitectura Naval Española* (en Madera), Ed. del Autor, Madrid.

GODINHO, V. M. (1991) – *Os Descobrimentos e Economia Mundial* vol. 1, Presença, Lisboa.

GRENIER, R., WILLIS S., and BERNIER, M.-A. (2007) (eds). – *The Underwater Archaeology of Red Bay: Basque Shipbuilding and Whaling in the 16th Century*, Government Depository Service Program, Ottawa.

KEPLER, J. (1615) – *Nova Stereometria Doliorum Vinariorum*, Joannes Plancus, Linz.

LEVENSON, J. A. (2007) – *Encompassing the Globe: Portugal and the World in the 16th and 17th centuries*, Arthur M. Sackler Gallery, Smithsonian Institution, Washington DC.

LOUREIRO, V. and ALVES, J. G. (2008) – The Arade 1 Shipwreck: Preliminary Results of the 2004 and 2005 Field Seasons. *International Journal of Nautical Archaeology* 37.2: 273–82.

LOWEN, B. (1999) – *Les Barriques de Red Bay et l'Espace Atlantique Septentrional, vers 1565*. PhD Diss., Universidade Laval, Québec.

MAROTO, M. I. V. (1998) – *Diálogo entre un Vizcayno y un Montañez sobre la Fábrica de Navíos*, Ediciones Universidad de Salamanca, Salamanca.

MARSDEN, P. (2003) – *Sealed by Time. The Loss and Recovery of the Mary Rose*, The Mary Rose Trust, Portsmouth.

MARSDEN, P. (2009) – *Mary Rose: Your Noblest Shippe: Anatomy of a Tudor Warship*, The Mary Rose Trust, Portsmouth.

MENDOZA, J. E. (1996) – Itinerario de Navegacion de los Mares y Tierras Occidentales (1575), transcrito por Cesário Fernandez Duro, *Disquisiciones Nauticas*, Vol. 5 (1880), Ed. Instituto de Historia y Cultura Naval, Madrid.

MIRABAL, A., (2013) – *The Excavation of the Nossa Senhora Da Consolação* (1608). Report Published by Arqueonautas Worldwide SA.

PISSARRA, J. V. (2001) – *A Armada da Índia. Computo, Tipologia e Funcionalidade das Armadas de Guerra Portuguesas no Oriente (1501-1510)*, Dissertação de Mestrado em História dos Descobrimentos, Faculdade de Letras da Universidade de Lisboa, Lisboa.

RAHN-PHILLIPS, C. (1987a) – *Life at Sea in the Sixteenth Century: The Landlubber's Lament of Eugenio de Salazar*. The James Ford Bell Lectures 24 (1987a), University of Minnesota.

RAHN-PHILLIPS, C. (1987b) – Spanish Ship Measurements Reconsidered. The Instruccion nautica of Diego Garcia de Palacio. The *Mariner's Mirror* 73.2: 293-296.

RAHN-PHILLIPS, C. (1993) – The Evolution of Spanish Ship Design from the Fifteenth to the Eighteenth Century. *American Neptune* 53.4: 229-238.

RAHN-PHILLIPS, C. (2000) – Manuel Fernandes and his 1818 Livro de Traças de Carpintaria. *American Neptune* 60.1:7-29.

RODRIGUES, P., ALVES, F., RIETH, E., and CASTRO, F. (2003) – L'épave d'un navire de la deuxième moitié du XVème siècle / début du XVIème, trouvé au Cais do Sodré (Lisbonne). Note préliminaire. In Fancisco Alves (ed.), *Proceedings of the International Symposium Archaeology of Medieval and Modern Ships of Iberian-Atlantic Tradition*, Lisbon.

SANTOS, T., FONSECA, N., and CASTRO, F., (2006) – Stability characteristics of an early XVII century Portuguese Nau. In Marcelo Neves (ed.), *Proceedings of the 9th International Conference on Stability of Ships and Ocean Vehicles (STAB 2006)*, Rio de Janeiro, Brazil: 69-80.

SANTOS, T., FONSECA, N., and CASTRO, F., (2007) – Naval Architecture Applied to the Reconstruction of an Early XVII Century Portuguese Nau. *Marine Technology* 44.4: 254-267.

WERZ, B. (2009) – The Oranjemund shipwreck, Namibia. The excavation of sub-Saharan Africa's oldest discovered wreck. *Journal of Namibian Studies* 6: 81 – 106.

