

SESSION:

Floating forests / submerged forests: an environmental history of trees

SESSION CHAIRS:

- **Nigel Nayling**

University of Wales Trinity Saint David, Lampeter, Wales

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Underwater cultural heritage is a diverse resource—temporally and spatially—which has much to tell us about the millennia of interaction between human communities and the 'natural' environments of forests and woodlands. It is often characterised by the excellent survival of organic materials, particularly waterlogged wood, resulting from the unique combinations of site formation processes and the burial environment.

The wooden hull remains of ships, dating from prehistoric to early modern times, sometimes referred to as 'floating forests', form a further significant part of our globally distributed shared heritage. Equally, the investigation of timber buildings preserved in prehistoric lakeside settlements provided an impetus for the development of underwater archaeology more than 170 years ago (and the inspiration for the IKUWA2 field school and conference in Zurich).

Preservation of former wooded landscapes as 'submerged forests' has intrigued researchers for centuries. Archaeological remains and today's wooded landscapes can be perceived as products of complex, often competing demands for wood and timber—demands leading to the development of regional traditions in forestry practice and woodland management suited to meeting the needs for fuel and building materials, including specialised industries such as iron working, mining and, not least, shipbuilding. The exploration of this environmental history can best be achieved through a multi-disciplinary approach, which brings together complementary historical, archaeological and wood science disciplines.

The core of this session explores the application these approaches including: documentary research, archaeological recording (wood characterisation), dendrochronology, wood chemistry, wood anatomy and genetics with reference to a major Marie Curie project, ForSEADiscovery, which involves examining timber supply and selection for Iberian shipbuilding during the Age of Discovery (16th–18th century). Contributions from other research projects exploring analysis of wood assemblages, be it natural 'wildwood' such as submerged forests, prehistoric settlements or other shipwrecks, are invited.

Key words: Timber, forests, environmental history, dendrochronology.

PRESENTERS:

Filipe Castro

Texas A&M University, Texas, USA

Title: Ship sizes and wood scantlings

Key words: Ship sizes, scantlings, architectural signatures

Abstract: Oceangoing wooden ships were built by specialists according to tradition, taste and availability of materials. When analysing and reconstructing a ship from its archaeological remains, it is not always easy to determine a ship's size based on the size of its structural timbers. This paper proposes an approach to investigate whether there is a clear relation between the sizes of a ship's main structural components and its overall size, and whether this relation is regional, functional, and changes in time.

Adolfo Miguel Martins, Ana Almeida, Antonio Santos, Ivone Magalhaes, Filipe Castro, Jemma Bezant, Marta Dominguez-Delmas, Nigel Nayling & Peter Gronendijk
University of Wales Trinity Saint David, Lampeter, Wales

Title: Reconstructing Trees from Ship Timber Assemblages Using 3D Modelling Technologies: Evidence from Belinho in northern Portugal

Key words: Archaeology, dendrochronology, multidisciplinary, computing, shipbuilding

Abstract: During the ferocious storms of 2013/4, violent waves threw up a remarkable set of ship timbers and hundreds of pewter plates onto the beach of Belinho in northern Portugal. An international investigative team was assembled jointly between archaeological experts from the Council of Esposende and the ForSeaDiscovery project whose objective it is to develop innovative timber and shipwreck recording and analysis methodologies, as well as exploring historic timber supply and forest management in the Iberian Age of Discoveries.

A key recording strategy included the usage of Faro Arm digital measuring technology, which allowed the detailed recording of individual diagnostic ship timbers and was complemented using photogrammetry. This allowed a complex model of each timber to be rendered in Rhino engineering 3D modelling software. Alongside a detailed timber record using photography, measurement and contract tracing, a comprehensive record of the assemblage was collated.

This data is allowing investigators to model and reconstruct parent tree forms for each ship timber. In this way, we can say something about how trees were grown, managed and selected as part of a major Iberian shipbuilding industry.

