



# ISBSA

**14** International  
Symposium on Boat  
and Ship Archaeology

## Baltic and beyond

Change and continuity in shipbuilding  
National Maritime Museum in Gdańsk  
21-25 September 2015



**55** 1960 · 2015  
YEARS

**ISBSA 14. International Symposium  
on Boat and Ship Archaeology  
Baltic and beyond**

Change and continuity in shipbuilding  
National Maritime Museum in Gdańsk  
21–25 September 2015

**Book of Abstracts**

**Symposium organizer**

National Maritime Museum in Gdańsk

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**NATIONAL  
MARITIME  
MUSEUM**  
in Gdańsk

Cover: National Maritime Museum in Gdańsk,  
photos by Dariusz Krakowiak, Piotr Krajewski

**Ministry of  
Culture  
and National  
Heritage of the Republic  
of Poland**



**Prezydent  
Miasta Gdańska**  
PAWEŁ ADAMOWICZ



At the start of this conference I would like to present a brief outline of the history of our museum in the context of the work we have been doing on the history of shipbuilding, where we have been making use of archaeological, ethnographic, pictorial and written sources.

Founded in 1960 as a result of the efforts of the Society of Friends of the Maritime Museum, our institution from its inception was faced with the problem – one that every museum has to solve – of how to acquire exhibits. Fifteen years after the end of the war, there were hardly any appropriate ones; those that had survived the war were already in museums founded earlier – the Maritime Museum in Szczecin (founded in 1947) and the Naval Museum in Gdynia (founded in 1953).

In this situation, the Maritime Museum in Gdańsk – after 1960 with the status of a local museum and running on a very modest budget – was unable to fill its display rooms with its own exhibits. So in order to acquire some, diverse activities were undertaken. The most fruitful of these turned out to be the idea of the Museum's then director, Przemysław Smolarek, to search for historical objects under water. The Museum began this search in 1968, at the same time attracting a team of associates from diving clubs and the assistance of experts from the Maritime Office and the Polish Maritime Salvage Service in Gdynia. This led to the successful development of underwater marine archaeology in Poland. Acting in favour of this was also the government's plan to construct the Northern Port in Gdańsk. Already in 1969, while trawling the future roads and anchorages of this port in the Gulf of Gdańsk, the crews of ships from the Maritime Office and Polish Ship Salvage Service discovered the wrecks of two timber vessels, which received the designations W-5 and W-6 in the Museum's register.

Even at first sight, it was clear that the Museum had come across two wrecks of exceptional historical value. From one of them, W-5, which later turned out to be a mediaeval hulk, we recovered oval-shaped, cast slabs of copper, after which the wreck came to be known as the Copper Ship. From the other one, W-6, divers recovered twenty bronze cannon, as well as hundreds of other artifacts. Sixteen of the cannon were Swedish ones from the late 16<sup>th</sup>-early 17<sup>th</sup> century, two were Russian from the times of Ivan the Terrible; there was also a Polish one, cast in 1560 for King Sigismund August, and one bearing the coat-of-arms of the Lithuanian Radziwiłł family. This latter wreck was taken to be the remains of the Swedish warship "Solen", which sank during the battle with Polish ships at Oliwa in 1627.

The activities of the Society of Friends of the Maritime Museum and the Museum's management led, in 1972, to its being renamed as the Central [Polish] Maritime Museum, an institution now of national status. This act, as well as the fact that the Museum was now financed by the Ministry of Culture and Art, was of enormous significance for its further development.

The successful underwater archaeological explorations carried out by amateur divers in cooperation with the Museum persuaded Director Smolarek to create a specialist department employing diver-archaeologists and an expert in underwater photography. To improve this group's operational capabilities, the Museum acquired a type B-12 supercutter from the Koga company in Hel in 1973. Bearing the name "Modra Woda", this vessel was used until 1975. A conservation laboratory was also opened, as at that time no conservation workshop in the country was capable of properly preserving the artifacts recovered from under water. In 1974 Maria Dyrka, a chemistry graduate from the Gdańsk University of Technology, took up employment as a restorer. Today she is the chief restorer and deputy director of the Museum. In 1974 the Museum obtained from the Gdańsk City Authorities a small historical building, the Żuławy Gate, which was converted for use as a conservation workshop and laboratory. This is where the restoration of the cannon recovered from the wreck of the "Solen" was later completed.

In 1975 our Museum acquired a further cutter withdrawn from service, which had until then served as a fisheries research vessel. It was in good condition and turned out to be useful for our archaeological exploration purposes. The craft received the name "Wodnik". With our own ship we could now complete our explorations of wreck W-5 and get the remains of this wreck and its cargo ready for recovery. This operation was carried out in 1975 and 1976 with the assistance of the Polish Navy and archaeologists from the Nicholas Copernicus University in Toruń. The following year we resumed work on wreck W-6.

Cooperation with the Maritime Office, diving clubs and the Polish Maritime Salvage Service yielded further wrecks: by 1978 we had more than 20 in our register.

Independently of the Museum's underwater archaeology explorations, its first Director, Przemysław Smolarek, had for many years been doing research into Scandinavian boatbuilding from the time of the Vikings, after which he began to delve into the history of Slavic boatbuilding from the same period. Apart from this, ship modellers working with the Museum and under the Director's guidance attempted to reconstruct in model form early Mediaeval Slavic boats, Vistula ships from the 17<sup>th</sup>–19<sup>th</sup> centuries, Pomeranian vessels from the Middle Ages and Renaissance, not to mention the ships on which sailed Józef Konrad Korzeniowski, the English maritime writer, originally from Poland, who is known to the world as Joseph Conrad. The fruits of all this work are a variety of models in scales 1:10, 1:20 and 1:50, which have added richness to our permanent displays. The first articles began to be published on research into historical boatbuilding, among which are Przemysław Smolarek's essays on early-mediaeval Slavic shipbuilding which, though published as long ago as 1968, which remain valuable sources to this day.

The results of our researches into historical shipbuilding led to some of our staff being invited to the 2<sup>nd</sup> International Symposium on Boat and Ship Archaeology in Bremerhaven, and two of our Staff members gave talks at the subsequent symposia in Stockholm and Porto.

In the 1980s the Polish Maritime Museum achieved further successes in archaeology, especially along Baltic coast: five wrecks from the 15<sup>th</sup>–16<sup>th</sup> centuries were discovered in meadows near Tolkmicko, the wreck of an 11<sup>th</sup> century Slavic boat was recovered during drainage work at Czarnowsko on Lake Łebsko, and another wreck of an early-mediaeval boat was discovered in Puck Bay and subjected to preliminary examination. This was the second early mediaeval archaeological site that we were systematically exploring for wrecks.

In 1984 our Museum opened a branch in Tczew – the Museum of the Vistula. This is situated on the premises of a former factory, and some of the buildings have been converted into conservation workshops. All the buildings there required refurbishing and adaptation, but for lack of funds, we still haven't been able to complete this work. There were also plans to construct a hall for the display of large exhibits, but they too remain on paper.

Independently of the research work being carried out in 1987–1989, preparations were under way for the opening of our first permanent display in the new exhibition complex that we had acquired on Ołowianka Island. This exhibition – “Poland on the Baltic” – was formally opened on the 26<sup>th</sup> of September 1989.

On the 19<sup>th</sup> of June 1991, our Director, Przemysław Smolarek, died suddenly. In the same year, Dr Andrzej Zbierski was appointed his successor, as was his deputy, who is speaking to you now.

Our regular participation in ISBSA events led to our being granted the right to organize the 8<sup>th</sup> such conference in Gdansk in 1997. More than 100 experts from all around the world took part, and the post-symposium materials published by our Museum were received with acclaim.