WERZ, B. (2008) – *The Oranjemund Shipwreck Project Phase 2 Excavation Report*. Cape Town.

ZINN, H. (1980) – *A People's History of the United States: 1492-Present*, Harper Collins, New York.

Shipwreck	Date Lost	Location - Country	Found	Status
ANG-004 - *Sto. António*?	1512?	Mozambique, Baixo de Santo António	November 1st, 2003 by Arqueonautas SA.	Surveyed
Etoile Shipwreck	c. 1530	Madagascar	By 4 French divers	Looted
Oranjemund Shipwreck	c. 1530	Namibia, Mouth of the Orange River	By Kaapanda Shatika, from Namdeb	Excavated
S. João	1552	South Africa, Near Port Edward, Natal	1980 by L. Harris, and in 1983, by J. R. Wood and E. Roest	Salvaged and repeatedly looted
S. Bento	1554	South Africa	1967 by a sport diver	Salvaged 1968
NAC-003	1547-1678	Mozambique	By Arqueonautas SA.	Surveyed
NAC-005	1547-1678	Mozambique	By Arqueonautas SA.	Surveyed
ANG-003	1560-1620	Mozambique, Nampula, Ilha da Caldeira	By Arqueonautas SA.	Surveyed
IDM-001	1560-1620	Mozambique	By Arqueonautas SA.	Surveyed
IDM-002 - Fort San Sebastian Wreck	1560-1620	Mozambique	By Arqueonautas SA.	Salvaged
IDM-006	1560-1620	Mozambique	By Arqueonautas SA.	Surveyed
IDM-012	1560-1620	Mozambique	By Arqueonautas SA.	Surveyed
IDM-013	1560-1620	Mozambique	By Arqueonautas SA.	Surveyed
IDM-014	1560-1620	Mozambique	By Arqueonautas SA.	Surveyed
Santiago	1585	B. da India Atoll	In December 1977 by Ernest Erich Klaar	Salvaged
Stº António?	1589?	Seychelles, Boudeuse Cay	In 1970 by local fishermen	Looted. Surveyed in 1976
Sto. Alberto?	1593?	South Africa, Sunrise on Sea	No information	Surveyed
Cochin Shipwreck	c. 1580	India	No information	Looted?
Wan-Li Shipwreck (possibly a junk)	c. 1600	Malaysia	No information	Salvaged
Nossa Senhora dos Mártires	1606	Portugal, São Julião da Barra	In the 1980s by Carlos Martins	Looted. Excavated in 1996-2001
S. Salvador ?	1606?	Malaysia	No information	Looted? No information
Galeão of Duarte Guerra?	1606?	Malaysia	No information	Looted? No information
Espiritu Santo?	1608?	South Africa, between Double Mouth and Haga Haga	No information	Surveyed
IDM-003 - *N. S. Consolação?*	1608?	Mozambique	By Arqueonautas SA	Salvaged
Madre de Deus	1610	Japan	No information	Destroyed by dredge works
Nossa Senhora da Luz	1615	Azores, Porto Pim, Faial	In 1999 by Paulo Monteiro and a team from CNANS / DRAC	Surveyed
CAD-001 - *N. S. Pópulo?*	1619?	Mozambique	No information	Surveyed
Nossa Senhora da Conceição?	1621?	Portugal, North of Ericeira	By Mário Jorge Almeida and Patrick Lizé	No information
S. João Baptista ?	1622?	South Africa, Cannon Rocks	No information	Surveyed?
MOG-003 - *São Joseph*?	1622?	Mozambique	By Arqueonautas SA.	Salvaged?
IDM-017 - *Santa Teresa*?	1622?	Mozambique	By Arqueonautas SA.	Salvaged?
S. Bartolomeu	1626	France	No information	No information
Sta. Helena	1626	France	No information	No information
S. Gonçalo	1631	South Africa, Plettemberg Bay	No information	Survivor's camp excavated
Sto. Inácio de Loyola?	1632?	Portugal, Tagus River	Just a few guns, never	Looted

