

# Ship Timber: Forests and Ships in the Iberian Peninsula during the Age of Discovery

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## Abstract

The 15<sup>th</sup> and 16<sup>th</sup> centuries were crucial to the economic, political, and social development of the Western world, in large part due to exploration and expansion from the Iberian Peninsula. The primary vessels of this expansion were ocean going ships. Without the resources to build and maintain the naus, caravels, and other large ocean going ships the world would certainly have developed differently, perhaps drastically. The study of Iberian ship timber during this period provides an excellent first glimpse into the subject of my dissertation as this period has seen comparatively more recent scholarship than other eras.

*This paper is primarily an introduction to my doctoral dissertation, Ship Timber, in light of its cardinal case-study investigating how the Spanish, Portuguese, Basque, and other Iberian cultures managed, exploited, and processed perhaps the most valuable resource of the Age of Discovery: wood.*

## Introduction

The role that seafaring played in the discovery, expansion, and conquest of the world should not be underestimated. Whether it was the trade and exploration on the Nile in ancient Egypt that first opened the interior of Africa to the Mediterranean world or the exploits of Spain across the Atlantic to “discover” and explore the New World, there is one common thread: ships.

Until the Industrial Revolution, the primary means of spreading culture were trade and war, both typically facilitated by ships and boats. Watercraft were, and in many cases still are, the culmination of the most

advanced technologies a society possessed and thus clear indicators of power, wealth and organization. In ancient Egypt ships were so important to civilization that pharaohs were frequently buried with several full-sized boats, constructed of only the rarest and largest timbers from neighboring lands. The degree of bureaucracy ultimately required in the age of Christopher Columbus and Ferdinand Magellan to build even a single large ship for trade or exploration was second only to the money required to procure the materials and manpower. Later, England's ships of the line were perhaps the ultimate case-study of the interaction between public policy, management, and technical ability.

Any study of the vessels that shaped the world in which we live is incomplete without an understanding of the resources required to construct them, specifically, timber resources. Frequently, the restrictions of timber reserves dictated politics, military tactics, and technological changes in the construction of the vessels themselves. When Napoleon's navy lost access to the Baltic timber reserves it crippled his momentum and forced him to explore other timber resources thousands of nautical miles away around the Black Sea. Such stresses on resources often contributed to or caused modifications in construction. Occasionally, the modified methods were extremely successful, became trends and eventually tradition or rule of thumb.

A complete understanding of the changes in European and Mediterranean shipbuilding over time should include an investigation and discussion of the basic building material, its properties, and how it was acquired and maintained as a sustainable resource. Prior to the end of the great wooden ship battles, generally considered the Battle of Hampton Roads in 1862, there were over 6,000 years of wooden shipbuilding in the Western world, which preceded the conversion to iron as the primary construction material.

Any study of archaeological or historical wood, forests, or timber should begin with two references: R.G. Albion's *Forests and Sea Power* (1929) and R. Meiggs' *Trees and Timber in the Ancient Mediterranean World* (1982). Albion was the author first to explore naval history intensively through the filter of the forests. Later, Meiggs took this concept and produced a brilliant addendum to the study of the ancient Mediterranean. Meiggs states that "...the most spectacular addition to the corpus of ancient timbers has come from the development of underwater archaeology" (1982:14). Yet,

Meiggs himself mentions just one archaeologically excavated shipwreck in his entire masterpiece, and this only in passing. He cannot be faulted, however, as his chosen task was epic and, at the time he was writing, the discipline of nautical archaeology was still in its first generation. Both Albion's and Meiggs' works are classics but with the growth of nautical archaeology and the plethora of shipwrecks that was excavated since they wrote, their studies are in need of update and expansion. By the turn of the recent millennium, the field of nautical archaeology was still viewed by prominent botanists and historians as having great *potential* to add to the knowledge of history through the analysis of hull timbers (Rackham 2001:14). That the discipline was viewed as "potentially" beneficial only a few years ago confirms that no seminal author or series of authors has yet to make a comprehensive addition.