After 1987 our underwater archaeological explorations were pursued from the research vessel “Kaszubski Brzeg”. Our greatest success in this respect was the discovery in 1995 of the English ship, the “General Carleton”, built at Whitby in 1777; she was wrecked in a storm off the beach near Dębki in 1785. This was the 32<sup>nd</sup> sea water wreck examined by the Museum. Our achievements in underwater archaeology, documented in articles published in highly-ranked journals, were rapidly achieving worldwide recognition.

The final years of the 20<sup>th</sup> century brought us the first experiences in implementing programmes funded by the European Union. These were the NAVIS I and II programmes, to which we were invited to attend by the Museum of Ancient Seafaring, Mainz.

Then came other projects, both local – Baltic – ones and those within the framework of EU programmes. One of these in which our Museum took part was MACHU (Managing Cultural Heritage Underwater) in 2007–2009. Headed by Dutch specialists, this programme also involved partners from England, Northern Ireland, Portugal, Denmark, Germany and Poland. Its main objective was to develop tools and techniques for locating, monitoring and conserving underwater

cultural heritage. One of the project's more important achievements was to create a foundation for developing a system of administering and monitoring underwater archaeological heritage in the waters of the participating countries.

In another project our Museum took up cooperation with the curator of historical monuments in Mecklenburg with the aim of conserving the underwater cemeteries that are the wrecks of German war transport ships sunk in 1945.

Since the year 2000 our representatives have been taking part in the Working Group for underwater archaeology, appointed by the Cultural Heritage Monitoring Group of the Baltic Sea countries, established by the region's Ministers of Culture. Among other things, this group has drawn up a list of 100 archaeological sites in the Baltic requiring urgent conservation, which may in turn ensure that they are added to the list of UNESCO World Heritage sites. Moreover, this group developed a set of good practices, to be applied during underwater explorations, and also during underwater tourist expeditions, for example, to view wrecks.

In consequence of an agreement in 2005 between the Provincial Governor of Pomerania and the Museum's director, confirmed by the Minister of Culture (General Curator of Historical Monuments), our Museum became the curator of underwater relics in waters in the province of Pomerania in order to ensure better protection for historical wreck sites.

Our underwater archaeologists regularly make fresh discoveries. The results of the work by Iwona Pomian and her team on the early mediaeval port in Puck and the wrecks found there have generated great interest among the ship and boat archaeologists. The discovery in 2003 of the bow section of a wrecked 13<sup>th</sup>-century cog in the port basin at Rowy – the first of its kind in Poland – was a revelation. Another important undertaking was the archaeological work by Waldemar Ossowski and his team in 2003 at the site of an 18<sup>th</sup> century river ship discovered at Krosno Odrzańskie. Even more sensational were the results of the archaeological exploration of the wreck of a river ship in an ox-bow lake at Czersk near Warsaw. Thanks to funding from the Ministry of Science and Higher Education, work was carried on there in 2009 on a large scale, which enabled the excavation and documentation of an almost intact, late-15<sup>th</sup> century wreck, identified as an early example of a szkuta. Further discoveries of Vistula ships from the 17<sup>th</sup> and 18<sup>th</sup> centuries were made during hydro-engineering work on the former banks of the Vistula in Gdańsk. In 2012 and 2014 the bow sections of two river ships of the szkuta type and also a lichtuga, once known as a burdyna in Gdańsk, were discovered there and excavated.

In the last few years we have been surveying further potential archaeological sites, discovered during hydro-engineering works in the Polish zone of the Baltic by the Maritime Office, the Maritime Institute and the Polish Navy. Usually we focused on a preliminary exploration of the site and an assessment of its possible historical value. By the end of 2009 we had nearly 70 wrecks on our books; now we have more than 80. Cooperation with the Polish Navy, whose hydrographic



and salvage vessels have helped to pinpoint deep-water obstacles, we have been able to identify several new sites. One of them is the wreck of a vessel that we call the "Corn Ship". It was documented from the Navy's submarine robot, which not only transmitted footage of the hull's appearance but also took samples of the timber structure for further study. The robot's equipment enabled it to collect some of the artifacts lying around the wreck, like a large stone jar containing butter, and other small items of everyday use. In cooperation with the crew of the Marine Institute's ship, we were able to recover part of a transport of 18<sup>th</sup> century cannon cast in Sweden from another wreck lying in about 80 m of water. Again, the wreck discovered in 2012, known as the "Glass Ship", is what remains of a vessel from the first half of the 17<sup>th</sup> century. It was carrying a varied cargo, most of which had probably been taken on board in Gdańsk. Evidence for this are the numerous little bottles with tin stoppers stamped with the Gdańsk coat-of-arms and the marks of local tinsmiths.

The comprehensive studies of the history of inland boatbuilding and shipbuilding at our Museum include facilities for carrying out detailed analyses of authentic, original materials, such as structural elements of historical ships, which we and other museums have in our collections. The aim is to establish the place and time when a given ship or boat was built. One such project, entitled "East Pomeranian shipbuilding in the Middle Ages in the light of dendrochronological analyses" was carried out by Waldemar Ossowski; it received funding from the Polish Committee for Scientific Research.

Members of our staff publish the results of their conservation work on organic and inorganic objects of historical interest, recovered from both fresh and salt waters. In this context, our Conservation Workshop is unique in Poland. We make use of the latest techniques such as the polyethylene glycol method, vacuum freeze-drying and the sucrose method. In view of the problems with the hull of the "Vasa" warship, it was also important to find ways of getting rid of the sulphur acids that form around iron fittings during the conservation of wood with polyethylene glycol. In consultation with Swedish experts, we have been addressing this problem in our laboratories.

In the autumn of 2013, during the 55<sup>th</sup> anniversary celebrations of the Society of Friends of our museum, Professor Małgorzata Omilanowska, then deputy Minister of Culture and National Heritage, informed us that our institution had been granted the status of National Maritime Museum.

For many years now, the Ministry of Culture and National Heritage has organized a competition in several categories for the "Museum Event of the Year", the first prize for which is the "Sybilla" statuette. Our Museum has regularly participated in this competition, often receiving distinctions, and sometimes that coveted first prize. In 2009 the competition jury awarded the Museum the third prize for the monograph on the "General Carleton", edited by Waldemar Ossowski, to which more than a dozen authors contributed, some from abroad. In 2015 for the publication entitled "The Copper Ship – A Medieval Shipwreck and its Cargo", also

edited by Dr Ossowski, and published as Volume II in the series "Archaeological Research of the National Maritime Museum in Gdańsk", we received first prize in the scientific research category.

In recent years our Museum has published a number of other works, including Waldemar Ossowski's individual study of the transformations in Polish inland boatbuilding, and Robert Domżał's "Ships and their crews on the Lower Vistula in the 13<sup>th</sup>–15<sup>th</sup> centuries."

The Museum's tasks in conserving and popularizing underwater historical objects has led to certain concrete construction projects being included in its development plans. Fifty percent of these projects have already come to fruition. One involved the expansion of the laboratories recording objects of archaeological interest and conservation laboratories, which are now located on the ground floor of a new building, the Maritime Culture Centre erected in 2012. At present, work is in hand at our Tczew branch, where next to the Museum of the Vistula we are building the Centre for Conservation and Reconstruction of Historical Ship Wrecks and the Collections Research Area – both structures are being financed by EEA funds and subsidies from the Ministry of Culture and National Heritage. The third aspect of this plan is the construction of the Museum of Underwater Archaeology and Baltic Fisheries in Łeba. For this we have acquired an attractively situated piece of land as well as the funds for organizing an architectural competition for designing the building. We chose this particular location for this future branch of our Museum not only as a result of the invitation and attractive proposal in the part of the Łeba municipal authorities, but also because on the shores of the nearby Lake Łebsko, in the late 19<sup>th</sup>–early 20<sup>th</sup> centuries, Prussian archaeologists identified the wrecks of early mediaeval boats they had discovered there as coming from the times of the Vikings. In this building we are planning a hall given over to Slavic shipbuilding in the early Middle Ages, in the West known as the Viking era. This is where the wrecks of the boats from Orunia, Puck and Lake Łebsko will be on display. This exhibition will inform visitors that during that era, the Slavs and their boats on the Baltic were at times the partners of the Vikings, at times their enemies.