			really associated with the name	
Sta. Catarina de Ribamar	1635	Portugal, Cabo da Roca	In the 1970s by António Gil	Looted
Santa Maria Madre de Deus?	1643?	South Africa, Bonza Bay	Porcelain shards found in the 1960's by Capel Baines. In October 1993 a wooden structure washed ashore on the Bonza Bay beach	Surveyed?
Santíssimo Sacramento	1647	South Africa	By sport divers	Salvaged
N.ª S.ª da Atalaia do Pinheiro	1647	South Africa	No information	Survivor's camp excavated
Sunchi Shipwreck	c. 1650	India	By archaeologist Sila Tripati	Excavated
IDM-004	c. 1650	Mozambique	By Arqueonautas SA.	Surveyed
IDM-005	c. 1650	Mozambique	By Arqueonautas SA.	Surveyed
IDM-007 (possibly more than one shipwreck)	c. 1650	Mozambique	By Arqueonautas SA.	Surveyed
IDM-008	c. 1650	Mozambique	By Arqueonautas SA.	Surveyed
IDM-018	c. 1650	Mozambique	By Arqueonautas SA.	Surveyed
MOG-002	c. 1650	Mozambique	By Arqueonautas SA.	Surveyed

Table 1. Presumed Portuguese Indiamen Shipwrecks.

Designation	**Sided Dimension [cm]**	**Moulded Dimension [cm]**	**Area [cm^2]**	**Moment of Inertia b.h3/12 (cm^4]**	**Wood Species**
Keel*	11	13	143	2,014	*Quercus suber*
Sternpost*	11	13	143	2,014	*Quercus suber*
Stern Knee	11	12	132	1,584	*Quercus rotundifolia*
Floor Timbers**	12	16/12	144	1,728	*Quercus suber* & *Q. pyrenaica*
Room and Space	32	-	-	-	-
Planking	30-37	4.3	-	-	*Quercus suber*

Table 2. Timber Scantlings: Corpo Santo (c. 1400). *In fact, the keel and sternpost portions of the stern heel. ** Y-frames have higher molded dimensions than normal frames.

Designation	**Sided Dimension [cm]**	**Moulded Dimension [cm]**	**Area [cm^2]**	**Moment of Inertia b.h3/12 (cm^4]**	**Wood Species**
Keel	12-14	12	156	1,872	*Quercus sp.*
Stern heel	12-14	12	156	1,872	*Quercus sp.*
Stern knee	?	?	-	-	*Quercus sp.*
Keelson	13	12.5	163	2,116	*Quercus sp.*
Floor Timbers	12	12.5	150	1,953	*Quercus sp.*
1st Futtocks	12	12	144	1,728	*Quercus sp.*
Room and Space	30-35	-	-	-	-
Stringers	24-30	5-6	196	800	*Quercus sp.*
Planking	20-33	5-5.5	-	-	*Quercus sp.*

Table 3. Timber Scantlings: Aveiro A (c. 1450). Reconstructed Keel Length 8 *Rumos* (12.32 m).

Designation	Sided Dimension [cm]	Moulded Dimension [cm]	Area [cm^2]	Moment of Inertia b.h3/12 (cm^4]	Wood Species
Keel	25	30	750	56,250	*Quercus sp.*
Keelson	27	26	702	39,546	*Quercus sp.*
Apron	22.5	15	338	6,328	*Quercus sp.*
Breast hook	13-23	25-29	-	-	*Quercus sp.*
Floor Timbers	22-24	20	460	15,333	*Quercus sp.*
1st Futtocks	22-23	20	450	15,000	*Quercus sp*
Room and Space	40	-	-	-	-
Stringers	18	17	306	7,370	*Quercus sp.*
Ceiling	20-25	4-5	-	-	*Pinus pinea* & *P. sylvestris*
Planking	20-50	7-8	-	-	*Quercus sp.*
Whipstaff	Ø = 8	-	-	-	*Crataegus monogyna*

Table 4. Timber Scantlings: Cais do Sodré (c. 1500). Reconstructed Keel Length 18 *Rumos* (27.72 m).

Designation	Sided Dimension [cm]	Moulded Dimension [cm]	Area [cm^2]	Moment of Inertia b.h3/12 (cm^4]	Wood Species
1st and 2nd Futtocks	16-23	18	351	9,477	Oak?
Room and Space	c. 47*	-	-	-	-
Clamp	c. 20	35	700	71,458	?
Planking	16.5-25.5	9	-	-	?
Ceiling	?	1.8	-	-	Pine?

Table 5. Timber Scantlings: Oranjemund Shipwreck (Bom Jesus, 1533?). *Measured in the corrected drawing (Alves 2009: 60).