This study is rooted in one general question: what can the wood from ships and boats reveal in terms of construction methods, trade patterns, societal strengths and weaknesses? This dissertation intends to develop a framework for an efficient and practical analysis of the timbers from ships and boats. This framework will consist of a list of analytical questions and quantitative tests that can be explored or performed on any collection of ship timbers with a clear understanding of what can, or cannot, be gained from such analysis. Several resources exist to aid in a study of ship timber, such as the material record, chemical analyses, the written record, iconography, and in some cases ethnographic studies. A study of the timbers alone would be too limiting if carried out outside the social, economic, and political frames from their respective periods. It is important to include varied resources. For example, the analysis of treatises on shipbuilding, of which examples survive dating to the early 15<sup>th</sup> century (such as the Timbotta Manuscript [ca.1445] and seem to cluster around the late 16<sup>th</sup> and early 17<sup>th</sup> century, such as F. Oliveira's *O livro da fábrica das naus* [ca.1580] and J. Lavanha's *Livro primeiro da architectura naval* [ca.1610]), shows that they neglect many of the practical aspects of the art that the material record can help reveal. Many of the day-to-day methods used by Italian or Iberian shipbuilders in the 15<sup>th</sup> and 16<sup>th</sup> centuries would have been considered common knowledge and may have gone unrecorded for a variety of reasons, but evidence of such methods remains in the shape, placement, and character of the timbers themselves (Loewen 2000).

The specific questions that will be addressed in my dissertation include:

1. What is “ship timber?”
2. How did populations obtain their ship timber?
3. What technological knowledge regarding ship construction can be extracted from a study of ship timber?
4. Can the origin of watercraft be determined based on the timber utilized; can wood typologies reveal the general purpose of the vessel?
5. Did societies recognize a need to manage their timber resources and if they recognized a need to manage their resources did they take action?
6. When does “management of the forests” transition to “forest management?”
7. Can the environment of a given period be reconstructed from geo-archaeological evidence and does ship timber support such reconstruction?
8. Were dominant societies self-sufficient or dependent on foreign resources?
9. Did the availability of adequate ship timber contribute to the growth, dominance, and decline of a society?

Although study in nautical archaeology encompasses many millennia of seafaring history, since man first ventured out onto the water, my work will employ four case-studies of selected time periods and geographic regions to test the effectiveness of the proposed framework. The following periods have been chosen because each one presents a unique combination of challenges and opportunities regarding the study of ship timbers:

1. Ancient Egypt during the Middle Kingdom
2. Athens during the Classical period
3. The Iberian Peninsula during the Age of Discoveries
4. The New World pre-American Revolution.

Some of these four periods have ample written records and limited material evidence, in the form of watercraft (Classical Greece and the Iberian Peninsula), while others have limited written records and ample archaeological evidence (ancient Egypt’s Middle Kingdom). Still others may be prolific in both (the New World). The contributions and limitations of each period will be outlined in a dedicated section and are briefly outlined below. I chose these particular places and times because each case-study

represents a critical period in the history of Western shipbuilding and has benefited from decades of nautical study and excavation.

Ancient Egypt has been chosen because it is the traditional beginning for a discussion on the history of shipbuilding (Creasman 2005, 4). Likewise, it is a great example of a seafaring culture with scarce local timber resources. Within ancient Egypt the focus is on the Middle Kingdom (2055-1650 B.C.) for its corpus of information including: four nearly complete Twelfth Dynasty vessels collectively known as the Dahshur Boats, a series of robust timbers that appear to be ship frames in the Lisht timbers, numerous boat models including the most heralded set from ancient Egypt buried with the Eleventh Dynasty nobleman Meket-Rē (including a model of a carpentry shop), boatbuilding and boat use iconography, as well as some written accounts of trade and war. It should also be noted that this period was chosen as it was the topic of my master's thesis, *The Cairo Dahshur Boats* (Creasman 2005), and I am already quite familiar with the available resources

Athens was the pinnacle of Classical Greece (500-350 B.C.) and has been chosen both for its comparative abundance of written records, and because it was home to a seafaring culture whose authority was dependent upon ships. Extensive terrestrial excavations over much of the mainland and the Aegean islands may prove to be useful in acquiring contemporary data and pollen analyses to reconstruct distribution maps for local timber resources. One important resource for this endeavor is the excavation of the Tektaş Burnu shipwreck, by Texas A&M and the Institute of Nautical Archaeology, which was directed by a notable scholar of the period, Dr. Deborah Carlson, a member of my doctoral committee.

