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PRESENTATIONS

SESSION 1
STATE AND PRIVATE SHIPBUILDING

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State and Private Shipbuilding in Venice (13th–18th Century): Peculiarities, Strengths, and Weaknesses of the Ship Production System

Mauro Bondioli and Irena Radić Rossi

The exceptional longevity of the political independence of the Republic of Venice and the consequent continuity of its cultural identity represent an almost unique opportunity for scholars of Western European maritime history. A long history has witnessed extraordinary events that occurred between the rise of the great Mediterranean power and the slow decline which began in the 17th century. In the naval sector, its Arsenale represented the pinnacle of technological and productive progress from the late Middle Ages to the late Renaissance.

In fact, from the same state construction site came both the fleets of military galleys that for centuries defended the territories of the Serenissima, and the convoys of merchant galleys that made possible the creation of the first global network of regular maritime transport after the collapse of the Roman Empire. The commercial traffic extended from the coasts of Mediterranean to northern Europe, and up to the most extreme locations of the Black Sea. Furthermore, every type of vessel and ship, for work or transport, was launched from the small and large private shipyards of the lagoon. Shipyards were creating structures suitable for all needs, applying different techniques, like shell-first or bottom-based construction. As evidence of this diversity, there are, for example, the 14th century shipwrecks found in the Venetian lagoon, near the island of San Marco in Boccalama, and those of Lazise and Gnalić from the 16th century.

The paper intends to illustrate the peculiar and exclusive characteristics of Venetian public and private shipbuilding and the related production processes, through published and unpublished archival documentation. In conclusion, it presents an analysis of the knowledge of shipwrights regarding the construction of merchant ships and shipbuilding for military needs, including their similarities and differences.

Aproximación a la historia de la construcción naval en la Ciudad de Panamá en el siglo XVI.

An Overview of Shipbuilding History in 16th Century Panama

Aaron Samuel Bracho Mosquera and Rita Lis Ramos Pérez

With the Spanish access to the Pacific Ocean in September 1513, important territories in Central and South America were also reached. This process became possible through the developmentofa systemforboatconstructionfor the conquest of Nicarao, Tahuantinsuyo, among other territories. This shipbuilding industry was made feasible by the convergence of Spanish engineers, the abundance of good timber trees, financing from new conquest companies, and recommendations of certain naval materials by the indigenous people. This paper explores the main characteristics of the shipbuilding industry developed in the 16th century. Namely, what were the sources and forms of financing? What experience and expertise did engineers based on the isthmus have in boat making? What materials were used in the manufacture of the new vessels and where were they sourced? Was there any recommendation of materials from the indigenous peoples inhabiting the area? The research is based on the review of some primary and secondary sources available in digital archives.

Ship construction in late antiquity: The Ma'agan Mikhael B shipwreck

Deborah Cvikel and Maayan Cohen

At the turn of the 8th century CE, a 24-m-long, lateen-rigged merchantman was wrecked, perhaps as a result of a navigational error, off the coast of what is now kibbutz Ma'agan Mikhael, Israel. It was recently discovered, designated as Ma'agan Mikhael B, and excavated over eight seasons, revealing remarkably well-preserved hull components and notable discoveries, including the masthead fitting, rigging elements, and many amphoras. The ship was built to a high standard, as evidenced from its intricate and high-quality carpentry. Inscriptions on the timbers and fittings hint at the builders. The carpentry details suggest that the ship was built by skilled craftsman in an established private or state-owned shipyard.

Some of the shipwreck finds testify to an Egyptian connection, and perhaps origin, for the ship. The characteristics of the Ma'agan Mikhael B hull, such as the flat floor timbers, round turn of the bilge, longitudinal reinforcements and lack of edge-fasteners, suggest a skeleton concept based on frames and construction, typical of the Eastern Riverine tradition (Root 4, Pomey, Kahanov and Rieth, 2012). The ship and her contents provide a unique example of ship construction, seamanship, and maritime trade in late antiquity.

Timber resource exploitation for shipbuilding – can dendrochronology demonstrate diversity of timber usage between state and private shipbuilding?

Aoife Daly

In Northern Europe an extensive corpus of dendrochronological data from ships has grown through several decades of analyses in both the research and commercial sphere. The chronological precision from these analyses coupled with the identification of the sources of the timber used, provides the anchor for studying timber exploitation for shipbuilding across time and geography.

Taking a time-window from around AD 1100 to 1700, with Scandinavia as my main focus, I will try to assemble an overview of which shipwrecks can be connected by way of their dendrochronological data. I will examine whether it is possible to see patterns, distinguishing where possible between state and private ships, across regions and economies, and between regions with timber surplus versus regions with shortage.

SESSION 2
STATE AND PRIVATE SHIPBUILDING

Early Modern Ships and State Formation in Scandinavia
Johan Rönnby and Veronica Palm

Building the Swedish Warship Elephant 1554-1564
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Who taught them how to build carvel ships? Foreign influences in Swedish state shipbuilding in the 16th century
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The mysteries of converted lapstrake-built ships. A comparison of techniques and practices through the late 16th century Bispevika 16 (Oslo, Norway)
Tori Falck

The Norwegian Dutch-flush ship Bispevika 8- a departure from local shipbuilding traditions through the influence of state or private interests
Sarah Fawsitt, Aoife Daly, Marja-Liisa Petrelius Grue, Lucy Kubiak-Martens

Early Modern Ships and State Formation in Scandinavia

Johan Rönnby

At the end of the 15th century and during the 16th century, large new carvel-built warships were built in shipyards all over Europe. These ships are associated with the contemporary European state formation process. The new countries and their rulers needed efficient ships for war and to bring home resources from newly discovered areas across the sea.

This process also applied to the Scandinavian countries, and for the new royal rulers in Denmark and Sweden it primarily applied to dominion over the Baltic Sea. This Early Modern maritime struggle for power will be discussed and highlighted in the presentation based on the maritime archaeological investigations and interpretations of a handful well-preserved shipwrecks from this time, including Griffen (1494), "Kraveln" (1525), Elefanten (1550) and Mars (1564).

Building the Swedish Warship Elephant 1554-1564

Ingvar Sjöblom

The large Swedish warship "Elefanten" was built in Stockholm at the newly established Naval yard in 1554-1560. She was built side by side with the scrapping of the warship "large carvel" (Stora Kraveln). Wood, bolts, and cables were recycled and reused. The amount of heavy siege artillery guns seems to have affected the stability. The ship was strengthened which led to an extended construction period. Elefanten was one of the first warships built in Sweden that was equipped with gun ports. The ship was planned for Duke Erik's (later Erik XIV 1560-1568) diplomatic journey and marriage proposal to Elisabeth of England. Elefanten fought a victorious battle against the Danish Navy in 1563 and a disastrous battle near Öland against the allied Danish - Lübeckian navy in 1564. She grounded and after incorrect handling, the warship sank near the shipyard in Calmar, Sweden. Contemporary salvage attempts were fruitless and the wreck was filled with stones. She was found in 1933 and some parts were salvaged. New interdisciplinary research in archives and marine archeological investigations rewrites our understanding of the building of northern carvel-style warships. One of the ship masters involved in the ship design was later responsible for building the warship Mars (which sank in 1564. The wreck was discovered in 2011). Understanding the Elefanten design helps puzzle together the even larger carvel-built Mars. The historical sources give a unique insight into the building process. Documents reveal almost every single nail. The 52-gun port hinges reveal the amount of planned heavy guns. This kind of information has been the base for new research questions for the ongoing marine archeological investigation. Building the Swedish Elephant 1554-1564 contributes to a new level of scientific understanding.

Who taught them how to build carvel ships? Foreign influences in Swedish state shipbuilding in the 16th century

Niklas Eriksson

It is often said that the Swedish navy was founded in 1522 when the nobleman who was later crowned King Gustav I, bought a number of ships from Lübeck. After his succession to the throne a domestic production of warships developed. Towards the end of the century, Sweden had an impressive navy equipped with ships that represented the most modern naval architecture and technology that existed.

In contrast to the ships hitherto built in Sweden, these new ships were carvel-built. Written sources are far from clear on how and wherefrom the carvel construction knowledge came to Sweden, but it is likely that persons with those skills were recruited from abroad. However, the material remains of the ships themselves may provide some clues. This paper will use archaeological remains to shed light on one of the most dynamic periods in Swedish state shipbuilding.

The oldest wreck of a carvel-built ship that undoubtedly was built in Sweden is Elefanten, (The Elephant) which was finished in 1559. When the remains were archaeologically surveyed in the 1930s several odd and peculiar details were noticed, not least a system of caulking laths aimed to hold the caulking in place. Since then, several other wrecks of Swedish carvel ships have been relocated and surveyed, such as Mars 1563 and Samson 1598, which reveal similar technical solutions as Elefanten.

The technical traces on these ships provide a glimpse of a shipbuilding environment in which a certain set of ideas were accepted, communicated, circulated, and reproduced. Towards the end of the 16th century, Sweden actively recruited master shipwrights from abroad with fresh ideas and methods. This is possible to see in the remains of the ships that they built.

The mysteries of converted lapstrake-built ships. A comparison of techniques and practices through the late 16th century Bispevika 16 (Oslo, Norway)

Tori Falck

The boatyards were a hive of activity in the thriving maritime landscape of 16th-century southeastern Norway. While the workshops remain elusive, the abundant discovery of shipwrecks in Oslo over the last decades attests to the high demand for small to medium-sized cargo carriers. These vessels, often crafted from oak sourced in the forests of southern Norway and western Sweden, reflect a flourishing economy intertwined with timber export to continental Europe and England. The implementation of water-powered saws earlier in the century undoubtedly played a role in facilitating this expansion, as well as leading to a more professionalised approach to shipbuilding.

Delving into the biographies of some of these vessels unveils their captivating role as a tangible representation of changing craft practices. Rooted in North European lapstrake boat-building practices with medieval origins, these early modern techniques evolved in response to the demand for larger, sturdier vessels for war and trade. The changes in boat-building techniques materialised in communities of practice that resulted from the mix ofvernacular craft and initiatives from the state. Intriguingly termed "double-planked" or converted clinker-built ships, some vessels started as lapstrake-built constructions before acquiring an additional layer of flush-laid planking on the exterior. As evidence of such vessels multiplies in North European archaeology, studying the diverse techniques applied in these conversions becomes an exciting opening for comparison.

This paper explores this phenomenon, focusing on the late 16th-century vessel Bispevika 16 as a primary case study. Excavated in Oslo in 2019, this wreck is one of well over 60 documented in the medieval and early modern harbour of Norway's capital, providing valuable insights into the evolving shipbuilding practices of the era.

The Norwegian Dutch-flush ship Bispevika 8- a departure from local shipbuilding traditions through the influence of state or private interests

Aoife Daly
Sarah Fawsitt
Marja-Liisa Petrelius Grue
Lucy Kubiak-Martens

"One of the oldest known Dutch-flush shipwrecks, Bispevika 8, has been found in Oslo. New analysis of this wreck from the mid-16th century enables us to suggest the ship's place of origin and to discuss its use. Bispevika 8 stands out as the only carvel ship found from this time period in the inner Oslo-fjord region. The remaining 36 ship finds from Oslo are lapstrake vessels, so there is a clear delineation in building techniques. Can Bispevika 8 have been a Danish-Norwegian naval ship, built and used in the inner Oslo fjord in preparation for a war with the Swedes? Or was it a trading vessel, built by the up-and-coming merchants, where the Dutch influence gradually was becoming more apparent?

Using a well-established building date, date of wreckage, and archival sources, we seek to discuss what led to the building of this single Dutch-flush ship in the inner Oslo fjord region, in a period where there are no known shipyards. By utilizing the well documented wreck material, dendrochronological and macro botanical results, the scene is set to try to reveal the story of Bispevika 8, whilst shedding light on early ship construction at a time before permanent royal or mercantile shipyards had been established.

SESSION 3
STATE AND PRIVATE SHIPBUILDING

Flotillas of brigantines and canoes: historical-archaeological approaches to early modern shipbuilding practices and regional transport geographies in South America
Laura Maria Saari

Puente Mayorga IV. A late 18th-century gunboat lost in Bay of Algeciras (Spain)
Felipe Cerezo Andreo, et al

Henri Duquesne as a ship designer and shipbuilder in the service of the Republic of Berne, 1687-88
Paul Bloesch

The Mediterranean ship carpenter in the Late Middle Ages (Catalonia, 13th-15th c.). Categories, functions and knowledge
Marcel Pujol i Hamelink

Private shipbuilding in the north-western Mediterranean between the end of the Middle Ages and the modern era. The Laurons 11 wreck, (Bouches-du-Rhône, France): a vernacular Mediterranean coastal boat
Eric Rieth and Marine Sadania

A Kunlun ship sailing along the Maritime Silk Routes in Southeast Asia
Jun Kimura

Flotillas of brigantines and canoes: historical-archaeological approaches to early modern shipbuilding practices and regional transport geographies in South America

Laura Maria Saari

The presentation surveys the emergence of shipbuilding practices in the Pre- Columbian-European contact period, focussing on the construction of light watercraft along key sites of the regional communications landscapes of the Rio de La Plata, Tierra Firme and along the Pacific Coast, identified through the analysis of historical and archaeological sources.

Transport geographies are approached in diachronic perspective, with shipbuilding and navigation predicated on the relationship between mariners and the aquatic environments of coastal, estuarine and fluvial interfaces. The discussion examines environmental conditions that influenced nautical and technical knowledges, with reference to regimes of winds, tides and currents and, in the Rio de La Plata region, seasonal inundations that periodically reconfigured waterways and influenced the cultures of mobile canoero groups.

Drawing upon historical accounts that detail the sourcing of hardwoods, the reuse of materials and architectural innovation, the paper centres on the construction, adaptation and functions of brigantines, which originated in the Mediterranean, in early modern South America. Chaînes operatoires are surveyed as "organic" industries particular to early harbour and settlement sites, characterised by the transfer of knowledges pertaining to design, navigation and resource geographies, also with reference to the use of European and native watercraft along coastal and inland routes.

The importance of these industries in contexts of exploration, trade and the development of shipping routes and infrastructure is attested to, inter alia, by the liberalisation of shipbuilding in Rio de La Plata (1551). This indicates research apertures on the relationship between artisanal practices, regional production systems and the sciences of navigation and naval architecture within their (transoceanic) institutional frameworks. The implications for nautical archaeology, both as concerns submerged and foreshore sites and waterscapes of circulation and exchange, is highlighted.

Puente Mayorga IV. A late 18th-century gunboat lost in Bay of Algeciras (Spain)

Felipe Cerezo Andreo, Nicolás Ciarlo, Raúl González Gallero, Soledad Solana Rubio, Alberto Salas Romero, Elisa Fernández Tudela, Carlota Pérez-Reverte Mañas, Marta Domínguez Delmás, Marina Goñalons, José Bettencourt, Sergio López Martín, Natalia López Sánchez

In 2003, the remains of a well-preserved wooden boat were discovered at a depth of 2.5 metres, near the shore of Puente Mayorga, in the Bay of Algeciras. After an initial survey developed by researchers from the University of Cadiz in 2019, the wreck site was identified as the remains of a late 18th-century gunboat. In May of 2022, the site was fully excavated, documented, and protected. This research was carried out within the Herakles Project.