Designation	Sided Dimension [cm]	Moulded Dimension [cm]	Area [cm^2]	Moment of Inertia b.h3/12 (cm^4]	Wood Species
Futtocks?	17	18	306	8,262	-
Room and Space	36	-	-	-	-
Planking	-	9	-	-	*Larix sp.*?

Table 6. Timber Scantlings: Seychelles Shipwreck (*Santo António*, 1589?).

Designation	Sided Dimension [cm]	Moulded Dimension [cm]	Area [cm^2]	Moment of Inertia b.h3/12 (cm^4]	Wood Species
Keel	25	40	1,000	133,333	*Quercus suber*
Apron	38	25	950	49,479	*Quercus suber*
Floor Timbers	23-25	23-24	564	25,956	*Quercus suber*
1st Futtocks	21-25	23-24	541	24,874	*Quercus suber*
2nd Futtock	24	24	576	27648	*Quercus suber*
Room and Space	c. 47.5	-	-	-	-
Planking	15-35	11	-	-	*Pinus pinea*

Table 7. Timber Scantlings: Pepper Wreck (*Nossa Senhora dos Mártires*, 1606?). Reconstructed Keel Length 18 *Rumos* (27.72 m).

FOREST MANAGEMENT ON PORTUGAL DURING EARLY MODERN AGES – ANALYSIS OF HISTORICAL DOCUMENTS BELONGING TO THE KINGDOM OF D. MANUEL I (15TH AND 16TH CENTURIES)

António Rocha Santos
IAP/FCSH-UNL

SUMMARY

The following article aims to explore the thematic of forest management on Portugal during the late 15th century and early 16th. It consists on the analysis of documents belonging to the kingdom of D. Manuel I regarding forested areas and how it can be associated with the shipbuilding process from the given period. The great majority of those documents consist on requests, prohibitions, complaints and issues regarding wood, timber and trees. These documents do not necessarily associate the observed resource with shipbuilding. They are mostly associated with daily needs, necessities and other activities depending on wooden resources, such as the construction of domestic areas, wineries and industries as glass and coal.

The main parameters observed on this essay are: fire ('queimadas'), firewood, trees and timber.

METHODOLOGY

When we approach the research topic 'Iberian ships of Early Modern Age' we immediately understand that the documental sources of information are of difficult access and scarce, when considering the Portuguese case. Unfortunate past events have certainly contributed to a loss of unique and irreplaceable data. Consequently, the number of documents considered relevant to our research topic is still much reduced.

Nevertheless, some documents have been recovered and published on a way that even the public in general can access.

For our investigation, the research criteria embraces the following topics: 'madeira' (timber, wood), 'lenha' (firewood), 'matas' (woodlands), 'floresta' (forests), 'árvores' (trees), 'século XVI' (16th century), Portugal, 'construção naval' (shipbuilding), 'estaleiros navais/ribeiras' (dockyards), 'marinha' (navy), 'queimadas/fogos' (fires), 'carpinteiros' (carpenters), 'caravelas' (caravels), 'naus' (naos), 'galeões' (galleons) and 'navios e barcos' (ships and boats).

During a previous written essay, a dislocation to the 'Arquivo Historico Ultramarino' - Overseas Historical Archive - was conducted. After consulting all the section entitled 'Reino' - Kingdom – we identified six boxes possessing documents belonging to the given period of study. From those six boxes a total of six scarce documents were located. And none of them approach our research criteria.

Therefore, we opted for this moment to focus on already recovered and published documents. We would like to distinguish the 'Cortes Portuguesas, Reinado de D. Manuel I (Cortes de 1498)' - Portuguese Courts, Kingdom of D. Manuel I (Courts of 1498) – as the main reference consulted for this essay.

INTRODUCTION

The present work derives from the main research project under development entitled 'Forest resources and Ships for Iberian Empires: ecology and globalization in the Age of Discovery'.

This project is divided on different chapters of research, being ours the '16th century shipbuilding in Portuguese dockyards: a historical and archaeological perspective'.

If we start thinking on what it consists, the first parameters that come to our minds are: Portuguese ships

of early modern ages; caravels, naos and galleons; oceanic exploration; contact with different cultures, and so on. However, that is not what it is expected from this research. Our focus will take a different perspective that will stress pertinent questions regarding the construction supply of those ships.