Regardless of the Museum's investment plans, which I expect will be implemented in the near future, I hope that in the years to come, the National Maritime Museum, under the leadership of my successors, will continue to lay emphasis on the further development of underwater archaeology and the study of historical boat- and shipbuilding.

**Jerzy Litwin**

Director of the  
National Maritime Museum  
in Gdańsk

# Programme

## **Sunday, September 20th**

### **Artus Court in Gdańsk**

18.00–19.00 Pre-Registration

19.00–20.00 Reception

## **Monday, September 21st**

### **Conference room situated in the complex of Granaries**

8.00–18.00 Full Symposium registration and poster set-up

9.30–9.45 Opening – Minister of Culture and National Heritage of Poland Prof. Małgorzata Omilanowska

9.45–10.10 Keynote speaker – Prof. Sean McGrail

10.10–10.30 Welcome – Director of the National Maritime Museum in Gdańsk Jerzy Litwin

**10.30–11.30 Coffee**

### **Session: *Ships and Ships Finds in the Baltic***

#### **Conference room situated in the complex of Granaries**

Chairman Jerzy Litwin

11.30–11.50 Mike Belasus – *Those bits and pieces from the Baltic shores – Evidence for medieval shipping along the German Baltic Sea coast*

11.50–12.10 Klara Fiedler – *Large clinker built cargo vessels in Northern Europe in the late medieval period – The Mönchgut 92 wreck in context*

12.10–12.30 Maik-Jens Springmann – *The building and metrology of ships in the medieval – free creativeness or constructional and standardised building?*

12.30–12.50 Petr Sorokin – *The medieval vessels in the northwest Russia on written and archaeological sources*

12.50–13.10 Wojciech Filipowiak – *Early medieval shipbuilding of Wolin*

**13.10–14.10 Lunch**

### **Session: *Ships and Ships Finds in the Baltic***

#### **Conference room situated in the complex of Granaries**

Chairman Jens Auer

14.10–14.30 Iwona Pomian – *Latest archaeological researches led by National Maritime Museum in Gdansk – new challenges*

14.30–14.50 Maili Roio – *The preliminary research results of the Kadriorg shipwrecks*

14.50–15.10 Xenius Nielsen – *Dock Island's Wreck 3: New Studies into the Clinker Construction and Origin of a 15<sup>th</sup>-Century Ship Find from Copenhagen's Harbour*

15.10–15.30 Michał Grabowski – *Another double-planked vessel from Poland. An local tradition of converted planking shipbuilding as adaptation for shoreline condition*

**15.30–16.00 Coffee**

**Session: *Ships and Ships Finds in the Baltic***

**Conference room situated in the complex of Granaries**

Chairman André F. L. van Holk

- 16.00–16.20 Tomasz Bednarz, Janusz Różycki – *Research of the wrecks in the Gulf of Gdansk using photogrammetric 3D documentation*
- 16.20–16.40 Niklas Eriksson – *Riksäpplet: a neglected wreck that comes into favour*
- 16.40–17.00 Patrik Höglund – *Ships and Space – the spatial arrangement of Vasa 1628*
- 17.00–17.30 Christer Westerdahl – *Topography and adaptation. An bird's eye view of the maritime cultural landscapes in a Baltic perspective*

**Tuesday, September 22nd**

**Session: *Maritime Landscapes and Harbour Installations***

**Conference room situated in the complex of Granaries**

Chairman Benno van Tilburg

- 9.00–9.30 Jorge Freire – *Cultural identities and maritime communities: the maritime cultural landscapes of the Seixal Bay (Portugal)*
- 9.30–10.00 Alessandro Luciano – *The maritime landscape of Naples in the Byzantine period*
- 10.00–10.30 Yftinus van Popta – *Dynamics of the maritime cultural landscape of the Zuiderzee between 1100 and 1400 AD*

**10.30–11.00 Coffee**

- 11.00–11.30 Patrícia Carvalho, José Bettencourt, Gonçalo Lopes – *Between the South and the North: an overview of the Medieval or Early-modern Aveiro lagoon shipwrecks (Portugal)*
- 11.30–12.00 Thomas Dhoop – *Ships, Harbour Installations and the Maritime Townscape of Medieval New Winchelsea, UK*
- 12.00–12.30 Jens Auer, Martin Segschneider, Oliver Nakoinz – *A fortification in murky waters. Recent investigations of a submerged part of Dannevirke in the Schlei Fjord*
- 12.30 Photo Shot

**12.45–14.00 Lunch**

**Session: *Recent Discoveries of Remarkable***

***Ship Finds or Significant Sources***

**Conference room situated in the complex of Granaries**

Chairman Nergis Günsenin

- 14.00–14.20 Ronald Bockius – *Caisson or craft? Further Roman ship finds from Mainz, Germany*
- 14.20–14.40 Staci Willis, Massimo Capulli – *The Sutiles Project: An Investigation of Roman Era Laced Vessels of the Upper Adriatic Sea. The First Two Years of Research*
- 14.40–15.00 Carlo Beltrame, Elisa Costa – *The Late-Roman barge of Comacchio (Ferrara) S. Maria Padovetere, preliminary report*

- 15.00–15.15 Miran Erič – *New contribution to understand development of Rivers/Lakes shipbuilding tradition in 1st century AD: the case of Sinja Gorica barge, Vrhnika, Slovenia*
- 15.15–15.30 Sergey Olkhovskiy – *The Phanagorian shipwreck: continuation of study*
- 15.30–16.00 Coffee**

**Session: Recent Discoveries of Remarkable Ship Finds or Significant Sources**

Conference room situated in the complex of Granaries

Chairman Giulia Boetto

- 16.00–16.20 Stella Demesticha – *KARAVOI: Documentation of Ship Graffiti on the Medieval and post-Medieval Monuments of Cyprus*
- 16.20–16.40 Massimo Capulli – *The Precenicco Shipwreck. A vessel of the 11th century AD from Stella river*
- 16.40–17.00 José Bettencourt – *The Angra B Iberian shipwreck (Terceira island, Azores, Portugal). An excavation report*
- 17.00–17.20 Irena Radić Rossi, Mariangela Nicolardi – *The Post-Mediaeval Shipwreck of Gnalčić (Croatia) in the light of new discoveries*
- 17.20–17.40 Pablo de la Fuente de Pablo – *Triunfante: a Jorge Juan's 68-gun ship of the line*

**19.00 Conference Dinner Brovarnia Hotel Gdańsk**

**Wednesday, September 23rd**

**Session: Research Methods**

Conference room situated in the complex of Granaries

Chairman Nigel Nayling

- 9.00–9.20 Katrin Thier – *The early cogs – ships and words at home and abroad*
- 9.20–9.40 José Manuel Matés Luque, Oskar Moral Goirigolzarri – *3D Laserscanning of a mid 20<sup>th</sup> century Basque fishing vessel: the Antxustegi, a model for the digital recording the Basque traditional fleet*
- 9.40–10.00 Kotaro Yamafune, Rodrigo Torres, Filipe Castro – *A Proposed Methodology for Recording and Analyzing Shipwreck Sites Using Multi-Image Photogrammetry*
- 10.00–10.30 Pat Tanner – *The testing and analysis of Hypothetical Ship Reconstructions*

**10.30–11.00 Coffee**

**Session: Research Methods**

Conference room situated in the complex of Granaries

Chairman Fred Hocker

- 11.00–11.20 Taras Pevny – *Beyond La Belle. Longitudinal design concepts in frame-first construction: reassessment and implications*

- 11.20–11.40 Emmanuel Nantet – *The accuracy of the tonnage formula and the correcting coefficient*
- 11.40–12.00 Nicholas Ball – *Block models: change and control in early eighteenth century Royal Naval shipbuilding in Britain*
- 12.00–12.30 Nigel Nayling, Ana Crespo Solana, Ignacio García González – *ForSEADiscovery: Forest Resources for Iberian Empires: Ecology and Globalization in the Age of Discovery*