This type of vessel is of outstanding historical significance for the area, as gunboats were extensively used during the Spanish sieges of Gibraltar throughout the 18th century. They were, indeed, essential to the success of some of the confrontations. In addition, their speed, manoeuvrability, and effectiveness in firing, stood for a technological development that was successfully applied to the defence of Spanish ports in the Iberian Peninsula and the Americas.

This paper will present the first results of the comprehensive study of the shipwreck, comprising its architectural features and construction, specific technological solutions adopted, dating and provenance of timbers, and other aspects of the vessel's design. Moreover, we will present the analysis of the archaeological context, centered on the vessel's armament and life on board. The interpretation of the site and associated remains, together with data from documentary sources, provided new insight into the technical knowledge of the shipwright, the investment made by the state, and its function and operation as a gunboat.

Henri Duquesne as a ship designer and shipbuilder in the service of the Republic of Berne, 1687-88

Paul Bloesch

In 1687, the two bigger ships of the small bernese navy on Lake Geneva being desperately out of repair, the government decided to have them replaced by two new galleys built on the State's expense rather than to entrust private entrepreneurs with the business.

A few months later the french naval officer (capitaine de vaisseau) Henri Duquesne, the eldest son of the admiral Abraham Duquesne, offered his services to the Republic of Berne. He was its vassal since 1685 when he acquired the domain of Aubonne situated on the shore of the lake.

A first and very ambitious project consisting in the construction of two big barques or yachts, two galiotes à rames, and two felouques (outside the scope of the present contribution) had to be modified and reduced. In december 1687, the government decided to have two vessels built, and to begin with one capable of carrying 300 men and 10 guns. It entrusted Duquesne with the entire direction and inspection of the actual building process including the choice of the workmen to be engaged. This project is visualized in a most interesting plan which can be ascribed to Duquesne, who therefore appears as the conceptor as well as the builder of the new ship. It was he who prepared the necessary moulds.

This project was finally not realized. There were several annoying delays, the causes whereof are not very clear, and in spring 1689 Duquesne left Switzerland for the Netherlands, where he pursued a project much more important than shipbuilding : the establishment of a huguenot colony on the island of Bourbon (todays La Réunion) in the Indian Ocean.

The Mediterranean ship carpenter in the Late Middle Ages (Catalonia, 13th-15th c.). Categories, functions and knowledge

Marcel Pujol i Hamelink

The ship carpenters were not a homogeneous set of craftsmen, in which they all had the same knowledge and the same tasks in the development of their work. Basically we can differentiate the ship carpenters into two large groups, those who built ships and were called master ship carpenters and those who simply dedicated themselves to repair or worked in the construction of ships, but always under the direction of a master ship carpenter.

The master ship carpenter dominated the conception, the determination of sizes and shapes and used gauges to trace the shapes of the main pieces of the hull. Not all of them either had the same knowledge or built the same type of ship. The most common was the master ship carpenter who knew how to build small boats (for fishing, coastal trade, port tasks or auxiliary of ships and galleys), on the other hand there were master ship carpenters, rather few, who built the large trading ships, and finally the galley builders who were linked to the royal shipyards. Each of them kept like a treasure the set of gauges that allowed them to shape all the pieces of the hull that they knew how to build and that had given them prestige because of their qualities.

The ship carpenters of the second group used to work under the orders of the master ship carpenter, both in the royal shipyards and in private workshops, or they were in charge of the repair of vessels, many of them moving around the coast, in those towns where there was no ship carpenter - often in localities where there were only fishing boats. These ship carpenters are also often found on board ships and galleys, taking care of their maintenance, on the great routes from Barcelona to the Levant (Alexandria) or to Flanders (Bruges). The fact of spending a lot of time at the stern, together with the 'nauxer' (it. Nocchier), made them acquire the necessary knowledge to trace routes, calculate distances and courses, thanks to navigation charts, the compass, the hourglass, etc., it being possible that in future navigations they could be hired with a salary supplement as second 'nauxer'.

Private shipbuilding in the north-western Mediterranean between the end of the Middle Ages and the modern era. The Laurons 11 wreck, (Bouches-du-Rhône, France): a vernacular Mediterranean coastal boat

Marine Sadania and Eric Rieth

Recent archaeological excavations carried out along the French Mediterranean coast have documented the remains of boats and ships used for local or regional transport, fishing activities or port services. Their origin is most likely from a traditional techno-economic environment. The Laurons 11 wreck is distinguished by its remarkable state of conservation. Discovered in the Anse des Laurons (Martigues, Bouches-du-Rhône), the wreck, after a brief survey in 2019, was the subject of four scheduled archaeological excavation campaigns (2021-2024) under the direction of the two authors. Resting at a depth of 2/2.50 m, orientated perpendicularely to the shore, the wreck is preserved at almost 12 m in length, 4 m in maximum width (dimensions close to those of the original) and approximately 1 m in height. Two radiocarbon age measurements provided a date between the second half of the 15th century and the first third of the 17th century. The hull with pointed ends is characterized by an axial framework (keel, stem, sternpost), a transverse framework composed of floor-timbers and futtocks, ceiling planks, carvel planking. Remains of a deck with three hatches are preserved in the presumed forepart of the wreck. A series of "architectural fingerprints" (carvel planking, "hooked" scarf between floor-timbers and futtocks, joints exclusively with iron nails, transverse floating ceiling planks, green oak frames, etc.) is indicative of a "frame first" Mediterranean shipbuilding tradition. The cross sections made in the presumed aftpart of the wreck demonstrate a hull with relatively flat bottom, small draught, probably corresponding to a coastal/lagoon navigation area close, logically, to the place of construction of the boat whose fishing or servitude functions remain to be clarified. Beyond the presentation of the Laurons 11 wreck, the communication will offer an overview of other wreck discoveries that allow us to sketch from an archaeological point of view the question of the activity of the private shipyard in the north-western Mediterranean between the end of the Middle Ages and the era modern.

A *Kunlun* ship sailing along the Maritime Silk Routes in Southeast Asia

Jun Kimura

Maritime archaeological studies in Southeast Asia have contributed to increasing knowledge on the rise and growth of a regional shipbuilding tradition. A number of the archaeological findings of hull remains and ship timbers indicate that one of principle boatbuilding methods, developed over centuries in Southeast Asia, was the combination of the use of blind wooden dowels for planking and fibers for lashing. The Chau Tan shipwreck, found in the the Bay of Binh Son near the unknown anchorage of the Kingdom of Champa in Central Vietnam, was constructed with techniques around the end 8th century. A post-archaeological study on the remains of the hull suggests that the ship was originally more than 25m long and was used to carry a large amount of seaborne commodities including the ceramics of Tang (618-907 CE) period.

The name of Southeast Asian ships can be identified in the Chinese historical accounts, for example as a Kunlun bo (ship), whose record appears as early as in the 5th century. The other written sources dating to the 8th century depict that the Kunlun ship is one of the three major types of large merchant ships which anchored in estuaries in Guangzhou, China known as a trading hub. The other documented ones were an Indic ship and a Persian ship. The Kunlun ships were operated by Southeast Asian seafarers and sailors, and often chartered privately and nationally. The surviving historical sources were related to Buddhist pilgrimages for their long distance voyages across the regions of China, Southeast Asia, and the eastern Indian Ocean. While their shipbuilding hubs in Southeast Asia have not been clarified, based on the study of the Chau Tan shipwreck, this paper tries to induce the role of Champa as a Kunlun state in the supply of the Kunlun ships.

SESSION 4
SHIP CONSTRUCTION

Worlds apart? Two well preserved watercraft from the 4th-5th century AD burial site at Fallward in the German North Sea marshes
Mike Belasus

An archaeobotanical analysis of the sewn ship of Roman period from Alberoni (Lido di Venezia)
Carlo Beltrame et al

The Design of Warships and Naval Fleets from the 6th to 1st centuries BC
Peter B. Campbell

The curious case of blank timbers from Norwegian wetlands
Massimiliano Ditta

The 18th century Shipwreck at Nissia, Cyprus
Stella Demesticha

Worlds apart? Two well preserved watercraft from the 4th-5th century AD burial site at Fallward in the German North Sea marshes

Mike Belasus

The late Roman Iron Age and Migration Period cemetery in the northern part of the terp (artificial dwelling mound) Fallward in the North Sea Marshes of the Weser Estuary was excavated from 1993 until 1998. The preservation conditions proved extraordinary good for organic materials and the recovered finds are unique in Europe. Among the 260 documented burials were two boat graves of the mid-4th and early 5th century AD. Both graves contained logboats to bury the dead. The wooden grave goods from Fallward gained wide attention already during the 1990's while there was no information at all available on the boats. It took until 2021 before detailed analyses of the preserved material began at the Lower Saxony Institute for Historical Coastal Research in Wilhelmshaven. Until 2024, the two logboats from Fallward were digitally recorded and analysed within the research project "Coast without ships? – evidence for watercraft of the 1st millennium AD on the southern North Sea coast" funded by the State of Lower Saxony's Ministry for Research and Culture.

Even though both craft were buried at the same location, each is a distinct contrast to its counterpart. They show no obvious features that would connect them to the same building tradition. In a period of intense migration along the North Sea shores, they raise the question of the origin of their boatbuilding technique or the boats themselves.

An archaeobotanical analysis of the sewn ship of Roman period from Alberoni (Lido di Venezia)

Carlo Beltrame
Elisa Costa
Alessandra Forti
Stefano Marconi
Maria Ivana Pezzo

Between 1993 and 1997, fragments of a sewn ship were recovered along the beach of Alberoni, in the Lido di Venezia. Their study, carried out by C. Beltrame, demonstrated that they were part of a ship, of Roman period, of presumed big tonnage, built according to the construction technique by sewing, well diffused in the shipyards along the eastern and western coasts of the Upper Adriatic. Now, we want to present the new study of these finds, and of other finds from the same ship, recovered in the same zone in 2022, carried out by a team of the University Ca' Foscari in collaboration with the Laboratorio di dendrocronologia of the Fondazione Museo Civico di Rovereto. We present and comment the 3D digital documentation and cataloguing, carried out by E. Costa the new xylotomic analysis made by A. Forti and the dendrochronological analysis carried out by I. Pezzo and S. Marconi which have allowed to give a precise dating to these elements of elm. The documentation has been realized with a laser scanner Artec Eva and photogrammetry and gives the opportunity to better catalogue, measure, render and re-analyse the fragments.

We will discuss the regional environment in Roman times and the area of supply of the wood used on the ship according to palynological literature and archaeobotanical investigations.

The Design of Warships and Naval Fleets from the 6th to 1st centuries BC

Peter B. Campbell

The design and construction of warships have been debated since at least Torr in the 19th century, but it is only through recent discoveries that ancient naval vessels are becoming understood. Drawing on interdisciplinary datasets, including shipwrecks, numismatics, historical sources, and experimental engineering analysis, this paper examines three distinct conceptual approaches to the design and construction of warships from the 6th century BC through the close of the millennium. It demonstrates that changes in naval tactics drove changes to ship construction and, subsequently, the design of naval fleets. By examining the changes to the shape of naval rams (three types) and the construction of the ships' bows, the spread of these conceptual approaches to naval ramming can be mapped from their origins to early and late adopters across the Mediterranean. As this paper demonstrates, warships are an exceptional window into innovation and technological change in shipbuilding through time.

The curious case of blank timbers from Norwegian wetlands

Massimiliano Ditta

In Norway, a distinctive category of maritime-related material has been found over the years in the wetlands along its rugged coastline—with a notably high concentration in the South Western region. More than 30 sites have yielded what can be characterised as blank timbers for boat construction, notably unfinished and unutilised stems and keels. These artefacts appear to span a broad temporal range, from the Viking Age to potentially the post-medieval period. Presently, efforts to accurately date some of these timbers are underway, anticipating forthcoming results.

These components offer an unparalleled window into a particular facet of the Nordic clinker boatbuilding tradition, affording insights into both the locations of boat construction and the strategies employed in timber resource management. This paper aims to comprehensively examine these findings for the first time. It aims to analyse their morphological characteristics, the contexts of their discovery, and their interpretation. Furthermore, this paper seeks to explore the interplay between boatbuilding practice, the management of resources, and the broader social framework within which these activities were situated.

The 18th century Shipwreck at Nissia, Cyprus

Stella Demesticha

This paper discusses the results of two seasons of fieldwork (2014, 2017) at the Nissia shipwreck site, Famagusta Bay, Cyprus, conducted by the Maritime Archaeological Research Laboratory (MARELab) of the University of Cyprus, and funded by the Honor Frost Foundation. The study of the Nissia shipwreck, the only known shipwreck of this period in Cyprus, is still in progress but the first results contribute significantly to our poor knowledge of Ottoman period shipwrecks in the eastern Mediterranean. Moreover, the Nissia shipwreck has been engaged for decades with the maritime-oriented communities active in the area, which has added a special value to the site and its links to the local society. In this respect, the first results of the archaeological analysis were of key importance for several dissemination and public awareness activities.

The shipwreck was located at -28m, on a clearing surrounded by posidonia fields and covered by thin layer of sand. A considerable amount of wooden poles, of unknown function thus far, constituted the main movable type of artifact at the site. The fact that no other type of cargo has been located thus far, coupled with the low number of four cannons visible on the seabed, has not allowed the team to determine the function of the ship. Based on the dimensions of its diagnostic parts that have been exposed (keelson, ceiling planks, frames and a rider), however, it seemed to be of considerable size (possibly longer than 30m). Although the provenance and style of the recovered pottery place the operational zone of the vessel in the eastern Mediterranean, the wood species analysis indicate associations with north Europe. The wreck has been dated to the 18th century based on the type of the pottery and one of the cannons that was lifted, as well as dendrochronological and C14 analysis of organic remains.

SESSION 5
SHIP CONSTRUCTION

A shipwreck from the early Middle Ages
Laurent Grimbert and Marc Guyon

The design, procedure, and the pattern of the Viking boats from Gokstad
Svein Erik and Terje Planke

Äpplet – Vasa's sister ship
Patrik Höglund and Jim Hansson

Quantifying Iron Fasteners and Other Materials Used in Byzantine Ship Construction
Michael R. Jones

Villenave d'Ornon (Gironde, France) A shipwreck from the early Middle Ages

Laurent Grimbert and Marc Guyon

The wreck of Villenave d'Ornon (France) was discovered in 2013 during an archaeological diagnosis conducted by INRAP on the banks of the Garonne, six kilometers upstream from Bordeaux (France). A first phase of excavation in 2019, interrupted for technical reasons, was the subject of a preliminary presentation during the 16th ISBSA congress in Zadar (Croatia) in 2021. A second phase of excavation, in the summer of 2022, finally allowed to excavate and dismantle the entire wreck.