Therefore, we would like, before anything else, to underline the adopted perspective by this researcher when looking at a ship. For us, and during the given period of study, a ship consists on: a merchant and/or military wooden object, composed by a central cargo storage area, with two defensive structures defined as castles (one at the bow and another at stern of the ship), carrying broadside, frontal and backwards artillery, sailed and maneuvered by a crew, loaded with provisions, meant to cross seas and oceans, moved by tides and winds, with the objective of locating overseas territories and consequently establishing trade routes.

But, how were these ships built? By who? With which objective? With which timber? Where were they built? Did Portugal possess enough timber on its territory to maintain a constant process of construction? Or did Portugal intensify trade with other European countries objectively importing timber destined to shipbuilding? How did Portugal handle the fact that wood was necessary for any given activity at the time? Did it favour shipbuilding while comparing with other activities? On a very straightforward remark, the questions are vast and not ending here.

By the complexity exposed, and has it is stated on our chapter of study, this research will analyse and compare both historical and archaeological data. At the moment, let us focus on the historical data for now.

ANALYSIS OF HISTORICAL DOCUMENTS BELONGING TO THE KINGDOM OF D. MANUEL I

Before we pass to the analysis of relevant documents found, let us first make a reference to the territory administration of Portugal regarding its '*matas y coutada*' (forested areas and woodlands). These areas were mostly private. They belonged to monasteries, nobles or even the king and his family, as the *coutadas*. Their access was limited if not restrict, it required authorizations of access and these authorizations would vary according with intentions and only issued by their guards or the King himself. On these private areas we would like to underline the existence of the previously mentioned *coutadas*. What are these *coutadas*? From what we understand, they consist on private and protected forested areas, with restrict access where hunting activity is forbidden (except for the owners) and administered by a '*couteiro*', its guard. We also find '*montado*'" that seem to correspond to hunting areas (sometimes possessing cork trees or holmoak trees) where cattle could graze after paying for its access to its guard, the '*monteiro*'.

Passing now to the appreciation of the documents from the mentioned source, the Portuguese Courts, it consists on a compilation of several historical documents consisting mostly on requests, complaints, authorizations and prohibitions.

The first topic we shall observe is one of the most destructive processes and at the same time a constant in our human heritage: fire of 'queimada' (queimada is an agricultural practise that consists on clearing a field with fire with the objective of later planting or kettle usage). We found nine documents regarding this problematic, considering two of them important for this matter. These documents (fl. 149v.º in cap.º 79.º, page 105 and 106 and fl. 71v.º in cap.º 38.º, page 213) consist on two complains from the people to its masters about non-licensed fires that damage their wineries, olive groves, bee hives between others *('...vosso pouoo Reçebe muyto dampno pellos fogos que ssom postos pella terra … que danefica muyto a terra de vinhas paaes vliuaes matos colmeaes...'),* defending that the periods for fires should continue to be respected, that those fires should be previously required and demanding that those who not respect that period, receive a fine and compensate those who suffer injuries on their economic activities *('...que o fez sem pera ello teer liçença das camaras como se senpre custumou e estaa por rregimento que des o primeiro dia de mayo atee xb de nouenbro nam ponham o dicto fogo sem a dicta liçença onde se daa fiança que fazendo algu dampno se pagar pella dicta fiança...').*

After careful consideration seems necessary to raise the possibility of fires being a constant throughout Europe, during early modern ages, affecting not only activities as previously stated, but also forests, woodlands, domestic spaces and sometimes, cities. Clearly some fires could be controlled and handled before greater damage, but fires with bigger proportions on forested areas or in proximity with woodlands seems to

be hardly controllable during our period of research and therefore, its destruction clearly greater.