**12.30–14.00 Lunch**

**Bus ride to Gdynia**

**Thursday, September 24th**

**Session: *Studies in Ship Construction***

**Conference room situated in the complex of Granaries**

Chairman Patric Pomey

- 9.00–9.20 Katerina P. Dellaporta – *Ships in Greek Byzantine Iconography*
- 9.20–9.40 Ida Koncani Uhac, Marko Uhac and Giulia Boetto – *Sutiles naves in Istria: preliminary results of the study of the ship finds from Zambratija and Pula (Istria County, Croatia)*
- 9.40–10.00 Edoardo Riccardi, Virgilio Gavini – *Naval construction in 5<sup>th</sup> century AD: evidences from the architectural analysis of the Wrecks R1 and R2 from the Port of Olbia*
- 10.00–10.15 Taner Güler – *Construction Features and Reconstruction of Yenikapı 20 Shipwreck*
- 10.15–10.30 Evren Türkmenoğlu – *Yenikapı 27 Shipwreck: Hull Analysis and Reconstruction*

**10.30–11.00 Coffee**

**Session: *Studies in Ship Construction***

**Conference room situated in the complex of Granaries**

Chairman Yaacov Kahanov

- 11.00–11.20 Francesco Tiboni – *Repairs on ancient hulls: direct evidences of bow section's reconstruction*
- 11.20–11.40 Laura White – *An Industry or an afterthought? Archaeological and historical evidence for the production of waterproofing materials for ancient ships*
- 11.40–12.00 Ingunn Undrum – *Ropes and rigging from the Barcode excavation in Oslo Norway*
- 12.00–12.15 Grace Tsai – *Comparative Archaeological Analysis of Ship Rigging during the Sixteenth and Seventeenth Centuries*
- 12.15–12.30 Dan Atkinson – *The Ship Beneath the Floor: The archaeological investigation of an assemblage of naval ship timbers discovered in the Wheelwright's Shop at the Historic Dockyard in Chatham, England*

**12.30–14.00 Lunch**

**Session: Studies in Ship Construction**

**Conference room situated in the complex of Granaries**

Chairman Mike Belasus

- 14.00–14.30 Alice Overmeer – *A missing link in a period of change: shipwreck U34 in Flevoland, the Netherlands*
- 14.30–15.00 Juan Pablo Olaberria – *A new proposal about the conception of hull shape in Dutch-flush construction. Re-reading Arnauld 1670 and Witsen 1671*
- 15.00–15.30 Eric Rieth – *The EP 1-Epagnette wreck of the middle of the XVIII<sup>th</sup> century: an inland “flat-bottom” boat of the river Somme (France)*

**15.30–16.00 Coffee**

**Session: Experimental Nautical Archaeology**

**Conference room situated in the complex of Granaries**

Chairman Eric Rieth

- 16.00–16.20 Patrice Pomey, Pierre Poveda – *Prôtis Project: Gyptis sailing trials*
- 16.20–16.40 Yaacov Kahanov – *The Ma’agan Mikhael replica project*
- 16.40–17.10 Morten Ravn – *Viking Age War Fleets. Resource management and military organisation in late Viking Age Denmark*
- 17.10–17.40 Fred Hocker – *Ships, shot and splinters: field-testing a 17<sup>th</sup>-century 24-pounder naval gun*

**18.00 Next conference discussion (ISBSA 15, 2018)**

**19.00 Film night**

- *Gyptis*, 63 min
- *Lake Sevan* (Armenia), 26 min
- and others

**Friday, September 25th**

**Session A: Bark, skin, logboats**

**Conference room situated in the complex of Granaries**

Chairman Ronald Bockius

- 9.00–9.20 Aleydis Van de Moortel – *A new typology of bronze age Aegan ships and boats: developments in Aegan shipbuilding in their historical context*
- 9.20–9.40 Karl Brady – *Underwater Investigations of Prehistoric and Medieval Logboats from Lough Corrib, Ireland*
- 9.40–10.00 Staffan von Arbin, Maria Lindberg – *News on the Byslätt bark canoe*
- 10.00–10.30 Béat Arnold – *Bark-canoes of East Africa: typology and construction techniques*

**10.30–11.00 Coffee**

### **Session A: *Bark, skin, logboats***

#### **Conference room situated in the complex of Granaries**

Chairman Waldemar Ossowski

- 11.00–11.20 Evguenia Anichtchenko – *Ancient boats of the Arctic: towards understanding the potential of skin boat archaeology*
- 11.20–11.40 Krzysztof Zamościński – *Hide boats on the Lower Dnieper River in 16<sup>th</sup> century*
- 11.40–12.00 Darina Tully – *Change and Continuity in the Skin Boat Tradition in Ireland*
- 12.00–12.30 Roderick R. Stead – *The Building and Development of Philippine Logboats*

### **Session B: *Far Eastern Vessels***

#### **Conference room situated in the Maritime Culture Centre**

Chairman Benno van Tilburg

- 9.00–9.20 Li-wen Chia – *The Treading and Technology of Dye-root in East Asia – A Focus on Fishing Net, Sailcloth and Clothes Preservative*
- 9.20–9.40 Daniel G. Dwyer – *External stern-lashings on Southeast Asian Watercraft: new evidence for early technological regionalism in boat construction*
- 9.40–10.00 Zeeshan A. Shaikh – *Ramponchem Vode: A Regional Boat type of Goa, India*
- 10.00–10.30 Wen-Ling Hong, Jeng-Horng Chen, Jr-Ping Wang, Meifang Kuo – *The Technology Development and Mixing of Taiwan's Traditional Wooden Boats*

**10.30–11.00 Coffee**

**12.30 Closing remarks by Thijs Maarleveld**

Conference room situated in the complex of Granaries

**Saturday, September 26th**

**Post Symposium tour**



## Poster Programme

Karen Balayan – *Navigation on lake Sevan (Armenia) in ancient times*

Natasha Bani-Sadr, Adam Collins, Michael Ekenstedt,  
Daniel Diez Merida – *Blåvand Bjergebåd*

Giulia Boetto, Irena Radič Rossi – *Ancient ships from Cissa (Island of Pag, Croatia) in their cultural and historical context*

José Luis Casabán – *Design and construction of late 16th-century Spanish galleons: The Twelve Apostles (1589–1591)*

Chelsea Colwell-Pasch, Andrew Roberts, Peter Harvey, Wendy Van Duivenvoorde, Jonathan Benjamin – *The Archaeological Investigation of the Leven Lass: A 19th Century Scottish Brig Wrecked in Australian Waters*

John S. Davis – *The problems involved in reconstruction the original hull shape of a 15th-century Venetian galley*

Beñat Eguiluz-Miranda – *The Atlantic shipbuilding and the new transition in the Iberian Cantabrian tradition, 1560–1680*

Michael T. Ekenstedt, Adam Collins – *Quern stones and Edutainment: The shiesty business of Captivating an Audience*

Jonas Enzman – *Arbeitsgruppe für Maritime und Limnische Archäologie*

Miran Erič – *Initiative "Early Watercraft – A global perspective of invention and development"*

Cristóvão Fonseca, José Bettencourt, Tiago Silva, Inês Coelho, Patrícia Carvalho – *The early modern Belinho Ship (Esposende, Portugal): a first report*

Maria Jose García-Rodríguez, Jose Luis Gasch-Tomás,  
Ana Crespo Solana – *Development of a GIS for Iberian ships in the Age of Discovery in ForSeaDiscovery Project*

Philipp Grassel – *Reused medieval ship timbers found at the Frankenhof, Stralsund (Germany)*