These interventions confirmed the remarkable state of conservation of the wreck which measures 11.20 m long, for a width of 5.90 m and a height of 1.60 m. Part of the boat's stern is missing, as is the bow, bringing the total length to almost 17 m. All the structural elements are now very precisely documented (keel, frames, stringers, planking, ceiling, girder, beams...) as well as the connections between the different parts, essentially by treenails, with the occasional presence of iron nails to reinforce certain connections. With the exception of a few fragments of ropes and a birch spoon, little archaeological material (ceramics, fauna) was discovered in the wreck.

The presence of an archaeodendrologist throughout the 2022 phase has enabled various studies to be undertaken on the wood material (xylology, traceology, dendrochronology), the results of which complete the technical knowledge. Analyses on different samples (wood, caulking plants, pitch, pollens) are also in progress in the hope of determining the geographical origin of this boat. Architectural analysis indicates a very robust boat, adapted to transporting goods. The presence of a keel indicates the possibility of leaving the fluvial framework of the Garonne and of coastal navigation. The radiocarbon dates carried out are between the second half of the 6th and the first half of the 7th century. This wreck is therefore an exceptional testimony to both the archaeology of construction methods and to the issues surrounding navigation on the Atlantic seaboard, and even beyond, at the transition between late antiquity and the early Middle Ages.

The design, procedure, and the pattern of the Viking boats from Gokstad

Svein Erik Øya and Terje Planke

The ships and boats from the North Sea Viking era (8th -11th century AD) do show some great similarity with the traditional boats from the peasant fishermen from the 19th century. The peasant, vernacular fishing boats has a clear local, cultural geographical variation. The knowledge has a local foundation and flows between peasant boat builders (Planke 2001). In our studies, we have worked systematically with the three small boats and the ship from the Gokstad grave mound (Planke, Øya and Heide 2021). At the last ISBSA, we identified and compared the patterns of different vernacular and archaeological clinker-built boats. The patterns shows some interesting and systematic variation through time and space.

Singular ships or boats from iron age has been studied to investigate the relationship between handcraft, knowledge, and social organization (Ravn 2020). Or statistical comparison has been used to look for correspondence in the variation of traits (Bill 2009). In our paper, we take one step further and show how the proper Gokstad ship, the five-room-, and the four-room boat of the Gokstad find (late 800's AD) share the same type of pattern that makes clear "rule of thumbs" for both designing the hull of the boat and at the same time administrating the building process.

The identified pattern makes the concept of division of labor possible, and thereby making large scale prefabrication of boat-parts likely. The pattern we have identified makes it possible to build ships fast, and could fit well with the need for large shipbuilding projects within a chieftain or petty kingdom society. Furthermore we want to demonstrate how the Gokstad-Pattern and the pattern of the vernacular, traditional clinker-built boats (i.e. the Sognebåt and the Sunnfjordbåt from 19th century (Planke 2001)) is remarkably different.

Äpplet – Vasa's sister ship

Patrik Höglund and Jim Hansson

As part of the research program The Lost Navy, maritime archaeologists from Vrak - Museum of Wrecks, together with the Swedish Navy, have investigated a strait in the Stockholm archipelago. In December 2021, a large wreck was found. The collapsed sides contained gun ports on two different levels – the wreck was the remains of a two-decked warship. Measurement data, technical details and wood samples combined with archival data confirmed that the wreck was Äpplet (the Apple/Sovereigns Orb), the famous warship Vasa's sister ship. Lunched in 1629, Äpplet was built by the same master shipwright as Vasa and the ships lay on their building berths at the naval yard together. When Sweden intervened in the Thirty Years' War in 1630, Äpplet led one of the squadrons in the armada of some 100 ships that sailed against Germany. The ship remained in service for 30 years, until it was sunk outside Stockholm in 1659 to block a strategic strait.

The finding of Äpplet is another key piece of the puzzle in the development of Swedish shipbuilding. How did the large warships evolve, from the unstable Vasa to the seaworthy giants that could control the Baltic Sea – a crucial factor in Sweden's emergence as a great power in the 1600s.

During 2023 and 2024 the investigations on Äpplet have concentrated on creating a 3D-model of the complex wreck site, as well as a reconstruction of the ship's stern and its sculptural splendour.

Quantifying Iron Fasteners and Other Materials Used in Byzantine Ship Construction

Michael R. Jones

Shipbuilders of all periods must strike a balance between the cost of materials and the required characteristics and durability of a vessel. In the Mediterranean of the first millennium AD, the transition from planking- or shell-based to frame-based hull construction was almost certainly related, at least in part, to the cost of materials and labor; researchers on ships of the period have proposed that shipwrecks hulls from the period show various economizing measures, from fewer and smaller planking edge fasteners and changes in the use of metal frame fasteners. One significant expense for ship construction, besides ship timber itself, were the iron fasteners used in the ships' hulls, whose size and weight can be directly measured or estimated in many cases.

This paper will present an estimate of the number and weight of iron fasteners required to build the 9th-century Byzantine shipwreck YK 14, a 14.5-meter, relatively inexpensive vessel whose hull was built primarily with treenails, and estimates to the number and weights of iron fasteners from other Byzantine shipwrecks, including several excavated by the Institute of Nautical Archaeology (INA) Yenikapı team. These comparisons, especially when combined with other materials that may be more difficult to quantify (e.g., timber, sails and rigging material), should help in estimates of the relative cost of different vessel types. Textual evidence, such as the naval inventory chapter of the 10th-century Book of Ceremonies, which includes references to nail sizes and types, sails, oars, and other ships' equipment, can be used for such comparisons, in addition to archaeological and ethnographic evidence. These comparisons can potentially highlight the relative cost differences of locally-built coasters, larger merchant ships, and state-built naval galleys.

SESSION 6
SHIP CONSTRUCTION

Ship Remains of the Southern Caspian Sea:
the only direct archaeological evidence of wooden ships in Iran
Hossein Tofighian and Shadi Kalantar

The Newport Medieval Ship: Delving into the resource requirements for the construction of a 15th century Iberian clinker-built merchant vessel
Toby Jones, Pat Tanner, Nigel Nayling

Boat complex of the II half of the XVII century near the Bulgarian coast
Dmitry Kobaliia

Byzantine Period Rigging Equipment found at the Yenikapı Excavations – Preliminary Report
Orkan Köyağasıoğlu

The Brabank wreck from Gdańsk – a well-preserved example of a medieval flatbottom vessel
Krzysztof Kurzyk, Janusz Różycki, Paweł Litwinienko

Ship Remains of the Southern Caspian Sea: the only direct archaeological evidence of wooden ships in Iran

Hossein Tofighian and Shadi Kalantar

The only discovered remains of wooden shipwrecks in Iran are in the northern part of the country along the southern coast of the Caspian Sea. To date, more than four shipwrecks have been reported from the southern coasts of the Caspian Sea, lying on the shores of Gilan and Mazandaran Provinces.

Despite being technically a lake, the Caspian is commonly referred to as a sea due to its vast dimensions, covering more than 360,000 m^2. The southern shoreline on the Iranian side consists of sandy beaches and is surrounded by dense Hyrcanian Forests that blanket the Alborz mountains.

Wooden shipwrecks, with overall lengths of 20-30 meters, rest on this sandy coast, having run aground in shallow waters and now revealed due to fluctuations in the Caspian's water level. This paper focuses on the structure of the Qoroq shipwreck situated in a village of the same name in Gilan Province.

The excavation, led by Hosein Tofighian in 2020, is discussed, and attempts are made to suggest a dating and provenance for this wreck. A comparative analysis is also presented, drawing parallels between the Qoroq shipwreck and a newly discovered, unexcavated shipwreck in Anbarsar, Gilan Province, which closely resembles the Qoroq Wreck. Additionally, a brief overview of other shipwrecks in the Southern Caspian is provided.

The Newport Medieval Ship: Delving into the resource requirements for the construction of a 15th century Iberian clinker-built merchant vessel

Toby Jones
Pat Tanner
Nigel Nayling

The Newport Medieval Ship has been the subject of continuous archaeological and historical research since it was discovered and excavated in 2002 in Newport, Wales, United Kingdom. The construction and use-life of the clinker-built ship dates to the 1450s/1460s, with a probable Basque origin and strong Portuguese trade links. The comprehensive post-excavation digital documentation of the hull timbers has created a vast and accessible archive which has revealed a wealth of new information relating to the construction and repair of the Atlantic-Iberian vessel, with hundreds of examples of toolmarks, inscribed lines, maker's marks, and repairs. Capital reconstruction and analysis of the original hull form has helped to determine the dimensions, performance, and capacity of the ship. Dendrological research, including stable isotope dendrochronology, has provided detailed information about the timber supply, including dating, provenance, and woodland management practices of the period.

To better understand the resource requirements for building a vessel such as the Newport Ship, project archaeologists have been analysing the hull timber records in an effort to calculate the amount of timber, iron, pitch, tar, animal fibre and other materials required to build and maintain the ship. Resource implications along the length of the supply chain for certain commodities will also be considered – to use iron as an example: the mining of the ore, the transport and initial smelting, the intermediate refining and the final blacksmithing of the thousands of nails, roves, bolts and other fittings. These calculations can be used to help estimate the cost, labour and construction time requirements, which can, in turn, provide insights into shipyard organisation and operation along the Atlantic-Iberian coast in the late medieval period. It will be suggested that the building of vessels like the Newport Ship required sophisticated levels of planning and organisation that impacted society at many levels.

Boat complex of the II half of the XVII century near the Bulgarian coast

Dmitry Kobaliia

A large number of wrecks have been identified and investigated as a result of the BS MAP project 2015-2017. Among 64 sites 20 are relatively small objects. Taking into account their uniformity in look (open boats), probable age (confirmed by C-14), the close proximity in the group, it is likely that they represent a single sinking event. The working hypothesis for the origin of the wrecked squadron was Zaporizhzhia flotillas voyaging in the Black Sea.

At least 14 boats show constructive similarity. A number of details like the bow bulkhead and protruding beam, traces of winding on the bow, beam for handling anchors, davit timbers can unite them into a single chronological group. Certain variability in size, proportions and construction indicates that the boats were not built at the same time and according to the same pattern. All of them were built frames first, with a keel basis in accordance with Mediterranean traditions. The boats had carvel planking and probably Lateen rigging. This is important, because in that time Cossacks used clinker system, and a carved trunk served as the keel. Unlike the Cossacks, most of these boats had devices for lifting and transporting ship anchors and were used for auxiliary purposes.

The significant percentage of boats of the same type, as well as the fact that there are no large ships among the sunken vessels, is a testament to a sudden storm and not to a battle. Most have their rigs laid down on the rowing thwarts and some have only foremasts standing, which indicates attempt to run before the storm. Boats outside the group, despite the difference in design, could be part of the same flotilla.

Byzantine Period Rigging Equipment found at the Yenikapı Excavations - Preliminary Report

Orkan Köyağasıoğlu

During the excavations carried out between 2004 and 2014 under the direction of Istanbul Archeology Museums within the scope of Marmaray-Metro transportation projects in the area where Theodosian Harbor (Portus Theodosiacus) of Constantinople is located in Yenikapı, İstanbul, a total of 37 shipwrecks belonging to different dates from the 5th to the 11th centuries AD were found. Additionally, many different types of rigging and ships' equipment used by Byzantine seafarers were also discovered. This study will share information obtained as a result of preliminary investigations of the largest Byzantine Period collection of many different types of blocks and rigging equipment, particularly halyard blocks, single sheaved blocks, and toggles from the Yenikapı excavations.

The Brabank wreck from Gdańsk – a well-preserved example of a medieval flatbottom vessel

Krzysztof Kurzyk
Janusz Różycki
Paweł Litwinienko

In 2018 during the archaeological works conducted prior to the construction of the Brabank residential estate in Gdańsk, at the very location of the early modern Bragebank repair yard, remains of a medieval vessel were discovered, lying at the bottom of an earlier, medieval canal. The 16,5 m long and 2,5 m wide vessel was probably a barge or a ferry, used in unloading ships and transporting people and goods within the Gdańsk harbour.

The hull's construction is characterized with the flat bottom and clinker planking fastened with iron nails and caulked with moss, secured with wooden lath and sintels. The construction bears traces of numerous repairs conducted by its users. The dendrochronological samples and constructional features allow to date the wreck on after 1360.

The Brabank wreck seems to be a highly interesting example of medieval Baltic shipbuilding. There are only a few similarly dated remains of rivercraft found in Poland, while the Brabank is the first almost complete wreck of Gdańsk harbour tender from the second half of the 14th century. During the research the wreck was documented using laser scanning and photogrammetry. In 2022 it was salvaged and passed on to conservation, while in 2023 it was brought to the National Maritime Museum in Gdańsk collection for further study and possible future exhibitions. The individual elements had been studied and documented, which allowed to prepare a 3D reconstruction of the vessel and an assessment of its nautical characteristics such as cargo capacity and stability.

SESSION 7
SHIP CONSTRUCTION

The tradition of shipbuilding with mortise-tenon or sewing: Coexistence in the maritime space of Aquileia
Massimo Capulli

Reconstruction of the rigging and steering mechanism of a 9th-10th c AD Shipwreck from the Black Sea
Kroum Batchvarov

Emerging evidence for plank built boat technology in Bronza Age Ireland
Karl Brady

The wood of the late Bronze age sewn-boat of Zambratija (Croatia): new data on the morphology of the pieces and preliminary dendrochronological results
Alba Ferreira Domínguez and Frédéric Guibal

Shipbuilding evidences of the millenary tradition of crossing banks
Cristóvão Fonseca et al

The monoxylas of constantine porphyrogennetos and medieval russian log boats
Petr Sorokin

The Tradition Of Shipbuilding With Mortise-Tenon Or Sewing: Coexistence In The Maritime Space Of Aquileia

Massimo Capulli

As it is well known, unlike in the Archaic period, in Roman times sewn vessels construction was was limited to the Adriatic Sea. There this technique was used in parallel with mortise and tenon construction, which was common to the rest of the Mediterranean. Emblematic of this situation is the case of the maritime space of Aquileia, where until a few years ago five cases were known. Since 2021 a bit of luck and new research have made it possible to identify four more ship remains. These nine finds date to the late 3rd century B.C. and early 4th century A.D., and consist both of ship remains and secondary sites (reuses), as well as to both shipbuilding traditions.

This research is part of the Aquileia Waterscape Project which was born from a collaboration between the Department of Humanistic Studies and Cultural Heritage of the University of Udine, and the local Superintendence, and is aimed at reconstructing the submerged landscape of the barrier island of Grado, which separates the upper part of the Adriatic Sea from the lagoon of the same name. Due to the rise in sea level, today the lagoon covers part of what was once the outskirts of Aquileia. In the lagoon, in particular, the goods had to be moved from the larger ships to the flat-bottomed ones, which could more easily reach the urban port, or travel the internal routes that connected the entire region.

The presentation will be an overview of the naval findings of Aquileia-Grado, but above all I would like to illustrate the results of the last three years of research with unpublished data on the new shipwrecks.

Reconstruction of the rigging and steering mechanism of a 9th-10th C AD Shipwreck from the Black Sea

Kroum Batchvarov

In 2016 The Black Sea Maritime Archaeology Project discovered a Byzantine-period wreck dated to the 9th-early 10th centuries AD lying at a depth of 92 meters.