As a second topic of observation we would like to underline the firewood. Firewood would be vital on Europe during winter seasons. Surviving a winter on northern Europe five centuries ago, with the given domestic conditions, imaginable poor dressing and without firewood could offer quite a life challenge. Portugal, as a country in contact with the Atlantic Ocean throughout all its west coast, would also present low temperatures during certain periods of the year and therefore, firewood would also be a must. We found nine documents regarding firewood. Four of them were taken under consideration. One of those (fl. 1v.º in cap.º 4.º, page 340) consists on a complaint and a request from the habitants of Alandroal to their king, regarding the authorization given to the habitants of Olivença to pick firewood and timber on Alandroal ('*...Vosa alteza teem dado huua Carta aos de olyuemça que posam leuar deste termo llenha e madeira <verde>...')*. They request for their woodlands to be protected, since that is their only life-source while stating that Olivenza possesses better lands than Alandroal *('...este Conçelho Recebe gramde agrauo e perda E a Rezam porque olyvemça teem muy booas terras de pam … o que esta Vvilla de lamdroall nom tem que as terras de pam som muy fracas e poucas...nom temos pera ssoportamento de nosas vidas … Pedimos a vosa alteza que aja por bem, de nos mamdar guardar nosso mato...').* Another of those documents (fl. 1v.º in cap.º 5.º, page 341) consists on a refusal by Alandroal to consider two close regions, Borba e Estremoz, as "neighbouring ones", that require areas to kettle graze and picking firewood. The villa cannot carry such demand and apparently as well due to past disagreements ('*...Nos he dito que borba e estremoz Requerem a vosa alteza que os faça nossos vezinhos em que nos paes pera pastar e cortar mato, e leuar llenha … que hos nom façaajs nossos vezinhos e que cada huu guarde seu termo porque esta villa nom o pode comportar E … porquanto nas guerras passadas os da ujlla e seu termo a guardarom e defenderom...').* A third one (fl. 7v.º in cap.º 28.º, page 392 and 393) consists on a request, if not a cry for help, from the people of a Elvas that only find firewood on surrounding areas but the lords remove them the instruments to cut wood. They stress how hard is to cross the month of January without firewood and request some authorization to cut it, underlining that they do not intend to cut the trees by their roots *('...nom podemos auer lenha senam nas defesas que sam mujtas e por esta terra ser muj frja de Inuerno nom … teemos domde a trazer saluo das dictas defesas e os senhorios dellas nos acoimam nossos moços e lhes tomam os machados … o que he grande opressam mayormente no tempo de Inuerno. Pedimos a uossa alteza que nos dee lugar que … possamos fazer lenha nom cortando aruores pello pee saaluo decotando e leixamdo rramo rresaluado...').* The last document regarding firewood is a Royal letter issued by King D. Manuel I to the people of Setúbal (page 511) authorizing them to extract firewood from the woodlands of Arrábida without any obstacle *('Dom manuell … fazemos saber que .. nos foy Requirido e pidido … Soltar as matas d arrabida ... porquamto ha dita villa nom tinha outra parte de que se podese prouer e mamter de llenha … Temos por bem e queremos e nos praz que has dictas matas lhe sejam pera ello Soltas e descoutadas...').*

What we understand, after analysing these documents, is how important, if not vital, was to guarantee an access to forests and woodlands objectively to extract firewood. Cities as Lisbon in the 16th century would already have fixed prices and locations to obtain firewood, but the same could not be said from regions more distant from main city centres. This important resource could give origin to conflict, dispute or rupture of relations. Regarding our research topic, we can understand that, independently of Portugal requiring a growing amount of timber for shipbuilding to maintain and expand the empire, the vital necessities of different regions would demand a constant amount of wood for basic needs, as it was heating during winter seasons. A special remark to the document where local habitants commit to not cut trees by their roots. It was possible to remove timber from a tree without killing it, while allowing at the same time the tree to regenerate. And if we compare these results with data already published, regarding the population growth that Portugal crosses along the 16th century, we can presume that firewood needs were proportional to this increase of population (in 1527 Portugal would present between 1,1 to 1,4 million habitants (Reboredo & Pais, 2012 p. 33)).

Let us turn our attentions now to the third topic: trees. Thirteen documents were located. We shall once again observe four of them. The first and second documents (fl. 26v. º in cap. º 52. º, page 280 and fl. 11v. º, page 325) consist on other complaints, but regarding woodlands close to glass industry. The