Project Belinho has contributed in many ways to the development of a 3D digital glossary and new methodologies for recording and interrogating ship timber assemblages. The reconstruction of the whole story of 'ship' as a 'floating forest' is innovative in this regard. Equally, the wider international expert team is studying the ship's reconstruction and hull form, wood sciences including dendrochronology, DNA and isotopes, GIS mapping, and looking at trade routes.

Maria M. Intxaustegi
University of the Basque Country, Spain

Title: A timber voyage: the Havana Shipyard in the 18th century

Key words: Timber, shipyard, 18th century, Cuba

Abstract: The 18th century was a tumultuous period in Europe. The nations who were looking to the Atlantic Ocean were fighting amongst themselves to ensure the safety of their colonies, and more importantly, their trade routes. Failure to do so would have endangered their incipient economic systems and the power and control of each monarchy.

These are some of the main reasons which explain why the development of shipbuilding became such an important subject that would lead all the nations that had overseas colonies in the Atlantic Ocean (e.g.: England, Spain, France, Portugal or Holland) entering into a competition to build the most powerful, manoeuvrable and dangerous ships. The future of every nation was inevitably linked to this competition. At this point they were no longer concerned with the development of shipbuilding to bring spices from the Indies, their attention had now turned to holding up their own empires through Naval power.

Based in archaeological and documentary sources, in this dissertation we will try to explain why the Havana shipyard, located on the island of Cuba was one of the most important Spanish shipyard during the 18th century taking into account the geographical location, an abundance of exceptional quality timber, and the shipmasters.

We will also take a trip through the construction of a ship line from the first timber to the final launching, paying particular attention to the shipbuilding methodology but also taking into account the organization and management of the shipyard.

José L. Gasch-Tomás, Marta Domínguez-Delmás, Miguel San Claudio, Koldo Trápaga Monchet & Beñat Eguiluz-Miranda
Consejo Superior de Investigaciones Científicas [CSIC], Madrid, Spain

Title: The Ribadeo Shipwreck (c. 1600)—a multidisciplinary approach for an Iberian shipbuilding case study

Key words: Shipbuilding, forest resources, timber, dendrochronology

Abstract: During the dredging work in the Ribadeo estuary (Galicia, Spain) in 2011, a late-sixteenth or early-seventeenth shipwreck was discovered. The scientific and historic interest of that shipwreck is significant, since it is the best-preserved shipwreck dated in the sixteenth and seventeenth centuries in Spanish waters, likely a galleon. Many ships wrecked in the coasts of Galicia during the early modern era. However, the Ribadeo Shipwreck has not been historically identified. What type of ship was the Ribadeo Shipwreck? Was it really a galleon? What were the main constructive features of the ship? How were shipbuilding and forest resources for the construction of ships managed in Spain in the turn of the sixteenth century?

To answer these questions, a team of historians, underwater archaeologists and dendrochronologists is working together within the Marie Curie ITN ForSEADiscovery project. By implementing a methodology that crosses archival information produced by historians, constructive analysis done by archaeologists and analysis on the species and geographic origin of wood samples taken from the Ribadeo Shipwreck, this team expects to achieve a threefold result. Firstly, the team aims to historically identify which ship the Ribadeo shipwreck was, and the date and

circumstances under which it sank. Secondly, the group expects to shed light on Spanish shipbuilding patterns and management of forest resources about 1600. Thirdly, we plan to propose a systematic method for the implementation of this interdisciplinary approach in the study of similar case studies in the future.