This paper will address a set of finds that appear to be unique. These include the complete mast and yard, structure associated with the mast support and rigging, and the partially exposed beam for the quarter rudders. The shaft of the starboard quarter rudder is present, too, though mostly buried in the mud. Although by now a significant body of Byzantine wrecks has been excavated, documented and published, the archaeological evidence pertaining to the rigging and steering remain inadequate and are mostly limited to maststeps, blocks and one probable masthead. The Black Sea wreck is unique in having practically the entire mast and yard surviving, together with halyard blocks. The stump of the mast is still standing in situ, in context with a pillar short distance forward of it. The upper part of the mast, broken off, is lying on the wreck. The slightly tapering, broken and eroded the yard lies across and above the mast, indicating the likely circumstances of the ship's demise. Further aft, and in close proximity to the hypothesized lateen yard were found two double-sheaved blocks. The better preserved block was raised by the divers for documentation and analysis. During the cleaning, remains of rope were found around the sheaves. Samples were taken for further analysis and for C-14 dating, which confirmed the initial field date.

An equally rare survival is the beam that supported the quarter rudders. The starboard quarter rudder is also partially visible. This paper proposes a reconstruction of the rig and steering mechanism of this Byzantine period ship.

Emerging Evidence For Plank Built Boat Technology In Bronze Age Ireland

Karl Brady

In NW Europe, sewn plank boat technology has long been believed to be predominantly confined to Britain during the Bronze Age. However, recent discoveries, research, and analysis have revealed growing evidence of the use of this technology in Ireland and further afield during the second and first millennia BC. This talk will focus on the investigation of a newly discovered boat from Lough Corrib, along with the analysis and dating of an older find from Lough Derg. Together, both studies are helping to confirm that the knowledge, technology, and techniques required to build a plank-built boat were being developed in Ireland by the middle Bronze Age.

The Garraunfadda boat, originally discovered in Lough Derg in the 1930s, has largely been ignored in archaeological studies. However, a review of the original record and associated drawings taken at the time of its discovery reveals that it consisted of a logboat base with planks stitched to its sides using yew withies. Radiocarbon dating confirms that the boat dates to the Bronze Age, making it a rare example of a prehistoric extended logboat in Europe.

Another significant discovery is the Lee's Island boat, which dates to approximately 1300 BC. This boat comprises the base of a logboat that was repaired using the same components employed in constructing a sewn plank boat. The logboat had a central longitudinal split along its entire length, which was stitched back together using yew withies, longitudinal softwood laths, and moss caulking to help seal the split. Additional repair features, such as wooden cleats and transverse timbers, were incorporated to enhance the structural strength of the vessel's floor. The presence of these features clearly demonstrates that the methods used to build boats like the Dover Boat and other sewn plank boats of the period were more widespread during the Bronze Age than previously believed.

This talk will present a comprehensive overview of these findings while also addressing the evidence that supports a more widespread use of plank boat technology in NW Europe during the Bronze Age.

The wood of the late Bronze age sewn-boat of Zambratija (Croatia): new data on the morphology of the pieces and preliminary dendrochronological results

Alba Ferreira Domínguez and Frédéric Guibal

Systematic identification of the tree species used in the construction of the sewn-boat of Zambratija was carried out after the 2013 excavation campaign and the results published in 2019 in a monograph dedicated to the boat (Ferreira Domínguez et al. 2019). In this book, the results of six radiocarbon dating were also discussed (Guibal et al. 2019).

The dismantling of the wreck in 2023 provided an opportunity to observe the morphology of each preserved piece of the hull, in particular the planks that make up the main structure of this "shell oriented" and "shell-first" sewn-boat. Each section of the planking was prepared for detailed photographic dendrochronological documentation, enabling ring-widths to be measured in the laboratory.

This communication will present the results of the dendrochronological study of the Zambratija sewn-boat. It will also present the results of the study of the parent trees, assessing how many trunks were used to make the eight preserved planks. Finally, the question of the hypothesis of the expansion of the keel-plank will be also addressed in the light of the new data obtained.

Dugouts of the Lima river (NW Portugal) – Shipbuilding evidences of the millenary tradition of crossing banks

Cristóvão Fonseca
Gonçalo Correia Lopes
Pedro Caleja
Raquel Cunha

Between 1985 and 2008, six dugouts were discovered in the Lima River, located in the northwest of Portugal. Radiocarbon dating suggests the existence of at least two chronologically distinct groups. Dugouts 4 and 5 belong to the Iron Age (IV-III centuries BC), while dugouts 1, 2, and 3 belong to the Early Middle Ages (VIII-XI centuries). In January 2023, the archaeology office of Viana do Castelo City Council announced the discovery of a seventh dugout near the ridge of São Simão. The Portuguese National Centre for Nautical Archaeology (CNANS) intervened and carried out preliminary archaeological recording of the dugout in accordance with its competences.

The first six dugouts were recently listed as a collection of national interest/ national treasure, and are under the custody of CNANS/PC, IP. Through the Water World project, funded by EEA Grants, samples from both dugouts 7 and 6 were sent for radiocarbon analysis – the latter there had never been a financial framework. Currently we are awaiting the results to provide further context to the available data.

The group is heterogeneous, confirming the use of different construction processes, although some similar solutions were used within the same construction principle. In this case, the principle was the hollowing out of a single tree trunk. These archaeological finds are related to a long-standing tradition of crossing the river banks in this area, as evidenced by the local micro-toponymy, Lugar da Passagem.

The presentation aims to characterise the seven dugouts, evaluating whether there are any patterns of continuity or change over the centuries, contributing to the framing of the dugouts within their cultural and landscape surroundings.

The Monoxylas of Constantine Porphyrogennetos and Medieval Russian log boats

Petr Sorokin

Byzantine Emperor Constantine Porphyrogennetos in "De administrando imperio» described the voyage of the Rus' to Constantinople in mid 10 Century. The Eastern Slavonic tribes made in early spring dugouts, that were sent to Kiev. Rus' sailed on these vessels after equipping along the Dniepr river and coast of the Black Sea to Byzantium. Analysis of other medieval documents and archaeological finds will help clarify what these vessels might look like. Russian vessels used in the campaigns 9 - 11 centuries to Byzantium were called korabl' (ship) and lodia (boat) in Russian chronicles.

Medieval Russian log boats had two variations: simple dugout and expanded log boats (widened after heat treatment). First made of a single tree trunk have a massive hull, thick sides, and the bottom and internal partitions left after carving. The predominant vessel type in the South Rus' belong to the basin of Black sea and also in North-East Rus'` have been simple log boats and vessels based on them. Log boats expanded by heat were more common in North-West Rus' connected with the Baltic basin. Dug-out boats lodia and their varieties naboinaja and sea lodia (with additional planks), based on a log boat structure in accordance with their shape, size, and number of additional boards were used for fishing, for cargo and troops transportation along rivers and lakes, and after special equipping for sea sailing.

SESSION 8
SHIP CONSTRUCTION

Belitung and Phanom-Surin: shipbuilding in the Indian Ocean, 1st millennium AD
Tom Vosmer and Wongsakorn Rahothan

Ria de Aveiro G: a Basque boat from the late Middle Ages shipwrecked in the Aveiro lagoon (Portugal)
Gonçalo Correia Lopes and José Bettencourt

So much from so little
Jens Auer and Michał Grabowski

Archaeological Birch-bark Canoes from the Yukon River, Alaska, USA
Jason Rogers

A Solomon Island plank-built lashed-lug canoe in the Maidstone Museum Collection
Paul Clark

Belitung and Phanom-Surin: shipbuilding in the Indian Ocean, 1st millennium AD

Tom Vosmer and Wongsakorn Rahothan

The unexpected discovery in 1998 of a 9th-century sewn-plank vessel in Indonesia, the Belitung shipwreck, upended conventional thinking regarding trade routes and shipbuilding of the Indian Ocean in the late 1st millennium AD.

Due to features in its construction—sewn planks, through-beams locked in planking by halving joints and also sewn, typical of western Indian Ocean practice, it was postulated that the vessel originated in that region. Due to its fabulous cargo of largely Chinese origin it was thought the vessel was enroute from China to the Middle East.

At the time Belitung was the single archaeological example of Indian Ocean sewn-plank shipbuilding. But fifteen years later a very similar ship, Phanom-Surin, was discovered entombed in the mud of a shrimp farm seven kilometres inland south of Bangkok, Thailand. The 8-9th-century Phanom-Surin, was considerably larger, about 30 metres in length as opposed to Belitung's estimated 18 metres, but nearly identical in its methodology and salient features: sewn through-beams of identical form and similar spacing, plank seams continuously sewn with wadding on both sides of the planks, the stem mounted at similar angle using a mortice and tenon joint in the upturned end of the keel, and a distinctive huge keelson.

Although the stern of Belitung was never excavated, much of Phanom-Surin is extant, from bow to stern, providing marvellous opportunities to make comparative investigations of the structure and methodology of the two ships and to learn much about shipbuilding of the time.

While the identifications of the materials from which Belitung was constructed remain controversial, all those identified in Phanom-Surin are indigenous to Southeast Asia, raising questions about the origin of both vessels.

This paper analyses the design, structure, materials and construction methodology of the two vessels and speculates on the identity of their builders and places of origin.

Ria de Aveiro G: a Basque boat from the late Middle Ages shipwrecked in the Aveiro lagoon (Portugal)

Gonçalo Correia Lopes
Francisco Mendes
José Bettencourt

Ria de Aveiro G (RAVG) was discovered in the Aveiro Lagoon during the archaeological monitoring of the dredging works, for the construction of the solid bulk terminal of the Porto of Aveiro, which took place between October 2003 and March 2004, when fragments of planks and a clinker frame were found. The dive assessment unveiled that the site, at a depth of 10.5 m, contained a partially intact structure. The most notable features were the carved clinker floor timber, to which a ship's hull made up of several overlapping planks was attached, and the presence of iron nails between the joints. The results of the radiocarbon analysis indicated a chronology between 1290 and 1440 Cal AD.

This presentation outlines the results of the systematic study of the RAVG recently conducted. It is based on the analysis of archived documentation at the Portuguese National Centre for Nautical and Underwater Archaeology (CNANS), together with the systematic recording of the timbers. In general, RAVG features allow it to be associated with the shell-first clinker shipbuilding tradition. This tradition was predominant in northern Europe, especially in Scandinavia and north-western Europe, roughly from Late Antiquity to late Middle Ages. It was also widespread in the north of the Iberian Peninsula, particularly in the Basque Country.

So much from so little

Jens Auer and Michał Grabowski

Seeing ship timbers in an excavator bucket is a maritime archaeologists' nightmare. However, this is exactly how a small clinker built shipwreck dating to the early 15th Century was discovered in the bay of Greifswald in northeastern Germany. In June 2021 the wreck was struck by a dredger during the excavation of a trench for the landfall of an offshore power cable. Although all construction work was stopped immediately by the archaeologist on watch, the site was severely damaged.

Only a small part of the wreck could be recorded in situ and was subsequently excavated by an archaeological dive team. The majority of ship timbers were recovered out of context in the surroundings of the wreck site, leaving the investigators with an enormous archaeological jigsaw.

To extract the maximum amount of information from the scarce and dispersed evidence, all timber fragments were collected and recorded using the 3D annotated scans method. 3D prints of the individual timbers were then used to construct a working model, which helped to place many of the fragments back into context and served as a tool for the study of the shipwreck.

This paper focuses on the results of the work and presents the minor trading vessel as an example of the less prestigious small-scale coastal transport in the Baltic Sea. However, the unfortunate circumstances of discovery and the archaeological process from watching brief to excavation and analysis will also be discussed.

Archaeological Birch-bark Canoes from the Yukon River, Alaska, USA

Jason Rogers

Archaeological examples of North American bark canoes are extremely rare. While ethnographic canoe collections are found in many museums, bark canoes from buried contexts are very uncommon due to the fragility and rapid degradation of the material. Recently three examples of archaeological birch-bark canoes, all dating to approximately 200 years ago, have been identified from locations along the Yukon River, Alaska. One example appears to be approximately half of a complete canoe; the other two are smaller fragments. This presentation describes the contexts, materials, constructional elements, manufacture, decoration, and analysis of the Yukon canoes, with additional reference to ethnographic and historical accounts.

A Solomon Island plank-built lashed-lug canoe in the Maidstone Museum Collection

Paul Clark

This paper documents a plank-built, lashed-lug, bonito canoe collected from Malaita Province in the Solomon Islands by Julius Brenchely in 1865 while on a cruise of HMS Curacoa through the area. On display at the Maidstone Museum in Kent, the canoe is presented to the public as an exotic example of watercraft acquired during English colonial times in the South Seas of the Pacific Ocean. As well as providing an acquisition history, this paper also describes the methods and construction technology of plank-built lashed-lug canoe building in this part of the Solomon Islands. It also expands on a possible method for classifying similar plank-built lashed-lug canoes found in the region with the aim of suggesting a typology for identifying poorly provenanced canoes in museum collections and helping to understand lashed-lug boat remains found in the archaeological record.

SESSION 9
RECENT DISCOVERIES

Six unknown shipwrecks recently discovered within the Loire riverbed (France)
Annie Dumont et al

The Zaghemarz Shipwreck: Site Investigation, Shipbuilding Dating, Timber Sourcing, and Cargo Analysis of an 18th-Century Vessel in the Caspian Sea, Iran
Matteo Delle Donne, Saman Soortiji, Lorenzo Costantini

The Svælget 2 wreck – a cog-like cargo vessel from the 14th century – a preliminary report
Mikkel H. Thomsen et al

Six recently excavated shipwrecks in Varberg, Sweden: A status report of work in progress
Staffan von Arbin and Anders Gutehall

Six unknown shipwrecks recently discorvered within the Loire riverbed (France)

Annie Dumont
Philippe Moyat
Catherine Lavier
Jérôme Delaunay

Six unknown shipwrecks has been recently discorvered in surveys within the Loire riverbed. They range from classical Middle Ages to the modern period, with the wreck of Tronsanges (11th c.), La Marche 1 (13th c.), Saint-Satur (end of 15th c.), Marseilles-lès-Aubigny A and B (modern period, ongoing dendrochronological dating). In dire danger of erosion due to the global warming, they are the object of a preservation procedure, with excavations, dating and architectural study. These incomplete remains are particularly interesting for the middle Loire River, where naval data are particularly scarce for medieval and early modern times. Among them, the wreck of Saint-Satur is the only one with a preserved cargo, gathering stones and tiles meant for an unknown building, and mariners' tools (mallet, leather shoes).

These boats are consistent with the ones documented for this period on the Loire River and other watercourses as well: all flat-bottom hulls of oak and clinker-built. Yet, construction methods and sizes differ.

In archives, many terms are used to mention boats. Even so, it is hazardous to link one specific type to each name since these ones evolved greatly through times and are rarely combined to descriptive information. P. Mantellier[Histoire de la communauté des marchands fréquentant la rivière de Loire, 1864-68] has gathered a glossary of 11 terms employed to refer to the boats navigating on the Loire River from the 14th c. to the 18th c., without however any clue on their architectural type. Texts are mainly dealing with cargos, sometimes with some specific uses or arrangements, but also to sinking. These were quite regular in this river, where mariners had to deal with gusts of wind, ices and obstacles (sand bars, dikes and underwater stakes).