Marc Guyon – *The barge of the 2nd c. AD Lyon Saint-Georges 4 (Rhône, France)*

Wen-Ling Hong, Jeng-Horng Chen, Jr-Ping Wang, Meifang Kuo – *The Technology Development and Mixing of Taiwan's Traditional Wooden Boats*

Dmitry Kobaliya, Andrew Denysenko – *Investigation and restoration of the "baidak" type boat on Khortitsaisl. (Ukraine)*

Lars Kröger – *Within the network of fluvial ports. Efficiency and infrastructural development of inland waters and their vessels*

- Victor V. Lebedinski, Sergey Zelenko, Julia A. Pronina – *Results of the latest underwater archaeological investigation near the Crimea*
- Paweł Litwinienko – *New anchors founds in the Gulf of Gdańsk*
- Sabrina Marlier – *The gallo-roman barge Arles-Rhône 3*
- Adolfo Martins – *The Anatomy of Trees & Ships: How can we see trees in their timbers?*
- José Manuel Matés Luque – *Away from the sea, close to the water: the recording of some flat bottomed boats in Spanish inland rivers*
- Laure Meunier-Salinas – *Interdisciplinary collaboration on a 2nd c. AD barge project, archaeology and conservation of Lyon Saint-Georges 4 (Rhône, France)*
- Maria Molina Intxaustegi – *Shipbuilding in the Spanish Colonies During the 18th Century: The Havana Shipyard and their Ships*
- Liselore An Muis – *Remarkable find of the wreck site by Hasselt, the Netherlands*
- Mariangela Nicolardi – *Archaeological and historical perspectives on merchant shipwrecks' national identity: late 16th century Venetian ships case-study*
- Waldemar Ossowski – *Shipwrecks from the Vistula River near Gdańsk as examples of longue durée of transport system*
- Marcel Pujol i Hamelink, Pablo de la Fuente de Pablo – *The English shipbuilding in the Spanish shipyards (1749–1767). How to identify the Spanish and English construction details in shipwrecks from the mid-18th century*
- Jennifer Rodrigues, Jun Kimura, R. John Watling, Masako Marui, Anna Bradley – *Scientific analysis on lead ingots from the Western Australian Museum's Ko Shi Chang and Pattaya shipwreck collections*
- Emilio Rodríguez-Álvarez – *Deep blue sea. Diving in the ancient Mediterranean*
- David Ruff, Irena Radić Rossi – *Roman Ship in the Ager of Ancient Salona, capital of Roman Dalmatia – Preliminary Results*
- Simon Stephens – *The Ship Model Collection at the National Maritime Museum, Greenwich: A Rich Resource for Maritime Researchers*
- Ana Rita Trindade – *Written sources in the study of timber provenance in Spanish shipbuilding: the 18th century Andalusian case*
- Katheryna Valentynova – *Unique Finds from the Sunken Medieval Italian Galley. Weapon*
- Caroline Visser – *Wreck from Kampen*
- Jr-Ping Wang, Wen-Ling Hong, Meifang Kuo, Jeng-Horng Chen – *The Conservation and Research Problems of a Pacific-Crossing Junk Free China*

**Evguenia Anichtchenko**

University of Southampton, United Kingdom

## **Ancient boats of the Arctic: towards understanding the potential of skin boat archaeology**

Covering over 100,000 km of coastline, the skin boat traditions of the Arctic and Subarctic zones are arguably among the most expansive watercraft technologies in the world, going back at least 10,000 years ago, and in some circumpolar regions, probably even older. In rough geographical terms it extends from 50° to 82° North latitude and from 161° East to 20° West longitude. The ethnic spread of the tradition includes seventeen Native nations of Eurasia, North America and Greenland. Despite this impressive presence, the history of these watercraft remains poorly understood. Most of the scholarship dedicated to Arctic skin boats focuses on ethnographic data, the chronological depth of which rarely exceeds two hundred years. Archaeological finds are often overlooked either because the researchers are unaware of their existence or, more often, because of the challenging nature of these data. Finds of complete or nearly complete boats are very rare. Most boat-related artifacts are fragments, undated and often with inconclusive stratigraphic provenance. At the same time, vessel-derived artifacts are a fairly standard occurrence in the coastal archaeological sites of the high Arctic, particularly in North America, inviting more serious considerations of their research potential.

This paper presents some results and observations of the author's on-going study of the archaeological record of skin-covered watercraft from Arctic North America with a specific focus on the recent discovery of 1,000 year-old kayak and umiak remains from the Birnirk archaeological site in Barrow, Alaska. The site's environmental conditions allowed for preservation of a rich complex of boat frames, which in turn inspired a joint Smithsonian Institutions and University of Alaska initiative in computer-modeled reconstruction of these boats. In addition to engaging modern technology, special effort was given to incorporating the knowledge and expertise of Inupiaq elders, whaling captains and boat builders of Barrow, Alaska.

## **Staffan von Arbin, Maria Lindberg**

Bohusläns Museum, Sweden / Länsstyrelsen Västerbotten, Sweden

### **News on the Byslätt bark ‘canoe’**

Göteborgsstadsmuseum (Museum of Gothenburg), Sweden, holds in its possession a unique, but not very well-known collection of prehistoric boats. An exception is the renowned *Åskekärr ship* – Sweden’s only excavated find of a Viking Age *knarr* – which is now on permanent display in one of the museum’s exhibition halls. All the other boats are stored away and not publically accessible. One of the most puzzling finds in this collection is the so-called *Byslätt boat*, which was discovered in 1934 during construction works by the river Viskan. The excavation that followed the discovery revealed remains of a ‘canoe-like’ vessel; constructed from a large elm bark cut-out, with ribs made from thin hazel branches. A geological assessment indicated a date of the find to between 700 B.C. and 1000 A.D. Common opinion has been that the boat was built and used during the Iron Age. Based upon current knowledge the Byslätt bark ‘canoe’ represents, to this day, the only find of its type in Europe. Despite this and its frequent reference in both Nordic and international publications, the find has never been properly published.

In 2011 new research of the Byslätt boat was initiated as a collaboration between the maritime archaeology unit at Bohusläns museum, the collections department of Göteborgsstadsmuseum and the Maritime Archaeology Programme (MAP) at Syddansk Universitet in Denmark. This research included a <sup>14</sup>C-analysis of the bark hull. Analysis revealed, quite surprisingly, that the vessel in fact was built c. 900–800 BC, i.e. the late Bronze Age. This is a period in Scandinavian prehistory from which contemporary boat finds, other than a few dugouts, are lacking. The result therefore has implications on the ever continuing debate on whether Scandinavian Bronze Age boats were made from skin or wood. Can it be that some vessels depicted in Scandinavian rock art in fact are representations of boats of the ‘Byslätt type’? This paper reviews the research history of the Byslätt boat and presents the results of recent research efforts.

**Béat Arnold**

Switzerland

## **Bark-canoes of East Africa: typology and construction techniques**

Simple and complex bark-canoes are still quite frequently used in East Africa, as recent observations of *nikhula*, *kapepe* and *muterere* by the author in Tanzania and in Mozambique show. The diversity of these crafts makes it easier to identify the major constraints imposed by the raw material used and to underline the importance of the knowledge of the methods of waterproofing as well as the relation between the time necessary for the fabrication of the canoes and the duration of their utilisation. This parameter in particular plays an essential role in the fabrication of complex embarkations such as the bark-canoes of the American Indians. A general typology was elaborated based on these parameters and characterised by the intrinsic rigidity of the tree barks, a distinctive factor secondarily influenced by human intervention and the duration of the activity. This general typology can be extended to a global scale. Similar considerations were detailed by D. Davidson (1935), based on the canoes made by the Australian Aborigines. Finally, many similarities between bark-canoes and logboats can be established, such as the structural resistance proper to the axial element.