The Iberian Peninsula during the Age of Discoveries (A.D. 1400-1600) provides perhaps the most comprehensive series of data from which to make a study of ship timber. The ships from the Iberian Peninsula during this time opened the world to Europe, defining the way history developed thereafter. Several treatises on shipbuilding, historical documents, as well as nearly ten shipwrecks with published hull remains, terrestrial excavations, contemporary histories, tax records, some ethnographic works, and extensive recent scholarship are all available for the period. Another notable scholar of the period is certain to be helpful in this research, Dr. Filipe Vieira de Castro, and is the chair of my doctoral committee.

The New World pre-American Revolution (A.D. 1500-1776) provides evidence in excess, much like the timber resources were at the time. The abundance of obtainable timber in this period may resemble what other societies experienced early in their development. This is perhaps the only case-study in which the early stages are recorded in proportion to the later stages of resource management and technological advancement.

Several other periods were considered at first, but eliminated from this study for the sake of feasibility. Although already at least partially studied, Imperial Rome, Renaissance Italy, the Dutch during the time of the Dutch East India Company (V.O.C.), French Enlightenment, or the British Empire in the 18<sup>th</sup> century would have each been relevant case-studies worth developing and studying further. However, in the early stages of this research more can be learned by investing effort in almost virgin arenas such as those presented here. Rival's work with Roman navies (*La Charpenterie Navale Romaine*, 1991), Lane's with the Italian city-states (*Venice, A Maritime Republic*, 1973), Hoving's work in the Netherlands (*Nicolaes Witsen's Scheeps-Bouw-Konst Open Gestelt*, 1996), Bamford's with the French (*Forests and French Sea Power 1660-1789*, 1956), and Albion's work with the English (*Forest and Sea Power: the Timber Problem of the Royal Navy 1652-1862*, 1929) have each addressed the subject of timber resources in varying depths. Yet, none has made a comprehensive addition to the study of ship timber.

### **Present Status of the Question**

The extant body of work regarding a defined framework for the study and analysis of ship timber is negligible. While several works include chapters regarding ship timbers (particularly in the Baltic region) there are only a few extensive works on this topic, of which three stand as particularly relevant for this study: F.C. Lane's *Venice a Maritime Republic* (1973), Rival's *La Charpenterie Navale Romaine* (1991), and Meiggs' *Trees and Timber*. While Lane, a historian, framed parts of his work within the context of ship construction neither his nor Meiggs' work are written recently enough to take advantage of the contributions of the field of nautical archaeology. Only Rival's work presents a study of ships, their construction, and timber in depth. Few nautical scholars have dedicated the entirety of an article or chapter to the varied questions that my dissertation will hopefully address. Among others, F. Ciciliot (2002) and C. Pulak (2001, 2002) are notable

exceptions, although not mentioned elsewhere in this paper, from the nautical community that have devoted entire works to the subject. The majority of the academic references to ship timber are strictly historical or strictly archaeological. By restricting analysis to only one field of evidence, too many details about the most important material of every pre-Industrial wooden vessel have been overlooked.

My dissertation intends to present a more comprehensive approach to the study of ship timbers and try to establish a corpus of information, as reliable as possible, from the real treasures of underwater excavations: timbers. As I have mentioned above, while several authors have made progress towards this goal, none has addressed it in full. By combining the written record, the archaeological record, iconography, and ethnography, with the social, economic, and political factors that went into developing and maintaining the materials used to build the vessels that shaped the world, a more complete analysis of ships and boats can be made. Though few may recognize it, wood was the most valuable resource for many of the world's greatest civilizations.

### Methodology

In order to develop a framework for an efficient and practical analysis of ship timbers, pertinent terminology such as “ship timber” and “forest management” must be clearly defined. Precise definition and applications are critical to the transferability of the proposed analytical framework across regions and time periods. A thorough literature review will primarily focus on the methodological and technical studies of ship timber.

Socio-economic and socio-political events that shape each period will be summarized and documented. Their effects on shipbuilding of the times will be included in the analytical framework to be developed.