This communication would be the opportunity to present these hitherto undocumented sites, with plans yet unpublished.

The Zaghemarz Shipwreck: Site Investigation, Shipbuilding Dating, Timber Sourcing, and Cargo Analysis of an 18th-Century Vessel in the Caspian Sea, Iran

Matteo Delle Donne
Saman Soortiji
Lorenzo Costantini

The Zaghemarz shipwreck represents the first vessel remains excavated in the Mazandaran province (Iran), located on the southern coast of the Caspian Sea. The wreck was discovered in 2002 and measured approximately 28.00 m in length, 7.80 m in width, and was preserved to a maximum height of 3.00 m. The hull remains consist of the keel, framing timbers, hull planks, stringers, bulkheads, remnants of two masts, and other internal components. Among the discoveries were wooden artifacts, remains of animal bones, remnants of ropes, and three baskets, which may have formed part of the ship's stores and provisions. Wood anatomical analyses of the seven collected wood samples have identified three distinct wood species. Pinus sylvestris type and Picea/Larix type were used for hull construction planking and other construction members, respectively, while Populus was employed in tool production. Plant remains, including seeds of the Polygonaceae, Chenopodiaceae, Brassicaceae, and Rosaceae families, were identified from soil samples collected from three cargo baskets, with buckwheat (Fagopyrum esculentum Moench) achenes comprising the main component of the plant assemblage. Radiocarbon dating of three wooden samples from the hull and planks of the shipwreck suggests construction between the second half of the 18th century-beginnings of 19th century, while radiocarbon dating of the buckwheat achenes indicates sinking or abandonment in the second half of the 19th century to the early 20th century.

The Svælget 2 wreck – a cog-like cargo vessel from the 14th century – a preliminary report

Mikkel H. Thomsen
Otto C. Uldum
Morten Johansen
Klara Fiedler

In 2023 the remains of a large Bremen-type cargo vessel or 'cog' were excavated in 12 meters of water, off the present-day harbor of Copenhagen, Denmark. The preserved part of the wreck comprised the keel and substantial parts of the starboard side, up to the gunwale, including eight pairs of deadeyes for the starboard side stays as well as parts of the fore and aft superstructures which were of an unusual construction. The wreck also contained a large number of associated artefacts of both ships' equipment and personal belongings. A preliminary dendrochronological analysis dates the wreck to after 1329 AD.

Following excavation, the ship timbers have been disassembled,raised from the seabed, and transported to the Viking Ship Museum in Roskilde, Denmark. During 2024 artefacts will be post-processed and timbers documented using structured light 3D scanning and annotation in CAD-software.

Svælget 2 adds to an increasing number of wrecks of large 'cogs' or 'cogs-like' cargo vessels from the high and late Medieval period in Northern Europe. For a large portion of these finds, only the lower part of the ship is preserved. The discovery, excavation, and documentation of Svælget 2 provides an opportunity to examine constructional details of the upper parts of the structure and thereby contribute new knowledge about shipbuilding in the period.

The aim of this paper is to give a first report on the excavation and documentation of the wreck and its associated artefacts, as well as present perspectives on future studies of ship construction within the social and economic context of the high and late Medieval period.

Six recently excavated shipwrecks in Varberg, Sweden: A status report of work in progress

Staffan von Arbin and Anders Gutehall

In this paper, we provide an interim report of the ongoing recording and analysis of six shipwrecks excavated in the Swedish town of Varberg between 2021 and 2022. The shipwrecks were investigated in response to the construction of a new railway tunnel under the central part of the town. The first excavated wreck, Varberg 1, represents an all-clinker cargo vessel with an overall length of approximately 18 m and a likely building-date in the mid-1470s. Its analysis suggests that it has been used for transporting, among other things, dung and/ or living horses. Varberg 2 constituted only a minor part of the starboard side of a clinker-built vessel. A preliminary dendrochronological analysis indicates a building-date in the 1530s. Varberg 3 and Varberg 4, which were discovered within only 15 meters from each other, both constitute vessels of the bottom-based cog tradition. The initial dendrochronological analysis suggests that both ships were built in the mid-14th century. Of particular interest is Varberg 3, of which almost the entire port side of the hull, 20.5 m long and 5 m in height, was preserved. The bottom of the hold contained a uniquely preserved ship inventory, including rope, rigging equipment, and a decorative wooden pavise, or shield. Varberg 5, also clinker-built, and Varberg 6, the only fully carvel-built vessel, were only preserved in fragments and are both yet to be dated.

SESSION 10
RECENT DISCOVERIES

The Isola Dovarese logboat: the context and the boatbuilder practices
Alice Lucchini

Slave trade in Mauritus: a comparative study of legal and illegal shipwrecks
Stefania Manfio and Yann von Arnim

Two supposed lighters, one merchant ship and a small craft: A preliminary report on four ancient shipwrecks (1st-4th c. AD) recently investigated in the Rhône River
Pierre Poveda and Sabrina Marlier

The medieval boat from Rab: preliminary report
Irena Radić Rossi, Tena Blažević and Alba Ferreira Domínguez

Another medieval wreck below the modern ground surface in Tallinn
Maili Roio

The Isola Dovarese logboat: the context and the boatbuilder practices

Alice Lucchini

The paper presents the Isola Dovarese logboat, a recent find from Oglio River documented during the summer of 2022, and dated between the 5th and the 6th century AD. This early medieval logboat, 11.50 meters long, is the first find in northern Italy, presenting a large number of frames. The results of the xylotomy analysis, and the digital documentation of the logboat are displayed. The excellent preservation of this find at the time of discovery, allows us to recognize the tool marks in the wood, and extensively explore the selection of wood made by its builders.

The results of the wood analysis were compared with a wider set of data from a previous study on finds of early medieval logboats in northern Italy. This comparison allows us to outline some of the choices ofwood and tools used in early medieval logboats building. The distribution of early medieval finds is analyzed, the shapes, wooden species and dimensions of trunks of early medieval logboats are examined in order to delimit the area of wood supply.

Finally, through a comparison of available written sources, the possibility of local building yards, and the existence of norms regulating logboats use and construction is considered.

Slave trade in Mauritius: a comparative study of legal and illegal shipwrecks

Stefania Manfio and Yann von Arnim

This case study focuses on the island of Maurtius. It was uninhabited until Europeans arrived and established permanent settlements in 1638. Since then, the island has been of interest to the French and British colonial powers because of its strategic importance in military and trade. Due to naval battles, adverse weather conditions, and navigation errors, many vessels sank, resul.ng in approximately 1000 historically recorded shipwrecks today. If we include its Exclusive Economic Zone, the number of shipwrecks increases to 1215.

This paper presents two slave shipwrecks discovered in Maurtius. The first ship, the Victoire (1804), was a 220-tonage French three-masted ship from Lorient, which started to trade in the Indian Ocean in 1803. It was used as a legal slave trader during the French occupation of Mauritius.

The second shipwreck is the Coureur (1821), built in Mauritius in 1818 following a French lugger plan. The Coureur sailed during the English occupation when the trade had been declared illegal. Although theyare relativelychronologically close, they were parts of two distinct episodes of slave trading, Mauritius's history, and colonialism.

Analyzing slavery through the lens of shipwrecks makes a significant contribution to the understanding of labor migration. The ship is the largest artifact that should be studied in its totality. It is an 'object' capable of moving thousands of people—a vessel that facilitated the free and forced migration of laborers throughout the globe. Examining the social, craft, and biographical aspects of such shipwrecks can offer important new evidence and help to underscore the people and technical processes involved in various social actions necessary for building and modifying such a complex artifact.

Two supposed lighters, one merchant ship and a small craft: A preliminary report on four ancient shipwrecks (1st-4th c. AD) recently investigated in the Rhône River

Pierre Poveda and Sabrina Marlier

The Rhône Riverat Arles (Arelate) is one of the most importantarchaeological sites of south of France, The riverbed consist of an important harbour dump, dating from the Imperial period to Late Antiquity, which contains a large number of wrecks from the same period, 24 of which have been identified to date. The sedimentation of the river and the nature of its waters have enabled the remains of ancient wooden ships to be exceptionally well preserved, as demonstrated by the wreck Arles-Rhône 3, a Gallo-Roman barge raised almost complete from the Rhône in 2011 and now on display in the Musée départemental Arles antique (Mdaa). The position of Arelate, not far from the Mediterranean Sea, confers to the ancient city a special status as a port of call for both river and sea vessels. As a result, the types of wrecks lying in the river are extremely varied, presenting different sizes and architectural characteristics.

In 2023, a team of nautical archaeologists from the MdaA and the Centre Camille Jullian carried out the archaeological excavation of four wrecks previously identified. The campaign allowed to investigate the wrecks of two fluvio-maritime vessels, Arles-Rhône 7 and Arles-Rhône 14 (3rd c. AD), and one of a probable maritime merchant ship, Arles-Rhône 13 (4th c. AD). A special attention was devoted to the well-preserved wreck of a small boat with a transom, Arles-Rhône 15 (1st c. AD). This boat belongs to the horeia-type vessels already known from archaeology and iconographic sources, eg. the mosaic from Althiburus (Tunisia).

Although these four wrecks represent only a small portion of the large number of wrecks lying in the Rhône identified to date, they already give us an idea of the wide variety of ships and boats that navigated the Rhone in ancient times.

This communication will provide an initial overview of the structural system of the four vessels investigated in 2023, as well as an initial interpretation of their function within the river port system of Arelate.

The medieval boat from Rab: preliminary report

Irena Radić Rossi
Tena Blažević
Alba Ferreira Dominguez

In the construction area in the city of Rab on the homonimous island, during the archaeological inspection carried out in May 2022, the remains of two boats were discovered. The area in question was the former port of Rab, which still existed in the first half of the 19th century. It was determined that the remains of the boat Rab 1 were laid in a northeast-southwest direction, about 7 m long and about 2.5 m wide, ending in the northeast under the cemented profile of the construction area. The 14C analysis dated the boat to the 15th century.

The structure was preserved from the stern to the nineteenth frame towards the bow, where it was unfortunately interrupted by concrete filling. On its southern side, around the middle of the ship, extensive damage was caused by the action of the excavator. The entire structure was made of floortimbers, and futtocks attached to floortimbers towards the stern in the aft part of the boat, and towards the bow in its front part. It was also noticed that instead of a central keel there was a keel board, accompanied by two side beams, which probably served to stabilize the vessel.

The mediaeval boat from Rab belongs to the same shipbuilding tradition as the two finds from Nin, which were recovered in 1974, preserved and exhibited in the Museum of Nin Antiquities. Since the graphic documentation that accompanied the recovery of the Nin ships was lost over time, the remains of the ship from Rab are an excellent source of data for their high-quality reconstruction.

Another medieval wreck below the modern ground surface in Tallinn

Maili Roio

Over the past decade, several centuries-old shipwrecks have been unearthed during the developmentwork along the shores of Tallinn. This presentation provides an overview of a medieval wreck excavated in the summer of 2023, exhibiting some construction features typical of Viking ships.

The shipwreck was found during construction work on Sadama Street in Tallinn. The dimensions of the wreck are modest, with a length of 10.8 meters, a maximum width of 2.7 meters, and a height of 1.2 meters. The wreck was located approximately 1.5 meters below sea level. It is a smaller single-masted sailing ship, constructed following Nordic shipbuilding traditions. The preserved remains included the clinker-built bottom part of the ship along with the keel. The wreck had suffered considerable damage from previous construction activities, with concrete piles drilled into the ground and excavation work with an excavator causing harm to both sides of the ship. Therefore, a difficult decision was made to cut the already small wreck into pieces to retrieve it from the ground and submerge it in the preservation area in Tallinn Bay, where three other wrecks were awaiting. Next to the wreck, a heavily corroded anchor was found, with only the anchor stock remaining, featuring a hole in the bottom and one arm with a triangular fluke. Among medieval archaeological finds, anchors are quite rare, and none have been discovered near the three medieval wrecks excavated in Estonia so far.

Unfortunately, dendrochronological dating of oak planks, keel, and spruce keelson samples taken from the ship could not be successfully conducted. Considering the structural features and anchor typology, the wreck is tentatively dated to the late 13th century and the 14th Century.

SESSION 11
RECENT DISCOVERIES

The Lagoi wreck of Bintan Island, Indonesia: first evidence of metal and uncommon fastenings in the Southeast Asian lashed-lug boatbuilding
Chiara Zazzaro and Agni Mochtar

Ship construction from the ancient port of Barbir in Sukošan near Zadar
Mladen Pešić

Of square sterns and ships rigging. The excavation of a 17th century Dutch merchant vessel (Wadden Sea, Netherlands)
Thijs Coenen, Johan Opdebeeck and Arent Vos

The wreck-landscape of Süderoogsand: Recent discoveries from a desolate outer shoal in the North Sea
Daniel Zwick

A newly discovered wreck of a 16th-century English-built ship in Dungeness, England
Paolo Croce

Lagoi wreck of Bintan Island, Indonesia: first evidence of metal and uncommon fastenings in the Southeast Asian lashed-lug boatbuilding

Chiara Zazzaro and Agni Mochtar

In August 2023 an excavation was conducted to investigate a shipwreck on the white sandy beach of the northern coast of Bintan Island in Indonesia. The intertidal site was first discovered during a monsoon storm in 2016 and was initially documented by the local archaeological research office the year after. The team uncovered the tip of both ends of the ship and a small section near one end to hint that the ship belonged to the lashed-lug construction, a shipbuilding technique unique to Southeast Asia.

During the last excavation, a joined Italian-Indonesian team revealed a much larger part of the ship and confirmed that the hull is still intact above the waterline. With almost 23,40 m long and 6 m wide, this is likely to be the largest preserved lashed-lug ship to date. Besides the common features shared within this boatbuilding tradition, the boat has some particularities on its construction, such as nailed frames alongside the typical lashed frames. This is the first evidence of metal component used in a usually exclusive non-metal type of hull construction. This paper will describe the preliminary results of the ongoing excavation, focusing in particular on the characteristics of the hull construction in the wider context of technological transfers in shipping and boatbuilding within Southeast Asia and with the neighbouring regions.

Ship construction from the ancient port of Barbir in Sukošan near Zadar

Mladen Pešić

In the southern part of the Sukošana settlement, the remains of massive walls are still visible along the coast. Written sources tell us that already in the 17th century historian Šimun Ljubavac concluded that a Roman villa rustica could be located on this location. Interest in underwater structures at this site was activated in the 70s of the 20th century, when they were first documented in outline, but it was not until 2017 that systematic archaeological research, carried out by the International Centre for Underwater Archaeology in Zadar, began. In addition to the numerous researched archaeological trenches that gave insight into the construction of the ancient port, its stratification and the time of use, from 2021 the ship construction of the ancient ship is being systematically investigated. Ship construction is discovered inside the port, in the depth around 2 meters. A total of 9.53 x 3.23 m ship construction has been discovered so far. Among the ship's elements found in situ, we can recognize the keel, planks, floor timbers, futtocks, stringers and one element that could belong to the sternpost or the stem, part of the elements that belong to the upper part of the ship, as well as tenons, treenails, and metal nails. The wood samples that were collected defined the species from which the ship's structure was built, and the 14 C method dated the ship's construction to the 1st or 2nd century. Analysis of other organic material found inside the ship testified to the formation of the layers themselves after the ship was sunk. The archaeological findings give us a clearer picture of the time between the 2nd and 5th century when the port was used, as well as the maritime trade connections that passed through the ancient port of Barbir.