Translation: Jeannette Kraese

**Dan Atkinson**

Wessex Archaeology, United Kingdom

## **The Ship Beneath the Floor: The archaeological investigation of an assemblage of naval ship timbers discovered in the Wheelwright's Shop at the Historic Dockyard in Chatham, England**

The remarkable discovery of a suite of dislocated ship timbers and ship planking discovered in 1995 beneath the floor in the Wheelwright's Shop at the Historic Dockyard in Chatham represents a particularly rare, if not unique archaeological find, and one of the most significant discoveries of its kind found to date perhaps anywhere in the world.

The 169 ship timbers represent a variety of well-preserved ship components used to support the floor of the Wheelwright's, the details of which were surveyed and recorded during initial investigations in 1997. Since then the significance of the discovery has become increasingly apparent and highlights timbers consistent with a British ship of the line dating to a period between the mid-18<sup>th</sup> and early 19<sup>th</sup> century. Historical research has subsequently identified the likely ship from which the timbers have come to *HMS Namur*, a ship built at Chatham and which enjoyed a distinguished service career and battle honours – equal to that of *HMS Victory*. Recent investigations undertaken as part of the HLF funded 'Command of the Oceans' Project at Chatham have revealed yet further insights into the ship timbers and the purported connection with *HMS Namur*.

Dr Dan Atkinson has worked on the project since the discovery of the ship timbers in 1997 and will present the findings of the archaeological investigations; highlight how both historical and archaeological enquiry have maximised our understanding of the remains and their wider context; illustrate the use of both traditional and digital 3D survey techniques to help with analysis and interpretation and potential 3D modelling and reconstruction; and highlight the future of the remains as the centre piece of the story of the dockyard at Chatham during the Age of Sail as part of the 'Command of the Oceans' initiative.

## **Jens Auer, Martin Segschneider, Oliver Nakoinz**

University of Southern Denmark, Denmark / Archäologisches Landesamt  
Schleswig-Holstein, Germany / University of Kiel, Germany

### **A fortification in murky waters. Recent investigations of a submerged part of Dannevirke in the Schlei Fjord**

The Dannevirke is a defensive structure, which stretches from the marshes around the rivers Treene and Eider in the west across the Cimbrian peninsula to the Baltic coast in the east. Construction probably started as early as the 5<sup>th</sup> century AD, but the main palisade ramparts (Dannevirke Phase 1) could be dendrochronologically dated to 737 AD.

Although the Dannevirke has been subject of archaeological investigations since the 19<sup>th</sup> century, it is still not fully understood and recent excavations have produced unexpected results. However, archaeology has mainly focused on the parts of Dannevirke, which are visible in the landscape.

But Dannevirke also seems to have a maritime component. In 1925, a submerged timber structure was discovered in 3m of water near the Peninsula Reesholm during the dredging of a shipping channel in the Schlei Fjord on the eastern coast of the German state Schleswig-Holstein. With the Schlei Fjord providing marine access to the well-known nearby trading site Haithabu, archaeological authorities were informed of the discovery at the time. But the wooden structure was quickly disregarded as a later protection of the shipping channel and received no further archaeological attention until 1992. Between 1992 and 1997, the wooden structure was part of a research project, which resulted in its interpretation as part of Dannevirke.

Building on this project, a new investigation of the submerged structure in the Schlei was started as a co-operation between the Maritime Archaeology Programme at the University of Southern Denmark, CAU University Kiel and the Archäologisches Landesamt Schleswig-Holstein. A first field work season was undertaken in 2014, but work will continue in the course of the 2015. This project focuses on identifying the full extent of the structure using geophysical and diving methods and understanding the monument in its contemporary landscape.

Establishing the process of construction is another objective of the current research. In addition to presenting the results of the project, this presentation will also focus on the methodology employed to carry out archaeological recording in zero visibility.

## **Karen Balayan**

“AYAS” Nautical Research Club, Armenia

\*poster

### **Navigation on lake Sevan (Armenia) in ancient times**

Boats and rafts were discovered much earlier than the wheel. Thus were the rivers, lakes and seas, means of connected people, countries and civilizations and not of separating them.

Armenia was a trade crossroad beginning from the prehistoric times. Navigable rivers and big lakes provided trade connections from the ancient times. Written evidences since Hittites and Assyrian times and archaeological artifacts attest it.

A dugout boat, 4 meters long and 0.6m wide, dated 15 c. BC was found in the tomb of Letchashen archaeological site.

A clay model of a boat was found in a tomb on coast of Lake Sevan and dated 6th c. BC. Judging by the outlines and presence of expressive keel, this is a good multi-pieces sailing boat.

The biggest part of stone anchors were found in Letchashen gulf. The ruins of the fortress (5th millennium BC) have 7m high and 5m wide walls. The town has 30 hectares area, 3 rows of walls, 6 citadels, two huge bastions and three gates.

More than a dozen wagons have been found in tombs, dated 15c.BC. Curved wood planks had been used in their construction (important for shipbuilding!).

The South coast has a line of cyclopean fortresses with a number of cuneiform and Aramean inscriptions. A number of caravanserais located on the routes, leading to the Lake, indicate trading activity in the region.

Berdkunk fortress had a small well-protected bay. It lies on the trade road from Dvin, ancient capital of Armenia, to Partav, the trade town located in the floodplain of the navigable river Kura.

Hovhannes Draskhanakertci (historian, 10th century), described a sea battle on the Lake in 925. Armenian King Ashot the Iron with his 200 warriors on the eleven boats attacked the Arab army numbering 5,000 soldiers. The Arabs did not believe that 200 people are approaching their troops to fight! Armenians took them by surprise. After suffering heavy losses, the enemy's army fled and was no longer able to battle again.

We have reconstructed the boats of the lake and built them in their original size. These were narrow, fast rowing and sailing boats, rigged with sprit-sail with 7-8 sailors aboard.



## **Nicholas Ball**

National Maritime Museum in Greenwich, United Kingdom

### **Block models: change and control in early eighteenth century Royal Naval shipbuilding in Britain**

In 1716 the Navy Board issued an order declaring that proposals for new ships be accompanied by a 'solid' or 'model' as well as lines plans. These block models were scale three-dimensional representations of the full-size ships and illustrate hull form, profile, arrangement of decks, gun ports and stern galleries. Many examples survive in the collection of the National Maritime Museum in Greenwich, UK.

This project aimed to redress the balance in ship model study by examining the often overlooked block models to discover their role in the shipbuilding process.

This project used an *Xbox Kinect* to digitally scan an original block model of HMS *Victory* (1737) to create lines plans from the data. These plans were then used to assess the accuracy of the model's hull form by measuring conformity to the original eighteenth century lines plans of the *Victory* held at the National Maritime Museum.

Through studying the naval architecture of the *Victory* model this project has revealed the block models' relationship to the original lines plans and the phase at which they were made within the shipbuilding process. It has shown the potential of block models as reliable sources for study of ships for which there are no extant lines plans.

This study also attempted to show that block models should not just be viewed as practical objects produced in the dockyard for ship construction but should be considered as part of the broader shipbuilding process, from conception to launch. When placed within the wider context of Navy Board administration, block models can be viewed as having the function of sophisticated and accurate three-dimensional proposals, used not only for communication but also executive control of naval shipbuilding in the period.

**Natasha Bani-Sadr, Adam Collins,  
Michael Ekenstedt, Daniel Diez Merida**

University of Southern Denmark

\*poster

## **Blåvand Bjergebåd**

At first glance the Blåvand Bjergebåd appears as a typical nineteenth-century Scandinavian clinker-built vessel, but as students of the University of Southern Denmark's Maritime Archaeology Program discovered over the course of a digital recording project late last year, the Blåvand's true value is revealed when placed in historical context.

The last of its kind, this round-bottomed salvage vessel was once part of the local *Bjergelav*, the Danish maritime salvage association, which was responsible for recovering lost cargoes at sea. The maritime salvage industry in Denmark developed over hundreds of years; with roots in the birth of nations in Europe and the establishment of international trade, the Bjergelav was eventually formed as a means to secure shipping routes such that merchants were protected from robbery in the event of a sinking.