documents mention damage on trees close to these industries and defend that no single tree should be taken down to produce glass. Those who persist on this activity should be limited to obtain branches and paying a fee of two thousand 'reais' (currency at the time) for each tree taken down *('...pello gramde dano que se ssegue aas matas e matos na terra homde lauram fornos de vidros por sse queimarem muy conthijnuadamente as Matas e Matos das comarcas d aRedor … defemdemos e mandamos que aqueles que laurem os ditos vidros … nam Corteem nenhuua aruore per pee pera fazerem seu vidros nem a esmochem, ssoomente poderam dellas tirar allguus Ramos … so penna de pagarem dous mjll reaes por cada aruore que cortarem ou esmocharem.').* The third document (cap.º 8.º, page 342) consists on, if permitted, a declaration of incapacity by a villa, for being incapable of planting the demanded annual trees (we shall explain this parameter when we conclude all documents regarding trees), due to their soils being extremely dry and inappropriate for tree plantation *('...Sennhor vosa hordonamça he que todos ponham aruores neestes primeiros quatro annos … esta villa … he terra sequa que o nom pode soportar … de maneira que hy nom ha terra onde sse possam poes que a terra nom seja mujto sequa E mujto comtrarya aa nosa criaçom...').* The fourth document (fl. 1v.º in cap.º 2.º, page 558). Consists on an reminder from the habitants of Vila Viçosa regarding the demanded planted trees by the king. They state that Vila Viçosa is one of the most forested areas of the country and they have no free land for the king's demands. The royal demands consisted on each habitant planting on his fields forty trees during a period of four years with the risk of having to pay a fee of fifty "reais" for each non planted tree ('...*a dicta ujlla de ujlla ujçosa he hu dos luguares de uosos rregnos de majs hortas e aruoredos e que nom ha nenhu lugar … pera poer aruores … ora uosa alteza manda que quada hu morador da dicta ujlla ponha dez aruores … e esto quatro annos que sam quarenta aruores so pena de pagarem çinquoenta rreaes per cada hua aruore que nom derem presa … per que pedimos a uosa alteza que asy per a dicta uilla seer de mujtos aruoredos … nos aja per rreleuados do dicto mandado...').*

These documents are richer than any of the previously mentioned before. They give us the perception of how timber was a necessity for multiple activities, as the glass (or as we will find later, coal) industries, how these activities would rivalry by the access to wood and how damaging or cutting trees without previous license could conduct to costly fees (two thousand "eais for each tree taken down). They also give us the perception of a very important measurement developed by king D. Manuel I. This monarch was probably the first king in Portugal to understand that it was necessary to plant trees for the coming years. His attempt was not well succeeded. The program, in our opinion, was well intended but not planed on its best way since this demand reached areas with no conditions for planting, areas already forested and in some cases, did not reach the intended regions. From D. João III, the monarch that succeeded D. Manuel I in 1521, we did not find so far any similar policy regarding trees plantation. In the year of 1565 the young King D. Sebastião decrees the 'Lei das Árvores' (Law of Trees) – let there be planted trees for naos; *Pinus, Quercus* and *Castanea* as stated by the researchers Fernando Roboredo and João Pais (in '*A carpintaria naval e a destruição do coberto florestal em Portugal do século XII ao século XX*' in Revista On-line da Sociedade Portuguesa de Ecologia, 2012, nº4, p. 37). These last sentences raise a possibility: in the beginning of the 16th century, D. Manuel I understands the necessity of replanting trees. His actions demonstrate awareness of wood necessity. Later, with D. João III, we do not find this same preoccupation. To find a similar policy we have to wait for the year 1565 with D. Sebastião and his Law of Trees. So, between D. Manuel I and D. Sebastião how D. João III did manage forested areas? Did he intensify trade with other European countries objectively to bring timber to Portugal even though during his kingdom Portugal closed the 'Feitoria Portuguesa de Antuérpia' (Portuguese Factory House of Antwerp) in 1549? Or we can presume that Portugal intensified its naval construction on Indian dockyards during this period?

Let us now focus on our last topic of analysis: timber. We found ten documents regarding timber. To not vary, we shall take a closer look to four of them. The first two documents (fl. 155v.º in cap.º 98.º, page 113 and fl. 75v.º in cap.º 46.º, page 218) consist on complains by the people to the king, regarding the wood existing on Lisbon`s dockyard. They state that wood present on the 'ribeira' has already been taxed ('dizimas' and 'sisas') considering unfair that who wants to buy wood to be transported by boats ('barcas')has to pay another tax for the transportation as well, arguing that 'only by boat they can be transported' *('...veem vosso*

pouoo conprar a madeyra pera ssua neçesidade … e conpram a dicta madeyra que estaa na Ribeira da dicta çidade de que Ja he paga vossos djreitos dizimas e ssissa E quando vossos pouoos a vem conprar pera a leuarem … lhe fazem pagar outra dizima dizendo que a leuam em barquas ora veJa vosa alteza como se pode leuar a dicta madeyra … senam em barcas...'). A third document (fl. 4v.º in cap.º 7.º, page 420) does not present nothing relevant except a unique detail that is not present in any other document of this 660 pages of courts documents. It makes reference to the arrival of wooden planks to the dockyard of Lagos *('...Muytas vevees a esta villa vem per maar e per terra mercadorias assy como … tauoado madeira panos...').* The fourth and final document (fl. 2v.º in cap.º 5.º, page 454) consists on an alert by the people of Monforte. They present the difficulty of accessing wooden areas, since the majority of their surrounding areas are protected. Therefore they require an absence of fees when they want to graze their cattle and cut some wood for their daily needs *('...esta vyla … agora com empedymento de nove defessas … pedymos por merçe a vossa alteza que proueja ssobre as coymas em maneyra que nom ssejamos rroubados e assy mesmo que possamos cortar madeyra pera nossas lavoyras e casas e emjenhos e trazer lenha sseca...').*