After the literature review, a section on quantitative scientific analysis will outline the uses of the following and their specific application to the study of ship timber: 1) dendrochronology, 2) dendro-analysis, 3) radiocarbon, 4) palynological analysis (specifically, pollen analysis), and 5) deoxyribonucleic acid (DNA).

The benefits and limits of dendrochronology in an archaeological context are largely well defined (Kuniholm 2002; Brothwell and Pollard 2001), as is the case for radiocarbon or  $^{14}\text{C}$  dating (Taylor 1987; Bass et al. 1982). Pollen analysis, while certainly familiar in an archaeological

context (Bakker 1951; Faegri 1989) has had very little application in the study of waterlogged ship timbers, probably due to disturbed sediments and loss of pollen spores underwater (Giachi et al. 2003). Yet, by using the pollen analysis of terrestrial archaeological sites it may be possible to reconstruct timber distribution maps of the selected region for a given period. Extracting and analyzing DNA from waterlogged wood is extremely difficult, firstly supposing any survives; nonetheless, this resource has been under utilized in studies of ship timber. Yet, by using the pollen analysis of terrestrial archaeological sites it may be possible to reconstruct timber distribution maps of the selected region for a given period. In combination with associated artifacts, timber distribution maps should prove beneficial in helping locate the origin of a vessel or at least the origin of the raw timber source. Further study will investigate how far certain types of ship timber were known to travel (e.g. Levantine cedar in the ancient Mediterranean saw few boundaries, while Egyptian sidder is not known to have left the banks of the Nile as a ship construction material). Comparison of reconstructed distribution maps with modern distribution maps may also help to fill in the gaps where pollen analysis is unavailable or unreliable.

Physical inspection of ship timber can be extremely revealing regarding forestry practices as Loewen (2000) has demonstrated. On many occasions, when a person modifies a raw material, there remains distinctive evidence of the process and this is certainly the case for ship timber. In ancient Egypt tool marks are so well preserved that the different sizes of chisels, saws, and adzes used to shape the timbers can be identified and a shipbuilding tool kit effectively reconstructed (Ward 2000). Similarly, the management of ship timber stores can sometimes be reconstructed by looking at the arc of futtocks, relative age of common timber pieces, percentage of wood wasted, and the identification of “waney edges” (Loewen 2000). Size and shape of timbers can also be revealing about resource availability and construction method (e.g. *Nossa Senhora dos Martires*, Castro 2005). From these and other empirical observations a general concept of timber management can be inferred. Combined inference with written records, iconography, and other lines of evidence and a detailed understanding of the information the timbers have to offer should be possible.

Applying the methods above to each case-study will validate and caveat the final framework produced in this dissertation. The conclusion

will contain the final framework and notes on how ship timber can best be studied in an archaeological context, particularly nautical archaeology.

### The Iberian Case-Study

The Iberian Peninsula during the 15<sup>th</sup> and 16<sup>th</sup> centuries is the cardinal case-study of my dissertation as it provides, comparatively, much more information from which conclusions regarding ship timber can be drawn. Recent scholarship from this period has produced several translated and analyzed contemporary treatises, at least seven reliably excavated and published shipwrecks with timber (however limited), and extensive contemporary histories. Recent scholarship by Richard Barker, Michael Barkham, Filipe Castro, Furio Ciciliot, Frederic Guibal, Brad Loewen, Carla Rahn Phillips, Patrice Pomey, Eric Rieth, and others has developed an increasingly comprehensive view of the Iberian Peninsula and will be indispensable throughout this study. Loewen's work regarding Basque shipbuilding traditions (1998, 2000) provided much of the impetus and structure for this study. He has demonstrated how timber studies from individual wrecks can reveal information regarding forestry practices, but can such continued studies be used to place other wreck fragments into specific cultural contexts (Loewen 1998).

Preliminary results from this period indicate that there was a consistent practice of localized resource management in shipbuilding regions. The term "forest management" implies an inherent altruistic goal in preserving the environment and this was probably not the case during the 15<sup>th</sup> and 16<sup>th</sup> centuries. It is more likely that a "management of the forest" mentality pervaded; overseeing the timber and restricting its uses because the primary concern was having enough quality wood for construction purposes. Further study should yield a comprehensive analysis of the state of shipbuilding resources in the Iberian Peninsula during the Age of Discoveries which, in turn, will help develop the framework proposed above.

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