Introductory text on the theme of the book

How can archaeologists address questions about shipbuilding, forestry practices, wood selection and the symbiotic relationship between shipyards and forests? The answer lies in reverse engineering. This approach involves studying timbers as living objects with natural properties, rather than as inanimate objects. Ship timbers, whether assembled or disassembled, are remnants of a past forest, harvested for their best raw material to supply shipyards. The aim is to perform a wood feature analysis by reversing ship timbers to the morphology of their original parent tree. To accomplish this task, it will be necessary to analyse wood characteristics and use knowledge of forest environmental behaviour to reconstruct the parent trees of ship timbers and link them to landscapes. This approach will use the assessed timber assemblages presented in this book to record wood characteristics. The expected outcome of this process is to obtain a body of data that will provide missing information on the past forest practices used to supply timber to Iberian shipbuilding from the 15th to the 18th centuries.

To answer questions about these timbers, a fusion of two areas of expertise is necessary: nautical archaeology and wood sciences. The relationship between these fields is slowly developing within the nautical archaeology community. Dendrochronological dating is widely used in certain countries. This dating method has been in use for decades in countries like Denmark, Sweden, and the United Kingdom, and is now commonly used in ship timber investigations. Wood provenance (Daly 2007; 2009) is also increasingly being investigated in other countries, including Germany, Belgium and the Netherlands, as well as Denmark and Sweden.

Recent discoveries, such as Belinho 1 (the primary case study in this book, presented in Chapter 4), have raised questions about the methods used to shape ship timbers, the trees from which they were sourced, and whether these trees were subject to forest management practices. To answer these questions, a dendroarchaeological approach could be employed, focusing on timbers as a fragment of past forests. If a consistent outcome were achieved, this will inevitably lead to the reconstruction of ship timbers parent trees and associated landscapes. After placing the correct research questions, archaeologists can engage to practice with this conceptual approach.

Archaeological material whether timber assemblages or disarticulated ship timbers all have the existence of their natural features in common. By reconstructing these trees, evidence of forest practices and timber selection can clarify the methods employed by foresters to provide shipbuilders with quality timber in suitable shapes. This will also help explain which methods were used to obtain those shapes and how foresters achieved a systematic supply of adequate trees.

The dendroarchaeological approach introduced in this book allows archaeologists to better understand the raw materials used in shipbuilding. Consequently, the aim is to clarify the shipbuilders' decisions to address this material and convert it into adequate ship timbers. Wood scientists will improve their knowledge about the tree species and morphologies employed in the complex shipbuilding industry from the early modern chronologies. By adopting this approach in nautical archaeology, wood scientists can clarify aspects of past forests and former forest practices. This multidisciplinary approach also improves dendrochronological studies by offering a wider range of wood material, enhancing knowledge about climate reconstruction, timber provenance databases, and past foresters. It is important to emphasise the methodology required to achieve results, having established the questions to be addressed in this book. Various techniques can be used to record ship timbers, which can then be analysed using multiple methods.

In nautical archaeology, ship timber assemblages are typically assessed in underwater locations or laboratories. Due to the unique opportunities and challenges presented by each scenario, nautical archaeologists must adapt their methods accordingly. To record wood features, a three-dimensional digital environment was deemed the most suitable method for extracting, analysing, interpreting, and reconstructing the parent trees and associated landscapes of ship timbers. This method was adopted as advanced 3D digital recording techniques have proven to be reliable, even if their full capabilities have not been fully explored. Another reason for the usefulness of these techniques is their ability to transport data seamlessly between software programs without complex transitions or storage constraints.

This innovative approach was developed through the opportunities provided by the ForSEAdiscovery Project, which allowed for the exploration of several timber assemblages and disarticulated ship timbers, despite limited available material. The digital models produced reflect long-term conceptualisation and theorisation. An accurate reconstruction of the archaeological ship timbers' parent trees and past woodscapes has been attempted based on evidence recorded from the surviving timbers within a three-dimensional environment. The book presents digital reconstructions that result from a collection of matured tasks using various recording techniques. The approach focuses on the significance of trees as the fundamental source material for shipbuilding, one of the most complex industries in early modern society.

The main case study in this research was the Belinho 1 timber assemblages, which have been analysed for wood morphology at the level of individual ship timbers. The timbers have never been underwater, either on display or in a laboratory, nor have they ever been subjected to any conservation process. This case has attracted greater attention because of the opportunity to study a collection of ship timbers that had never been assessed before. Greater enthusiasm and dedication has been given to this case, to which a comprehensive dendroarchaeological approach is being applied. This collection of case studies aims to illustrate the requirements and methods for successfully identifying trees in shipwright assemblages. In addition to the Belinho 1 case study, the list of 3D digital models produced includes the analysis of each of the archaeological timbers evaluated during this investigation. This includes case studies of the conversion of legacy data into the 3D digital environment from Corpo Santo (see section 2.2.1), the Cais do Sodré (see section 2.6.1.) and Pepper wreck material (see section 2.6.2.).

The author included results obtained from diving operations at the wreck sites of Highborn Cay (refer to section 2.3.1) and Bayonnaise corvette (refer to section 2.3.2) to consider different recording scenarios. To ensure comparative methodologies and results, analyses from previous studies such as Red Bay (refer to section A2.6), Cavalière-sur-Mer (refer to section A2.4), and the Newport Medieval (refer to section A2.5) were also considered in this book.

Due to the lack of Iberian ships on display within the scope of this study, the author has decided to include two ships outside the regional and temporal scope: the VOC Batavia and the Bremen cog, making use of the opportunities offered by the ForSEAdiscovery project. This was done in order to test the developed methods on timber assemblages exposed to different conservation protocols, display criteria and limitations in the assessment of wood characteristics.