Of square sterns and ships rigging. The excavation of a 17th century Dutch merchant vessel (Wadden Sea, Netherlands)

Thijs Coenen
Johan Opdebeeck
Arent Vos

In the 1990s, the wreck of a seventeenth-century ship - the Burgzand Noord 9 - was discovered in the Wadden Sea near Texel, the Netherlands. The site lies in former Texel Roads, which was between the 16th and 18th century one the most important anchorages of the Netherlands. It is estimated that due to storms and treacherous currents between 500 and 1,000 ships perished here over time. Since the 1970s, dozens of these wrecks have been found. In 2013 a part of this area (Burgzand Noord), containing 16 shipwrecks, was designated a National Monument. Because of massive scouring of this seabed, these wrecks are exposed to all forms of erosion and it was clear that they could not be preserved without physical protection.

One of these wrecks is the Burgzand Noord 9. In the early 2000s, this site was investigated by the NISA (a precursor of the Dutch Cultural Heritage Agency or RCE). This non-invasive survey revealed the remains of a 40 m long, armed merchant vessel built in the Dutch Republic and loaded with grain. The find complex further consisted of cannons, luxurious Italian pottery and parts of the rigging. It was therefore concluded that this ship navigated into the Mediterranean. After this initial research the site was partially covered. Recent surveys showed in situ preservation was no longer possible because of the ongoing erosion of the surrounding seabed.

Between 2021 en 2023 the RCE therefore excavated this shipwreck and retrieved most of the finds. Although the elaboration of the data is still ongoing, the research already reveals many interesting details on the ships construction, especially on the square built stern. This lecture will present the latest results and will compare this wreck to similar finds, in order to comprehend these type of merchant vessels trading on the Mediterranean.

The wreck-landscape of Süderoogsand: Recent discoveries from a desolate outer shoal in the North Sea

Daniel Zwick

In recent years, several shipwrecks from the 17th to 20th centuries were exposed by coastal erosion, tidal currents and storms on the Süderoogsand, which is the largest of a group of outer shoals known as the North Frisian Barrier Islands, serving as a natural breakwater for the islands of the North Frisian Wadden Sea in the German federal state of Schleswig-Holstein. This shoal was notorious for strandings, so a beacon was installed as early as ca. 1611 and a system for the rescue of castaways and the salvage of cargo was refined in the 19th century.

Aside from the wreck of the Spanish barque Ulpiano, which stranded here on Christmas Eve 1870 and which imposing steel hull suddenly re-appeared in a scour in January 2013, most shipwrecks are still unidentified. Their way of construction and the preliminary results of the dendrochronological analysis indicate a very high research potential. Süderoogsand 1 wreck discovered in March 2020 appears to be a Dutch-flush construction with two layers of planking ("Double Dutch") dating around/after 1736. The Süderoogsand 2 wreck was entirely exposed by a storm in February 2022. It dates to the 18th/19th and the timber species originated from Northern America. The findings presented in this paper are interim results, as no further investigations have taken place.

The circumstances of the archaeological fieldwork on this desolate shoal presented a major challenge, as the wrecks are exposed only for a certain period of time before being reburied under the shifting sands. The documentation could only be carried out at low tide, the transfer to the shoal had to be individually organised, and landing on the open shore with a small dinghy added an adventurous aspect to the fieldwork.

A newly discovered wreck of a 16th-century English-built ship in Dungeness, England

Paolo Croce

This paper discusses the preliminary study of the remains of a 16th century wreck found and recovered in Dungeness, southeastern England, during spring 2022 while excavating in a quarry lake for aggregate. Thanks to funding provided by Historic England following an emergency funding application led by Kent City Council and Wessex Archaeology, the various sections of the wreck were recorded, before being re-deposited in the quarry. Dendrochronological analyses indicates that the construction of this ship is likely to date to the mid-16th century, with wood from the East and South-East England, thereby contributing to the limited corpus of detailed archaeological studies of English-built ships from this period.

SESSION 12
RESEARCH METHODS

3D visualisation of a 17th century ship
Ab Hoving, Johan Opdebeeck and Tomas Shuurbiers

Zambratija boat, recovery and presentation project (Croatia)
Ida Koncani Uhač, et al

Sailing Through Change: Modern Naval Engineering Approaches to Evaluating Ship Performance in the Transition from Nordic Cargo Ships to Cogs
Hernandez Jaume Montfort

The Ban Khlong Yuan lashed-lug boat: construction, capacity and performance
Wongsakorn Rahothan, Patrick Couser and Tom Vosmer

The Proof is in the Plans: Knowledge transfer and utilisation in 18th century warship design
Ida Christine Jorgensen

The Digital Network for Nautical Archaeology (DN²A)
Nigel Nayling and Jens Auer

3D visualisation of a 17th century ship

Ab Hoving
Johan Opdebeeck
Tomas Shuurbiers

In 1671 Nicolaes Witsen (1641 – 1717) published his work on Dutch shipbuilding in the 17th (and 18th) century. His publication has been the default work on the subject ever since. However, as Nicolaes Witsen was not a shipbuilding master, he wrote most of the information in a confusing and illogical manner, which makes the extensive knowledge on Dutch shipbuilding inaccessible to most. Ab Hoving wrote several books on this 17th century work to simplify the information (Nicolaes Witsen and shipbuilding in the Dutch golden age). In 2006 the idea arose to create a digital 3D reconstruction of a 'pinas of 134 feet', based on the detailed descriptions in Witsen's publication. Early attempts to create the model proved to be difficult. Between 2018 and 2021, the Dutch Cultural Heritage Agency has in collaboration with Ab Hoving and the company Tijdlab successfully created a 3D model of the pinas in the Unreal Engine, a commonly used game engine developed by Epic Games. This was the starting point for what has now become the Witsen Scheepsbouw platform (https://witsenscheepsbouw.nl).

By using 3D visualisation, the Witsen Scheepsbouw platform makes Witsen's original publication comprehendible to both scholars and the interested public. The platform currently consists of several modules allowing users to explore virtual reconstructions of 17th century Dutch ships: a gamification which allows the users to walk through different ships, a visualisation of the consecutive building steps of a ship and an extensive encyclopaedia with descriptions and 3D models of the separate parts of a ship.

The current Witsen Scheepsbouw platform is still regularly being updated and expanded. Future plans include adding riggings and furnishings to the 3D modules, increasing the interactivity such as firing a cannon, and adding 3D modules of more types of ships described by Witsen.

Zambratija boat, recovery and presentation project (Croatia)

Ida Koncani Uhač
Pierre Poveda
Marko Uhač
Giulia Boetto

The late Bronze Age sewn boat of Zambratija (last quarter of the 12th and the last quarter of the 10th c. BCE, Croatia) was discovered in 2008 and ihas been the object of several excavation campaigns, the most recent of which took place in 2013. An initial presentation of the discovery was made at the 14th ISBSA held in Gdansk in 2015, and a book presenting the main characteristics of the vessel was published in 2019.

Given the historical significance of the Zambratija wreck, which is to date the oldest fully sewn boat in the Mediterranean and the archetype of the sewn boat traditions of the Adriatic, the Archaeological Museum of Istria has set up a project to recover the wreck. The idea is for this exceptional wreck would be presented in a future new extension of the museum near the touristic port in the city of Pula.

The choice of lifting method was dictated by the fragility and size of the wooden remains. Prior to the operational phase on the field, the process of recovery was studied and designed. It was decided to recover the vessel in several pieces and to design specific supports adapted to the shape of each section of the hull. This design phase enabled the techniques to be developed, the materials to be chosen and the operating chain to be planned. The support structures used to lift the wooden sections were therefore produced from the 3D photogrammetric model developed in 2013. The supports were made from PVC assembled with stainless-steel fasteners. These materials can also be used during the conservation treatment (PEG and freeze-drying).

At the end of June and July 2023, the Croatian-French team ofarchaeologists and technicians from the museum and the Centre Camille Jullian lifted and fully documented each part of the Zambratija wreck. The dismantling and recovery also provided a remarkable opportunity for the scientific study of this unique boat. New data was obtained concerning the construction process, repairs and the watertight system. Each section of the planks was also specifically documented for use for the dendrochronological analysis and radiocarbon dating to be carried out in the laboratory.

Sailing Through Change: Modern Naval Engineering Approaches to Evaluating Ship Performance in the Transition from Nordic Cargo Ships to Cogs

Hernandez Jaume Montfort

During the 13th and 14th centuries, maritime trade in the Baltic Sea and North Sea regions underwent a profound transformation, characterized by the ascendancy of German merchants and the Hanseatic League. This shift led to the decline of the Nordic shipbuilding tradition and the emergence of cogs as the predominant cargo vessels in Northern Europe. Initially, scholars attributed this transition to the perceived technical limitations of Nordic cargo vessels, which were thought to be incapable of matching the size of cogs. However, subsequent discoveries of well-preserved larger Nordic cargo ships prompted scholars to reorient their focus towards socio-economic explanations. Despite this shift, the notion of cog's superior performance persists in historical discourse.

Given the distinct hull shapes of Nordic cargo ships and cogs, differences in performance are expected even when comparing vessels of similar sizes. However, a comprehensive performance evaluation between the two types of vessels has yet to be conducted. Employing modern naval engineering techniques, this study conducts a performance comparisonbetween 3D model reconstructionsof a Nordic cargo ship and a cog of equivalent dimensions. The aim is to investigate whether the socio-economic factors that prompted the transition from Nordic ships to cogs were accompanied by improvements in ship performance. The analysis includes weight and stability calculations, speed estimations, and seakeeping assessments on the Big Ship of Wismar (a 12th-century Nordic cargo ship) and the Bremen cog (a 14th-century cog).

The findings underscore the major role of socio-economic factors in the transition from Nordic cargo vessels to cogs, providing compelling evidence against the notion of cog's superior sailing capabilities. This study not only broadens our understanding of the driving forces behind the transition in shipbuilding traditions but also highlights the usefulness of modern naval engineering techniques in evaluating the performance of historical vessels.

The Ban Khlong Yuan lashed-lug boat: construction, capacity and performance

Wongsakorn Rahothan
Patrick Couser
Tom Vosmer

Remains of the 9th-century Ban Khlong Yuan lashed-lug boat, having languished in an open shelter for twenty-one years after being hauled from a creek bed were transported to the headquarters of the Underwater Archaeology Division located in Chanthaburi, Thailand in 2019. In relatively good condition, considering they had not been conserved, the timbers and planks were re-articulated. The remains comprised nine plank strakes, bow and stern 'wing' ends and about three-fifths of the original hull length of estimated 14 metres, plus some smaller plank fragments.

From measured lines of the reconstructed vessel a hypothetical hull form was developed. Using that hull form, various hydrostatic analyses were done using MaxSurf naval architecture software. Estimates of the likely waterline, displacement, stability, prismatic coefficient, down-flooding angle, powering requirements and likely performance were made.

Taking clues from the remains and forms of other lashed-lug boats (ethnographic and archaeological) the likely hull weight was estimated, which provided information on cargo stowage and capacity.

This paper will briefly describe the re-articulation process and the results of technical analyses, and speculate on the probable uses of the vessel.

The Proof is in the Plans: Knowledge transfer and utilisation in 18th century warship design

Ida Christine Jorgensen

In the war-ridden 18th century, shipbuilding knowledge transfer was extensive. Engaging in an arms race and building the most complicated machine of the early modern period, the navies satisfied their need for innovative shipbuilding knowledge by importing it from abroad. The methods used to gather foreign shipbuilding knowledge stretched from dockyard visits and espionage, over employment in foreign navies and in dockyards, to studying captured enemy ships. While written sources show plenty ofevidence ofknowledge which was transferred, they only partially disclose what foreign knowledge was actually utilised in the warship design. That information lies in the lines and curves of the ship plans.

This paper introduces a new method to compare historical ship plans with the aim to determine foreign influence on their design. By digitising historical ship plans in a computer aided drawing software and overlayed, it is possible to compare their lines directly. Through examples from Britain, France, Denmark, and Sweden this paper will demonstrate the method in use. It will highlight the difference between transfer and utilisation of knowledge and reveal the provenance of various warship designs.

This new method considers historical ship plans artefacts — a testimony to the decisions made by shipbuilders and administrators alike. Entering the early stages of Chaîne Opératoire, this comparative analysis supported by written sources gives an insight into the process of designing a warship. It demonstrates the abilities of the shipbuilder, available know-how and choices to be made by the state, represented by various boards and committees.

Finally, this paper outlines the ongoing development of the method, including automating the digitisation of plans to speed up the workflow and producing historically accurate 3D models.

The Digital Network for Nautical Archaeology (DN^{2}A)

Nigel Nayling and Jens Auer

The use of digital methods for the documentation, reconstruction, interpretation and curation of archaeological ship finds have intensified, developed and diversified in recent decades. During the widespread application of coordinate measuring machines (CMM) such as the Faro-Arm and linked Rhinoceros 3D software for the 3-dimensional documentation of excavated ship timbers, an informal network (FRAUG) provided a forum for sharing experience, undertaking training and fostering a degree of convergence in documentation and data standards. As digital tools, especially for data capture, have developed (such as multi-image photogrammetry and structured light scanning) there has been a growing need to reform this network. Following discussions at the previous ISBSA16 conference, where the conference theme focused on such digital developments, and a dedicated session at the Society of Historical Archaeology conference (Lisbon, January 2022), the authors applied for and secured short term funding for a refreshed Digital Network for Nautical Archaeology.

This presentation seeks to review progress of the network in terms of workshops undertaken, and platforms established for communication, debate and training. Equally, this is an opportunity to encourage debate and engagement within the body of conference participants and consider future directions for the network.

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SESSION 13
RESEARCH METHODS

Reconstructing the cargos of three Phoenician shipwrecks from the 8th and 7th century BC: Xlendi, Tanit and Elissa. Reconstruction methodology, results and comparative study
Alberto Bravo-Morata Rodríguez, Jean-Christophe Sourisseau and Timmy Gambin

Which Sources are more useful for Nautical Archaeology?
Timm Weski

Reconstructing the cargos of three Phoenician shipwrecks from the 8th and 7th century BC: Xlendi, Tanit and Elissa. Reconstruction methodology, results and comparative study

Alberto Bravo-Morata Rodríguez
Jean-Christophe Sourisseau
Timmy Gambin

The existing data for Phoenician shipwrecks is noticeably limited, even more so when it comes to cases that preserve their cargo in situ. The information on Phoenician maritime trade is indeed restricted to three shipwrecks found at deep sea: Xlendi in Malta and Tanit and Elissa off the coast of Israel.
This paper presents a recent study and reconstruction of these shipwrecks done in the framework of a PhD research at the University of Aix-Marseille in partnership with University of Malta.