The Blåvand was in operation of the local Bjergelav from its construction in 1876 and the last known wreck it salvaged was likely a German trawler in 1919, although it may have been in use as late as 1923. When assisting a floundering vessel the Blåvand would have aided in the rescue of human lives before returning to recover any cargo that could be salvaged, of which a percentage would be kept by association members as payment. At its height, this industry made up to a third of yearly earnings for Bjergelav members.

The specialised features of this recovery boat speak to this unique function, in particular the anchor-repositioning rollers at its stem and stern. By recording and digitally rendering it, the story of the Blåvand Bjergebåd and Bjergelav and their importance to the local development can be preserved for posterity. In sharp contrast to its nondescript initial appearance, the Blåvand's central role in the life and livelihood of the coastal community make it a remarkable piece of regional history.

## **Research of the wrecks in the Gulf of Gdańsk using photogrammetric 3D documentation**

Since 2013, the National Maritime Museum in Gdansk has been developing an innovative method of underwater documentation creating photogrammetric 3D models wrecks from the Bay of Gdansk. Using that new documentation technique, archaeological research of three wrecks was accomplished till now.

The first object was F 53.27 "Porcelanowiec" (porcelain), which is the remnant of the 20 meters length sailing boat built of spruce wood and pine in the first half of the nineteenth century, sank after 1853. Fragments of English earthenware vessels, and brass snuff box produced in Sweden were discovered on the archaeological site.

In 2014 two successive underwater archaeological positions were accomplished using innovative methods of documentation. The first was the 30 meters length shipwreck F53.14 lingering in the area of the entrance to the port of Gdansk, representing relics of a sailing vessel built of oak. The vessel was made probably in the first decade of the nineteenth century, and the wood used in its construction came from Eastern Pomerania.

The second of the wrecks documented using the photogrammetric 3D models was a wreck F53.31 "Głazik" (boulders) representing the remains of a several meters length small sailing vessel with a transom stern, clinker built after 1831. To construct the unit the oak wood growing in Gdansk Pomerania was used. Ship sank at the height of Gdynia Redłowo, 2.5 km from the coast, with a cargo of stones in diameter up to 1 meter. Among many items excavated from the wreck there was a corked stoneware bottle of soda water (seltzer) "Selters". After analysing the composition of the fluid, it turned out that the gin was inside, which means that it was re-filled with an alcoholic beverage.

The advantages of 3D photogrammetric documentation of underwater archaeological sites since 2013 in the NMM are:

- it takes short time to perform underwater photographs compared to the traditional method of underwater drawing,
- high accuracy and detail of mapping the individual elements of wrecks,
- the possibility of performing models in low water clarity, even below 1 meter,
- the ability to perform throws, cross and longitudinal sections and create their drawings documentation at any point of the object,
- models are a form of backup data in the concerned period of time, and can be used to monitor of state preservation of underwater objects and the changes taking place on them. Monitoring the impact of changes applies to both the environment and human activities,
- creating of visually stunning animations and presentations for the exhibition and educational purposes.

**Mike Belasus**

German Maritime Museum

## **Those bits and pieces from the Baltic shores – Evidence for medieval shipping along the German Baltic Sea coast**

A research project, funded by the German Research Foundation was carried out from 2008 - 2011 to evaluate the archaeological evidence on medieval ships along the German Baltic Sea coast. Only a few ship wrecks were raised or documented in detail but the ship timbers found in secondary use in the former towns of the Hanseatic League gave some detailed information on the development of the maritime infrastructure along a coast which was inhabited by Slavic people and later colonised by German traders. It shares some light on the success of a new economic and infrastructural system introduced by the merchants from the West. Among these ship timbers is also important evidence from the earliest phase of the town of Lübeck which played the key role in the establishment of the Hanseatic trading system in the Baltic Sea. The ship timbers from Lübeck's earliest quarters and later on do not represent sea-going ships but bottom-based built inland vessels. They are evidence for the introduction of an infrastructural system from the homelands of the German traders in the West that were now settling on the Baltic Sea. There might be a connection of these vessels to ships of the Kollerup-Bremen type as was suggested by Bill and Hocker in 2004. The evidence from other towns in later periods gives a rather heterogeneous impression with evidence of Kollerup-Bremen type ships and clinker vessels built at the same time in the same area. The vanishing of features of pre-German shipbuilding in the material evidence marks the beginning of a new era but does not mean the end of their shipbuilding traditions.

## **Carlo Beltrame**

Ca' Foscari University of Venice, Italy

### **The Late-Roman barge of Comacchio (Ferrara) S. Maria Padovetere, preliminary report**

In the autumn 2014, close the High Medieval Religious site of S. Maria Padovetere of Comacchio, the Soprintendenza per i Beni Archeologici per L'Emilia Romagna, decided to investigate a shipwreck seen during previous test excavations. The excavation was carried on by a private company, directed by Mario Cesarano (of the Soprintendenza), in collaboration with the Department of Humanistic Studies of the Ca' Foscari University of Venice. The excavation exposed a 13.5 m long river barge with a flat bottom 290 cm wide. The hull lies on a side of the ancient riverbed of the Padovetere, already know from aerial photos, probably in a condition of abandonment which could happen in the early 5th century AD. On this site, in collaboration with IUAV University of Venice, we compared 3D photogrammetry with simple cameras, laser scanner and total station techniques of documentation.

The boat was built with a sewn technique to joint fourteen planks of elm in one piece. The framing is composed of L shape "embraced" floor timbers of oak.

The diagonal position of the hull on the riverbed allowed the extraordinary and complete conservation of one side which will allow the reconstruction of the complete shape of the barge.

This precious archaeological evidence is helping us to know the typology of boats which navigated in the rivers of the North of Italy in the Late Roman Age which were built with the well know sewn planking technique. The lucky conservation of one side and of the complete length of the hull is a rare condition in archaeology which is allowing the authors to reconstruct a 3D model of the entire boat with minor hypothesis.

## **José Bettencourt**

Portuguese Centre for Global History

### **The Angra B Iberian shipwreck (Terceira island, Azores, Portugal). An excavation report**

Discovered in 1960s, Angra B wreck was first surveyed in 1996 by the Institute of Nautical Archaeology and has been investigated by CHAM, after 2006, in the scope of *PIAS* and *An iberian ship for the Atlantic: shipbuilding, life aboard and Angra port of call in 16th and 17th centuries projects*. The monitoring work showed that the ship remains were gradually disappearing due to bio erosion processes, and it was decided to excavate the most affected area. The first excavation field season, in the summer of 2012, focused on a central area dominated by a ballast mound. The ballast, which included different rock types and blocks of dead coral, preserved several artefacts, highly fragmented. The ceramic assemblage includes Sevillian olive jars, columbia plain (*plates* and *escudillas*) and 16th century lead-glazed redware fragments. The ballast mound protected a substantial part of the ship's structure along one border, from the keel to the top of the second futtock/ bottom of the third. This structure has several features of Atlantic ships, with similarities mainly found in ships related to the Basque Country, in the north of Spain.

## **Ronald Bockius**

Romano-Germanic Central Museum in Mainz, Germany

### **Caisson or craft? Further Roman ship finds from Mainz, Germany**

In 2003 excavations took place in a construction pit 300 m off the modern river side of the town. Conducted by the state authorities for the preservation of heritage (General direction Kulturelles Erbe Rheinland-Pfalz) wooden remains of an ancient embankment were uncovered on a length of more than 30 m. The timber installations were made from oak piles, still 2.6 to 2.8 m high facing to the water side. They kept horizontally laid planks cut from oak and fir which were additionally reinforced by oak beams from the back side. Dendrochronological analyses proved dating of all timber categories to AD 16 to 28.

The 3.5 m long planking proved secondary usage indicated by empty tree-nail holes and pegged mortise-and-tenon joints some of which were broken or cut-off. Interestingly there were also traces of organic luting substance sticking in the seams. Single timber components were joined together, or reinforced by iron clamps. The section of at least one fragmented stealer is preserved.