The conclusions we take from these documents might be in some way negative ones. It seems hard for us to understand how timber that arrives to Lisbon dockyards can be used on activities that do not associate with shipbuilding. How could the dockyard`s masters and carpenters manage their construction projects if their timber deposit is "an open market" to others that wish to obtain wood for the construction of houses or any other activity? Should not the timbers present in 'Ribeira das Naus de Lisboa' be exclusive to shipbuilding? Another remark would point to the fact of overtaxing timbers. It is taxed when arrives to the dockyard and taxed again when it is transported by boat to whatever location. If we join the previously mentioned parameters regarding the payment for cutting non authorized trees, together with the fees resulting for not planting forty trees during four years or even the fees for damaging trees, we can conclude that, at least, during the kingdom of D. Manuel I (1495-1521) the care with trees, wood and timber was intense. We can even formulate the hypothesis that overtaxing this resource was a way of limiting those who could access it. The third document is unique by containing the word 'tabuado' (planks). It does not have to necessarily be associated with shipbuilding, but its arrival to the dockyard of Lagos raises the possibility. The fourth document shows us again the importance and variety of timber necessities and its limited access.

FINAL REMARKS

To conclude the analysis on this source of documents, we would like to remind the reader that practical inexistence of a document associating timbers with shipbuilding. At the same time we also want to transmit this thought: wood was the 'oil' at the time, the main resource until the 19th century. Everything we did (we humanity) and even our lives depended on this resource. For shelter, heating, working instruments, furniture, ships, coal and glass industries, as source of fuel...an endless variety that would actually compete by the access to a resource, mostly controlled by the king, nobles and clerks. Everything depended on wood. And by the immense variety of uses, together with few documental references, we intend to agree with researcher Nicole Devy-Varetta. According with her researche in '*Geo-morphologia du litoral et Hinterland: des relations difficiles a saisir. Hinterland des ports du Nord du Portugal et ressources forestières' (*2007, p. 92), it seems extremely difficult, if not impossible nowadays, to represent the Portuguese forest during the 16th century. Not only because of the loss of considerable historical documents, but also due to the intense human factor that influenced the landscape during the early modern ages. Devy-Vareta also tells us that, in her opinion (and we tend to agree), the actual forest of Portugal is mostly 'human made' contrary to the usual tendency of considering it a result of Mother Nature by itself.

Seems also important to underline the potential of archaeological interventions on known and accessible underwater sites possessing relevant Portuguese shipwrecks belonging to this period of study. Crossing the information obtained on documents and different references (regarding wood origin, species and year of cut) with archaeological interventions supported by dendrochronological analysis, will allow us to develop a map with the different species and different origins of shipbuilding timbers, on a national and European scale.

REFERENCES

DIAS, J. J. A. (2002) – *Cortes Portuguesas, Reinado de D. Manuel I (Cortes de 1498)*, Centro de Estudos Históricos Universidade Nova de Lisboa, Lisboa.

DEVY-VARETA, N. (2007) – Geo-morphologie du litoral et *hinterland*: des relations difficiles a saisir. *Hinterland* des ports du Nord du Portugal et ressources forestières, *European Seaport Systems in the Early Modern Age – A Comparative Approach, International Workshop, Proceedings*, pp. 89-93, Instituto de História Moderna – Universidade do Porto, Porto.

ROBOREDO, F.; PAIS, J. (2012) – 'A construção naval e a destruição do coberto florestal em Portugal do século XII ao século XX'. *Revista On-line da Sociedade Portuguesa de Ecologia*, nº4, 31-42. http://speco.fc.ul.pt/revistaecologia.html.

AAVV (2001) – *Dicionário da Língua Portuguesa Contemporânea*, Academia das Ciências de Lisboa, Lisboa.