The archaeological works on the Xlendi wreck, conducted since 2007 by the University of Malta in collaboration with other international partners, allowed us to study the cargo composition of the vessel and to formulate the first hypotheses about the amphoras and the grinding stones. Thanks to the photogrammetric documentation of the site, the study and 3D scans of the objects raised from the seabed, we were able to replicate the cargo visible on the surface of the site. This virtual replica permitted a hypothetical reconstruction of the cargo's stowing and an estimation of its volume and tonnage.

As for Tanit and Elissa, they were documented in 1999 by R. Ballard, L. E. Stager and the Woods Hole Oceanographic Institute. This institution generously provided access to the raw legacy data. This documentation served for an in-depth study, whilst generating new 3D photogrammetry models from the raw images. We were then able to apply the method developed on the cargo of the Xlendi wreck, to then reconstruct the stacking systems and to produce more accurate estimations of the tonnages in the cases of the Tanit and Elissa ships.

This communication will particularly focus on methodological aspects which allow the study of deep-sea shipwrecks and, finally, to present the study of their dimensions and cargo volumes. It will also address the issue of Phoenician trading patterns in Central and Eastern Mediterranean contexts during the 8th and 7th centuries BC.

Artefacts vs Written and Iconographic Evidence Which Sources are more useful for Nautical Archaeology?

Timm Weski

In the early days of nautical historic research only written or iconographic evidence was available. This applies in particular to the Mediterranean in Ancient Times. Thanks to more than half a century of nautical archaeology, we now know a lot about hull construction or the kind of wood and tools which were used, but our knowledge about other details is still limited. Therefore one has still to rely on written sources or depictions to fill these gaps. But how reliable is this evidence? Do they really convey historic facts? Do we have to correct our knowledge based on nonarchaeological matters? A sources critic will show the limitations, because hardlyever a textwas written or an illustrationwas created with a purpose to explain a nautical topic to people 2000 years later. For example, Homer's description of the building of the vessel Ulyssis used to leave the nymph Kalypso led to several imaginative reconstructions, which can hardly be called as historically correct. It was only after the discovery of the Mediterranean shell-building technique that the Homer's text was fully understood. It will be possible to show that archaeology can be used to verify written or iconographic evidence as true, but not the other way round.

SESSION 14
NAUTICAL ETHNOGRAPHY

Vernacular and learned wood boatbuilding in Italy, some developments and interactions
Marco Bonino

Traditional boat building of the Wayúu indigenous people, La Guajira, Colombia
Juan David Sarmiento Rodríguez and Carlos del Cairo Hurtado

The Dgħajsa tal-Latini: a Maltese traditional cargo boat and its role in the local economic market
Julia Zerafa

Vernacular And Learned Wood Boatbuilding In Italy, Some Developments And Interactions

Marco Bonino

Different systems were used to mould traditional hulls in Italy (eight of them are mentioned), the most developed of which (that using the *garbi*) faced modern ship design since the end of the 18th Century.
Influences from arsenals to local traditions were not significant until the 18th Century, as moulding with the *garbi*, building techniques and rigging systems of average to large crafts had common features scattered around the Mediterranean at least since Roman times, long before the growth of our Medieval arsenals, and they developed in parallel. Arsenals generally produced galleys and before the 16th Century other types of ships needed by the states were built by private yards. In some cases wars did not affect local crafts, notwithstanding the presence of shipwrights coming from different traditions.

Acceptance of moulding with orthogonal and obliquous sections (modern ship design), started from the second half of the 18th Century at cultural institutions, due mainly to French influence. Similarly even if with some resistances, did arsenals, referring also to the English school. After Napoleon's time private boatbuilding traditions had their final settlements, mainly on our western seas. Some types disappeared (*polacca*, *sciabecco*, *pinco*, *vealcciere*, . .), the size of others was reduced (*tartana*, . .) and larger types reshaped (*cutter*, *goletta*, *brigantino*, *nave*, . .), with a sort of homologation of their hulls. For example Ligurian shipwrights took practice in Toulon arsenal until 1815 and later they transferred their experience in Genoa. Notwidthstanding the push also from the programs of the technical schools since the 19th Century, small and average crafts continued to be moulded with the traditional garbi or with more archaic methods. New types of crafts were introduced and moulding systems changed, but our *maestri d'ascia* used both traditional moulding and modern design.

Traditional boat building of the Wayúu indigenous people, La Guajira, Colombia

Juan David Sarmiento Rodríguez and Carlos del Cairo Hurtado

The construction of boats by the various indigenous peoples of Latin America has allowed them to navigate the rivers, lagoons, and oceans of this vast continent from the earliest years of their occupation to the present day.
One of them is the Wayúu indigenous people, located in the north of Colombia in the peninsula of La Guajira, and a part of them, specifically the Apalaanchi, who live on the Colombian Caribbean coast, have historically configured a particular relationship with the sea, in which it has become not only a space for obtaining their resources, but has also been configured as a territory and a medium through which they mediate their relationships with other spaces and communities of shipbuilding and navigation.

Thus, it is necessary to keep in mind that the construction process and the vessels have undergone changes and continuities over time, as well as the incorporation of other designs, raw materials, and tools that respond to new needs of the community. This could be demonstrated by an ethnoarchaeological record of the operational chain of construction of the monoxile and earlier skeleton boats, together with their biography.

The construction process made it possible to understand the relationship between the ecosystem and the raw materials, the tools and knowledge for their use, the processes of transformation, structuring and use and the knowledge transmitted from generation to generation, the process of abandonment and/or reuse and the formation of the archaeological site.

Thus, the study of the biography of the objects made it possible to learn about the knowledge transmitted orally, the body gestures learned, the practices carried out, the importance of the vessels in these communities, and the symbolisms and social structures carved on them.

The Dgħajsa tal-Latini: a Maltese traditional cargo boat and its role in the local economic market

Julia Zerafa

This paper delves into the historical and cultural significance of the Dgħajsa tal-Latini, a traditional Maltese cargo boat, embodying a rich maritime legacy. This study is structured around three principal research avenues, each shedding light on different aspects of this iconic boat. The first section of the paper is dedicated to unravelling the cultural heritage value of the Dgħajsa tal-Latini. Through a meticulous examination of historical records, Archival photographs, and material evidence, we explore its identity in the Maltese cultural landscape and its role in social and economic contexts, thereby underscoring its importance as a living testament to Malta's maritime heritage.

The second part of the study addresses the question of the demand for the construction of these sizable crafts on an island with limited forest resources. This investigation involves an analysis of local boat building practices, the boat's role in a monopolised, private market and the economic and historical contexts that led to its indispensability. We examine archival documents and material evidence to investigate the chain of supply, from the commissioning of a Dgħajsa tal-Latini to its eventual use as a cargo-carrying boat.

Lastly, the paper focuses on the intangible heritage associated with building and sailing the Dgħajsa tal-Latini. Knowledge of local seafaring and traditional sailing is almost extinct in the Maltese context. Using historical and archival sources, one can begin to understand the unique sailing characteristics and navigational skills required to operate these boats while carrying out work at sea. Through this, we aim to document and preserve these diminishing skills for future generations.

By exploring these three areas, the paper not only contributes to the understanding and appreciation of the Dgħajsa tal-Latini as a traditional working boat but also highlights the broader implications for cultural heritage preservation and the preservation of traditional and intangible skills in a modern context.

SESSION 15
NAUTICAL ETHNOGRAPHY

Jãba: The Dugout Canoe of the Emberá People in Panama. An Ethnoarchaeological Study on Its Design, Shipyards, Shipbuilding, and Uses

Abner Alberda and Rita Liss Ramos Pérez

This presentation delves into some of the findings of the Proyecto Etnoarqueológico Jãba in the province of Darién and the Emberá Wounaan Territory in Panama. With an ethnoarchaeological focus, the research explores the design of watercraft, the shipyards employed, shipbuilding techniques, and their primary utilizations. The methodology incorporates participant observation and semi-structured interviews to document the construction process of various types, such as "piraguas," "chingos," "esteleadoras," "botes," and rafts. The study's conclusion underscores that shipbuilding is a complex activity demanding a certain level of expertise to ensure the seaworthiness of the vessel. The Emberá and Wounaan demonstrate adept craftsmanship, producing not only functional vessels like canoes, piraguas, and boats but also infusing their distinctive style into the designs. The end results are recognisable both geographically and culturally, allowing a skilled craftsman to identify the work of another. Shipyards constitute a fundamental structure for executing vessel construction, typically confined to a flat area and, in some cases, with rudimentary coverage. The utilisation of a jãba is diverse, encompassing both maritime and riverine environments.

Palm tree constraints and shaping canoes

Béat Arnold

The palm tree presents many constraints as a material for hollowing out and shaping canoes. This results in a number of similarities between examples observed in Asia, from the eastern coast of India to Cambodia, but also with other types of craft made from palm trees in East Africa (Tanzania and Sudan), Madagascar (to the north of Fort-Dauphin), in western Cuba and on the eastern edge of the Andes, in the Montaña.

The palm trees utilised are characterised by the peripheral nature of their support fibres, forming a compact cylinder around a patchy parenchyma that enormously facilitates hollowing the stem, but making impossible the shaping of the outside of the cylinder and the ends of the stem. Constructed in a few days and usable for at most a few years, these canoes are vital in the coastal floodplains due to their low cost and the abundance of the materials employed. They are therefore quite distinct from the logboats and bark-canoes.

The Azorean whaling boat. Ethnoarchaeology of a 19th and 20th century local shipbuilding tradition

Patrícia Carvalho, José Bettencourt, Francisco Mendes, Carla Dâmaso and Juan Martin

Whaling boats are iconic ships in Azores. They come from a tradition of whale hunting in the Islands, first made the American Whaling fleet during the 18th and 19th century and later by local communities' shore based. They were inspired by American whale boats used by the Whaler fleets that visited the Islands and adapted to better sail in Azoreans waters, and to the open boat whaling practiced locally targeting sperm whales. They were used until mid-1980 when whale hunting was forbidden in Portugal. Since then, a trajectory of change took place in the Azores, from a past of hunting whales to a present of animal conservation and cultural preservation, trough whale watching and the musealization of whaling heritage. Several whaling stations have been preserved and are musealized across the islands, and the Azores Government invested in the construction of new whale boats by ancient shipbuilders, that are now used by local communities as sailing vessels, in competitive regattas throughout the Islands. Only a few ancient and original whaling boats are still preserved nowadays, kept by State or in some cases Private owners.

Studied from a historical perspective, ancient original Azorean whaling boats have never been approached from an ethnoarchaeological perspective. A work that we have started in 2022, with the cleaning and recording original whaling boats in Horta, in the scope of CONCHA Project (H2020-MSCA-2017 GA777998). The research made with the help of volunteers from the local community included the 3D documentation of three boats and equipment used aboard in waling activities. We also recorded some moulds used in the boat design.

In this communication we intend to present the context, the documentation procedures, and a systematic analysis of the whaling boat construction features.

The fleece on the stem top of traditional boats
A legacy of antiquity?

Stefano Medas and Davide Gnola

Many symbolic decorations appear widely on traditional boats, particularly on small vessels. These symbols express, in the broadest sense, the relationship between seafarers and the sacred, sometimes as a true religious feeling and sometimes as an expression of magic and apotropaic values. Not infrequently the two aspects interpenetrate each other.

In this context is the traditional custom of placing an animal fleece on the top of the stem, basically a goat or lamb fleece. This custom is related to a ritual sacrifice and is well documented by ethnography, in the seas and gulfs surrounding the Arabian Peninsula as well as in the Mediterranean (in Sothern Italy, Spain and Portugal for instance). Until the beginning of 20th century the seafarers of those areas wrapped the stem top of their boats with a goat or lamb fleece, with the fur outward, as testimony of the sacrifice made at the launching and as auspicious symbol. We have no direct evidence for the ancient world, but the custom of performing animal sacrifices in order to celebrate the launching or to propitiate the navigation or the departure of an expedition suggests that something similar also took place in antiquity.

In traditional seafaring the fleece is often replaced by a wool wig or by a more or less stylised hardwood sculpture reproducing it. The fleece sculptures on the stems of the Adriatic trabaccoli are realistic and artistically refined, to the point of deserving a specific analysis. It is a very rare material element, preserved in only a few specimens in maritime museums.

SESSION 16
NAUTICAL ETHNOGRAPHY

From Germ to Shanshola: A Maritime Material Culture of Boats in Ezbet El-Borg at Damietta
Sarah Wagdy

The Mondal family build a chhot: hull-conception, complex joinery and a stapling tradition in a vanishing vessel of West Bengal, India
Swarup Bhattacharyya, et al

From tree to plank: A multi-disciplinary approach to the study of wood use in boatbuilding in Egypt through time
Lucy Semaan

Haabjas – Expanded Logboat of Estonia
Aivar Ruukel

From Germ to Shanshola: A Maritime Material Culture of Boats in Ezbet El-Borg at Damietta

Sarah Wagdy

Ezbet El-Borg has been regarded as an important coastal city by Damietta Governorate from antiquity to the present. Bogas Village, Esbeh, and Borg Village are the names that have been referred to it for a long time. These names are all related to its location near the mouth of the Damietta Nilotic branch in the Mediterranean Sea, on the eastern bank, where a defensive towerwas constructed. Due to its strategic position at the confluence of the Mediterranean Sea, Lake Manzala, and the River Nile, their inhabitants have been able to engage in a variety of maritime activities that have shaped its rich maritime history. The most notable of these activities is maritime commerce. The marine transportation history of Ezbet El-Borg from the Ottoman era until the early 20th century relied on a variety of cargo sailboats, about which Arab and European travelers were informed about the names, functions, and some of their distinguishing characteristics. The Germe and Shakhtura were the prevalent types of cargo sailing boats in Ezbet El-Borg. Besides this commercial activity, there was a fishing activity in Ezbet El-Borg on the shore of the Nile, Mediterranean and in Lake Manzala.

The city was also inhabited by fishermen beside the owners of Germe and sailors, but the fishing activity was not as famous as the trading activity till the early 20th century. In about the fifties of the 20th century due to various factors some of these boats became propelled by engines it did not last long until its use stopped, and it was abandoned on the shores of Ezbet El-Borg, then it's remains vanished completely during the first decade of the 21stcentury. From the late 20th century until the present time, maritime activity in Ezbet El-Borg is dominated by artisanal fishing with its motorized fishing boats, of various types and sizes, namely Gar, Sennar, and Shanshola boats.

The Ezbet El-Borg's maritime cultural history has not been the subject of any ethnographic or historical studies. This paper will aim to present the types, sizes, equipment, and uses of boats used in Ezbet El Borg from the Ottoman era to the 20thcentury, through the examination of textual, iconographic, and photographic evidence during this period. furthermore, as the boating industry in this region is a private industry that was inherited by families, despite the cessation of building the sailing boats and shift to building motorized fishing boats, fortunately, material knowledge of the past traditional sailing boats, their production system, and marine professions associated with, and the technical terms is still active among the minds of the old boatbuilders in Ezbet El-Borg. The research will rely on the ethnographic approach to reveal the missing valuable information about the mentioned sailing boats to access a comprehensive record of the history of boat manufacturing in Ezbet El-Borg, in past and present.