***Ana Rita Trindade, Sara Rich, Adolfo Martins, Mohamed Traoré & Nathan Gallagher**

***Centro de Ciencias Humanas y Sociales–Consejo Superior de Investigaciones Científicas [CCHS-CSIC], Madrid, Spain**

Title: From forests to the sea, from the sea to the laboratory: the *Santa Maria Magdalena* frigate

Key words: 18th century, Spain, timber supply, wood science, archival sources

Abstract: Driven by the increased demands on seafaring defence, the Spanish Crown launched the *Santa Maria Magdalena* frigate from the Esteiro shipyard of Ferrol (Galicia) in 1773. After nearly 40 years of naval service, she wrecked in a storm in the bay of Viveiro, not far from her origin, as part of an Anglo-Spanish squadron against the French occupation during the Peninsular Wars of Santoña (Santander). In June 2015, the project ForSEAdiscovery (Forest Resources for Iberian Empires: Ecology and Globalization in the Age of Discovery) organised an underwater timber sampling campaign on this wreck site. Through various wood provenance studies (i.e. dendrochronology, inorganic and organic chemistry), combined with historical research in national archives and international sources such as the Sound Toll Registers, the ship's timbers promised to shed light on late 18th c. Spanish naval construction, forestry practices, and timber supply in relation to shipbuilding in northern Spain. As a highly interdisciplinary project, ForSEAdiscovery integrates research fields in the Humanities and Life Sciences; therefore, this paper presents the joint efforts of historians, archaeologists and wood scientists to determine: 1) what kinds of trees were used to construct which parts of the *Santa Maria Magdalena*; 2) their eventual provenance; 3) the timber trade networks and state management involved in supplying lumber to the Ferrol shipyard; and 4) best-practice methodologies to reach these conclusions.

Sara Rich, Garry Momber & Nigel Nayling

Maritime Archaeology Limited, Southampton, England

Title: Maritime archaeological timber sampling: methods and results from the silty Solent

Key words: Submerged forest, prehistoric sites, timber sampling

Abstract: The Solent is a part of a flooded ria system along southern England. The region has been a focal point for shipbuilding and maritime activity for millennia. Today it hosts a number of wooden shipwrecks, submerged prehistoric sites and drowned forests. The archaeological artefacts within these sites can answer questions about our past and their study often dominates research while detailed analysis of the timber itself invariably plays a secondary role. This lacuna is being addressed by the Marie Curie, ForSEAdiscovery, project that is training a team of researchers to recover and interrogate timber samples from underwater archaeological sites. This paper will focus on underwater work conducted in the Solent where the 16th century, Yarmouth Roads shipwreck lies adjacent to a submerged forest. The well-preserved timber retains evidence of climatic fluctuations, forestry and trade casting light on international socio-environmental change. The harsh environment underwater, strong currents, limited visibility and complex archaeological matrices necessitated the development of new methods to rescue and recover appropriate samples. This paper will present and evaluate the methods used by maritime archaeological divers to overcome the challenges faced in this busy marine channel. In particular it will look at the in situ timber sampling of the ship structure and the submerged oak forest. It will present results from analysis of the samples, highlighting the need to identify and characterise the timber within the context of the archaeological artefact (such as a shipwreck), while understanding its correlation with the tree from which it was converted.

***Aoife Daly, Wendy van Duivenvoorde & Jeremy Green**

***dendro.dk, Brønshøj, Denmark**

Title: Timber for the *Batavia*

Key words: Batavia, dendroprovenance, timber trade

Abstract: Remains of the hull of the *Batavia* ship stand on exhibition at the Western Australian Museum—Shipwreck Galleries in Fremantle, Australia. The *Batavia* was wrecked off the coast of Australia in 1629.

Although only a small portion of the hull survives, it is an important resource in the study of 17th-century Dutch shipbuilding, not least for studying the procurement of oak used in the Dutch East India Company shipyards.

Previous dendrochronological analysis of some timbers suggested a Southern Baltic source for some planks for the ship, clearly demonstrating the trade in timber to the shipbuilding yards in Amsterdam. But timber was transported to Amsterdam from many regions in Northern Europe. Could an extensive dendrochronological analysis

of the surviving *Batavia* timbers demonstrate the extent and variety of sources of timber used for this early 17th-century Dutch ship?

Sampling and dendroprovenance analysis of planking and framing timbers from the hull is building the history of timber procurement for the *Batavia* ship, and the results that emerge can be compared to that of other vessels from the period.

In this talk, the results of the *Batavia* dendrochronological provenance analyses will be presented.