The Mondal family build a chhot: hull-conception, complex joinery and a stapling tradition in a vanishing vessel of West Bengal, India

Swarup Bhattacharyya
John P Cooper
Zeeshan Shaikh
Vasant Shinde

This paper discusses the specially commissioned construction of a rarely built, 10.5m-long chhot boat by the Mondal family of boatbuilders on the Rupnarayan River estuary, West Bengal, India. The double-ended chhot is—in etic terms—a shell-conceived vessel, originally used for fishing, ferrying and local cargo-transportation. Its planking is fixed together along its edges according to a tradition of the Ganges Delta region—using metal staples—and its framing attached using clenched nails. Although the stapled-construction tradition appears robust more generally, vessel types such as the chhot have disappeared from the Rupnarayan as a consequence of sedimentation of the river channels, in turn the result of upstream barrage construction; the new environment favours more-flat-bottomed dinghis.

The chhot is remarkable for several reasons. Its stapling technique has not been reported widely or in detail outside West Bengal and Bangladesh. The majority of its hull planking is laid 'parallel' to the keel and posts—not hooded into them—and is edge-joined using staples along a continuous rebate. The joinery of keel, posts, and planking is elaborate. Although the hull is shell-built, its framing acquires a late, 'active' role in forming the final shape. And the anti-fouling mix is based on the stringent juice of a variety of persimmon fruit.

Our project documented in detail the Mondal family's highly skilled and remarkably rapid construction of the chhot in October–November 2022 as a project in the British Museum-based Endangered Material Knowledge Programme. It followed all aspects of the family's construction of the vessel, from their ritual preparations and materials acquisition through the entire build to the launch, a period of some 30 days. This paper focuses in particular on the strategies that the family deploy during construction to ensure size, proportion and symmetry, as well as the stapling and joinery techniques deployed throughout.

From tree to plank: A multi-disciplinary approach to the study of wood use in boatbuilding in Egypt through time

Lucy Semaan

Egypt has long been perceived within scholarly boat research as a country lacking natural wood resources for boatbuilding. However, a closer examination of the production system and the history of traditional shipwrightry reveal a more nuanced picture. This paper considers the development of the use of wood in traditional boatbuilding in Egypt as informed by a wide range of source material. It draws on related primary sources and available archaeological evidence from Pharaonic Egypt through to the Graeco-Roman period and the medieval Islamic period. The ethnographic enquiry focuses on the types of timber used in boatbuilding in Egypt and introduces their vernacular names. In addition, it explores the extent to which indigenous timbers were harvested and assesses the reliance on imported wood in the present and the past. This paper seeks to shed light on timber trade and the timber exploitation processes; and examines how these were embedded in the geopolitics and socio-economics of the time.

Through direct observation, this author has also recorded and documented the timber exploitation processes from acquisition to manufacturing; as well as the conceptual, sensorial, and physical parameters and variables that come at play in the metamorphosis of a tree into a boat part. Thus, the ethnographic research presented in this paper has the merit to document a vanishing craftsmanship, that is, wooden boatbuilding in Egypt. It also illuminates and colours interpretations of the subject in the past. By interlinking diverse pathways of enquiry drawing on texts, archaeology, and ethnography, this paper provides the field of maritime archaeology a deeper understanding of wooden boatbuilding and argues that there is merit in applying a multi-disciplinary model to the study of wooden boats.

Haabjas - Expanded Logboat of Estonia

Aivar Ruukel

The building and use of expanded dugout boats in Estonia's Soomaa national park was added to UNESCO's Intangible Cultural Heritage in Need of Urgent Safeguarding list in December 2021. Although dugout canoes are built in many places around the World, Soomaa region has the only living culture of expanded logboats within the European Union. Today only five master boat builders remain, the author of this abstract is one of the five men.

"Haabjas" is a boat, hollowed out from a single log and expanded by using fire. Boats are made from Populus tremula, in Estonian "haab". "Haabjas" means "aspen boat". In Scandinavian languages this boat is "äsping" or "esping", in Russia the boat is "osinovka", aspen is "osina".

"Haabjas"-boats form an essential part of everyday culture for Soomaa residents. Until the mid-nineteenth century, they were used for daily transport and fishing. With the advent of modern and cheaper boat types and extensive road networks, dugout canoes are no longer indispensable for everyday life. Despite their continued cultural significance and recreational uses the "haabjas" is now threatened by factors such as a lack of knowledge-transfer between masters and apprentices, weak demand for use of logboats, the limited availability of raw materials, and declining populations in the Soomaa region.

Today, preserving the tradition is the main role of the Soomaa logboat builders. The stories, legends and rituals that surround the "haabjas" are more valuable than their practical use in daily life. The building of a dugout canoe is a communal activity involving masters, apprentices and other community members. Boat building is a complex process, beginning with the selection of a suitable tree and culminating with the boat's launch. The paper will explain the construction technique and processes in detail. a large and healthy aspen tree.

SESSION 17
EXPERIMENTAL ARCHAEOLOGY

Reconstructing the late Viking-Age warship, Skuldelev 5: the evolution of the imperfect reconstruction
Martin Rodevad Dael and Tríona Sørensen

The first special forces of the North – written evidence and experimental trials concerning seaborne sabotage, kidnapping and reconnaissance operations in the Viking Age and early Medieval Period
Morten Ravn

Grado I shipwreck: 3D complete reconstruction and hydrostatic analysis
Elisa Costa, et al

Reconstruction hypothesis of a Late Hellenistic ship Ilovik-Paržine 1 (Ilovik Island, Croatia)
Anton Divić, et al

Anatomy of a sinking
Pat Tanner, et al

The simultaneous excavation and reconstruction of an early 16th Century Watership in the Zuiderzee-area, The Netherlands
Wouter Waldus

Reconstructing the late Viking-Age warship, Skuldelev 5: the evolution of the imperfect reconstruction

Martin Rodevad Dael and Tríona Sørensen

Since its discovery in 1962, the 11th century ship-find, Skuldelev 5, has remained something of an enigma. Its long and slender hull, equipped with a single sail and 26 oars, quickly identified the vessel as being a warship – albeit, at the smaller end of the scale when compared to other contemporary and much larger warships, such as Skuldelev 2 and Roskilde 6. However, the composition of the ship's hull – the quality of the materials, the extensive re-use of components from other ships and the ship's overall aesthetic – raised a number of questions concerning Skuldelev 5's cultural historical context, many of which still remain unanswered.

In 1991, the Viking Ship Museum in Roskilde, Denmark, launched HELGE ASK, the Museum's first full-scale reconstruction of Skuldelev 5. While HELGE ASK, and the ship's volunteer crew, have been instrumental in establishing the sailing capabilities of Skuldelev 5 and developing our understanding of 11th century seafaring, our approach to reconstruction at the time resulted in a ship with a rather different aesthetic appearance than that of the original.

Since HELGE ASK's construction, our reconstruction methodology has advanced and developed, and in 2022, a new full-scale reconstruction of Skuldelev 5 began at the Museum. This new reconstruction provides an opportunity to re-asses the technical aspects of Skuldelev 5 as a ship-find with its many imperfections, the methods used when building experimental archaeological reconstructions and how all of this sheds light on the cultural historical context within which the ship was built.

This paper will therefore present a detailed analysis of Skuldelev 5 from the perspective of both boatbuilder and archaeologist, re-opening the debate concerning Crumlin-Pedersen's original interpretation of Skuldelev 5 as a ledingsskib (ship of the levy) while also exploring the research and dissemination potential of embracing imperfections when building full-scale reconstructions of archaeological ship-finds.

The first special forces of the North – written evidence and experimental trials concerning seaborne sabotage, kidnapping and reconnaissance operations in the Viking Age and early Medieval Period

Morten Ravn

The early 13th century book Gesta Danorum (the history of the Danes) mentions several examples of special forces at work. They conduct seaborne sabotage, kidnapping and reconnaissance operations remarkably similar to the operations conducted by special forces today. These reconnaissance operations were of vital importance for the large-scale amphibious military operation of the Norse in the Viking Age and early Medieval Period.

Finding a suitable place for landing warriors, cavalry and equipment was paramount for a successful outcome of such seaborne military operations, and combined with the special forces' other operations, such as sabotage and kidnapping, the small units in small boats contributed significantly to the numerous Scandinavian military campaigns.

In this paper, I will discuss the written evidence of the special forces at work in great detail. However, the written accounts provide limited information about the design and sailing capabilities of the small boats utilized in these operations.

We must therefore turn to the archaeological finds to investigate these aspects. Boat-finds like the expanded boat from Tuna in Badelunda, Sweden (dated to c. 9th century AD), the three Gokstad boats from Norway (dated to c. AD 895) and the boat found near Gislinge in Denmark (dated to c. AD 1130). The paper will present these boats in detail, and together with the results of newly conducted (in 2022 and 2023) experimental paddling and rowing trials with reconstructions of the above-mentioned Scandinavian boat-finds, the written evidence for special military operations will be contextualized and explored even further. The experimental trials aimed at investigating aspects such as: average and top speed of the boats utilized, and how to conduct the operations as silently and stealthily as possible.

Grado I shipwreck: 3D complete reconstruction and hydrostatic analysis

Elisa Costa
Pat Tanner
Carlo Beltrame

The Grado I shipwreck was discovered in 1986 at a depth of 15 m, 6 miles off the coast of Grado (Gorizia); it has undergone numerous excavation campaigns that have seen the complete recovery of the cargo and the hull in ten years.
The remains of the hull are well preserved, including important elements for the identification of the shape, up to the gunwale in a little portion of one side.

After the preliminary modelling of the in-situ hull and cargo based on archive and legacy data and the identification of the original shape of the boat and the hull lines through the correction of the distortions of the shape, we have continued with the reconstruction of the missing wooden elements.

An important modelling phase concerns those elements whose shapes and dimensions can be reconstructed on evident signs of their existence on the hull. Other elements, such as the rudder, the deck or the mast, are hypothesised based on archaeological comparisons, permitting us to obtain a completed hypothetical model of the boat.

Digital software is then used to analyse and study the internal spaces of the hull and examine the original stowage and calculate the weight of the boat and cargo. A 3D model facilitates a number of hydrostatic calculations, allowing the determination of different conditions of loading, drafting and seaworthiness. The first hydrostatic analyses were performed estimating the complete weight of the hull, considering the properties of the woods and their distribution. Then, we can calculate the tonnage, understand the original disposition of the amphoras in one or two levels and calculate the displacement and stability conditions.

Reconstruction hypothesis of a Late Hellenistic ship Ilovik-Paržine 1 (Ilovik Island, Croatia)

Anton Divić
Pierre Poveda
Igor Miholjek
Giulia Boetto

The Late Hellenistic shipwreck Ilovik-Paržine 1 (Paržine Bay, Ilovik Island, Croatia) has been systematically excavated between 2018 and 2022 by a joint international team led by I. Miholjek of the Croatian Conservation Institute (HRZ) and G. Boetto of the Centre Camille Jullian (CCJ). It has been presented on ISBSA 16 in Zadar, with the publication forthcoming.

The relatively good state of preservation of the ship's structures allowed us to formulate and effectuate a research project aimed at proposing hypothetical reconstructions of the shape, structure and technical system of the original ship. This reconstruction project has been carried out in 2022 by A. Divić (NavArchos) in close collaboration with P. Poveda (CCJ) within the framework of "e-Culture – Digitalization of cultural heritage" project implemented by the Croatian Ministry of Culture and Media.

The reconstruction process of Ilovik-Paržine 1 ship, developed by the CCJ, took into account abundant archaeological data, digital 3D models of the remains, physical scale models, and digital 3D modeling, thus combining established nautical archaeology methods with modern digital approaches.

This paper will present results of the 3D reconstruction of the shape, structure, and technical systems of the Ilovik-Paržine 1 ship, as well as the methods applied to obtain them. An emphasys will be placed on the hydrostatic analyses of the reconstructed vessel as well, useful in determining its navigational and transport capabilities.

Anatomy of a sinking

Pat Tanner
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This presentation examines the events surrounding the capsizing of the Kyrenia Liberty on the 29th of September 2023. Kyrenia Liberty is one of three replicas of the Kyrenia shipwreck, a 4th-century BC Greek merchant ship discovered and excavated in the region off Kyrenia in 1965. The initial research project involved departing Limassol Marina with a plan to sail west towards Paphos. During this voyage, various points of sailing and several sail plan configurations were documented electronically using video, 360° photography, and data logging. Speed, course, heading, heel angles, and wind data were all recorded by the Sailmon® sailing instruments.

During the first afternoon, in moderate sea and weather conditions, the starboard side rudder failed, followed shortly thereafter by the remaining port side rudder failing. The ship suffered a loss of steering shortly before 18:00 hours, which resulted in the capsizing of the vessel. While the digital recording equipment was lost during the incident, the capsizing brought a new research aim into focus: understanding the capsizing and highlighting its underlying causes. With this new aim in mind, the project team collected a 3D laser scanning model, enabling the evaluation, and testing of its three-dimensional dataset. This will facilitate the recreation of the events surrounding the incident and its underlying causes. It will also support additional research to examine alternative scenarios, such as modifying the internal ballast, reconfiguring the sail plan, and assessing the potential impact lead sheathing might have had on the outcome.

With gratitude to the Kyrenia Chrysocava Cultural Foundation, the Kyrenia Liberty crew, Pilots and crew of the Cyprus Police helicopter, the Navy personnel at Evangelos Florakis Naval Base, Joint Rescue Coordination Center "ZENON" at Larnaca Airport and the Larnaca General Hospital Ambulance staff. This project is funded through the support of the Honor Frost Foundation.

The simultaneous excavation and reconstruction of an early 16th Century Watership in the Zuiderzee-area, The Netherlands

Wouter Waldus

Among the most fascinating shipwrecks of the Zuiderzee-area are the so called watership. They were originally designed to function as trawler with a built-in central fishing-well to transport the catch alive to the market. However they are equally well known as tug, towing large seagoing ships to and from Amsterdam. Additionally they could be equipped with a gun and transport armed soldiers in times of war. It is one of the rare examples where written sources, iconography and archaeology yield enough similarity in data to assign a ship type to a wreck site. Watership have been in use from the 14th century onto the beginning of the 19th century and the nautical technological evolution of Dutch shipbuilding can be studied in the 40 shipwrecks known until today.

From 2022 onwards the archaeology department of the Dutch Cultural Heritage Agency organizes each year a nautical fieldschool studying on one of the oldest watership-wrecks known in the former Zuiderzee area. The opportunity to excavate a shipwreck on land offers students an unique learning experience. Parallel to this project, Batavialand in Lelystad works on the full scale reconstruction of a watership based on the documentation of a shipwreck that was excavated and well recorded in 1986.

Students work on both projects and practice excavation techniques and wood-construction techniques in shipbuilding. This interaction stimulates the students to better interpret field data in relation to the way ships were constructed at the time. In this presentation I will elaborate on the interaction and results of this archaeological and experimental nautical project.


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