The discovery of recycled timbers from the Tiberian period stimulated to a detailed examination by the same expert who also proposed to do the dendrochronological investigations. Comparing the constructional features with ancient caisson findings she came to the result that the timbers might be dislocated relics of wooden sheet-piling walls presumably used for the erection of stone pillars of the local bridge. The present speaker will discuss an optional view based on a detailed ship technical analysis. He identifies the material as relics each of a flat-bottomed craft and a round-built vessel both constructed according ancient Mediterranean boatbuilding principles at the beginning of the 1<sup>st</sup> c. AD. There is evidence of technical specifics characteristic for inland vessels in the northern and eastern Roman provinces.

## **Giulia Boetto, Irena Radič Rossi**

Aix-Marseille University, CNRS, France / University of Zadar, Croatia

\*poster

### **Ancient ships from Cissa (Island of Pag, Croatia) in their cultural and historical context**

The presentation provides an overview of the results of the international interdisciplinary research project *Cissa Antiqua*, promoted since 2009 by the University of Zadar and Centre Camille Jullian (Aix-Marseille University – CNRS), in collaboration with the Municipality of Novalja.

The island of Pag belongs to the geographical region of Northern Dalmatia, and is the fourth biggest island of Croatia. A Liburnian population inhabited it during the time of the Roman conquest, and Pliny the Elder mentioned it under the name of *Cissa* (*Hist. Nat.*, 3, 140). Although the position of the main Liburnian settlement has not been confirmed, it has been suggested that it was situated on the hill of Košljun in the near vicinity of the bay of Caska, at the north-western edge of the gulf of Pag.

The bay of Caska preserved the notable remains of a multi-stratified settlement, whose important phase seems to be identifiable with a big and well-organized maritime villa property of the senatorial family *Calpurnii Pisones*. The systematic documentation and study of the structures on land and underwater started just recently, revealing some interesting archaeological features.

The muddy bottom of the bay preserved a wooden anchor and the remains of two seagoing vessels from the Early Roman Imperial Period. The ship Caska 1, about 9 m long, was assembled with the old Liburnian lacing technique that survived in Roman times. It was probably sunk on purpose, and reused to reinforce some pier-like wooden coastal structure. The ship Caska 2 is more than 15 m long, and was assembled by the standard Roman mortise-and-tenon shipbuilding technique. This ship was also sunk on purpose, and reused in a pier structure. Other significant underwater finds include rectangular caissons composed of logs and filled with stones, which probably served as the basis of a pier or a breakwater.

The communication focuses on the detailed description of the preserved ships' remains, in their cultural and historical context.



**Karl Brady**

National Monuments Service, Ireland

## **Underwater Investigations of Prehistoric and Medieval Logboats from Lough Corrib, Ireland**

Hydrographic surveys carried out of Lough Corrib, a large lake located in the west of Ireland has resulted in the discovery of over 50 logboat and wreck sites. The Underwater Archaeology Unit (UAU) of the Department of Arts, Heritage & the Gaeltacht have been carrying out underwater investigations on a number of these newly discovered sites as part of a management strategy to ensure their long-term protection and preservation. This paper will provide an overview of the work carried out to date, comprising survey, recording, excavation and implementing protection strategies for the sites and will describe the difficulties and challenges encountered in doing so. Over 20 logboats have been investigated to date and results are providing new and exciting insights into the use of boats in the inland waterways in Ireland. The finds range in date from c. 2,500 BC to the 11<sup>th</sup> Century AD and a small number of the boats are almost fully preserved with feature such as thwarts, oarlocks and repair work surviving to varying degrees. The discovery of a range of weapons in the boats such as iron, bronze and wooden spears and axes along with a number of other artefacts are providing unique insights into raiding, hunting, wood working, boat building, travel and political control of territories but also evidence for possible ceremonial and depositional practices that took place on Lough Corrib throughout antiquity. The boats are also contributing to our overall understanding of the evolution and development of water craft in Ireland during prehistory and into later times. The UAU intends carrying out further dive work in Lough Corrib during 2015.

**Massimo Capulli**  
University of Udine, Italy

## **The Precenicco Shipwreck. A vessel of the 11th century AD from Stella river**

The remains of a Medieval wooden hull were exposed in September 2012 near the town of Precenicco (Friuli Venezia Giulia – Italy), during civil works a few meters from the banks of the Stella river. The ancient riverbank was reconstructed through geomorphological and sedimentological analyses: with a configuration similar to the present days, its flood area was 10 m wider, and this was where the vessel was covered by the natural evolution of the river. Two years after the discovery, in September 2014, the excavation of the shipwreck was carried out, including its recovery. This study is part of the Anaxum Project of Department of History and Preservation of Cultural Heritage of the University of Udine, in a joint venture with the Superintendency for the Archaeological Heritage of Friuli Venezia Giulia, and in collaboration with Texas A&M University and the Institute of Nautical Archaeology. The main goal of the Anaxum project is to reconstruct the history of the area, focusing on the relationship between man and the landscape of the Stella River through time. The research is based on existing documentation, non-invasive methods, and targeted excavations (for example the roman laced-barge Stella 1 – ISBSA 13).

The Precenicco Shipwreck, dated to the 11th century AD by C14 analysis, is a very important discovery because it is an *unicum*, a singularity, both for Italy and in the international archaeological panorama. The Precenicco boat is 8 m long, has a flat bottom without a keel, but presents curved sides and a smooth turn of the bilge, atypical in riverboats. Moreover, the presence of a mast step placed exactly in the middle of its length suggests that it was used beyond the small Stella River, into the nearby lagoon system. Perhaps the most interesting feature of this shipwreck is its internal structure, with alternating L-shaped floor timbers and only one futtock per frame. A similar system in the remains of the Yenikapi 12 and Serce Limani hulls, however, it has yet to be found on a vessel used for inland navigation.

**Patrícia Carvalho, José Bettencourt, Gonçalo Lopes**  
Portuguese Centre for Global History

## **Between the South and the North: an overview of the Medieval or Early-modern Aveiro lagoon shipwrecks (Portugal)**

In the recent decades a number ship finds made the Ria de Aveiro a privileged field of research in maritime and underwater archeology in Portugal. This was the result of, on one hand, the intense harbour constructions works, which turned the port of Aveiro in one of the most important ports in the country and, on the other hand, of the good archaeological preservation environment of the lagoon. Between the archaeological sites were found three shipwrecks named Ria de Aveiro A, Ria de Aveiro F and Ria de Aveiro G, that document different aspects of shipbuilding in the transition from Middle Ages to the Early Modern period.

In this paper we intend to make an assessment regarding the available archaeological data in a regional approach. With this perspective we will address how the current archaeological record reflects the dynamics of maritime activities in the region during Middle Ages and the Early Modern period, with the historical frame of the ship remains, including the identification of their *signatures architecturales*.

**José Luis Casabán**

Texas A&M University, USA

\*poster

## **Design and construction of late 16<sup>th</sup>-century Spanish galleons: The *Twelve Apostles* (1589–1591)**

In December 1588, immediately after the failure of the Spanish Armada and while the surviving ships of the expedition were refitted at the ports of northern Spain, Philip II ordered Juan de Cardona of the Council of War, the construction of 12 new galleons. These ships were to replace the losses of the Armada, to provide the Spanish Crown with a permanent navy for the coastal defence of the Iberian Peninsula (*Armada del Mar Oceano*), and to escort the fleets of the Indies Run (*Armada para la Guarda de la Carrera de Indias*). Between 1589 and 1591, the galleons, known as the *Twelve Apostles*, were built and launched in the shipyards of northern Spain. Their design and construction details were discussed by shipwrights and naval commanders generating numerous documents that are currently located in the Spanish archives.

This poster presents the preliminary results of the research conducted in various Spanish archives to determine the original hull design, construction, and outfitting of *the Twelve Apostles*. The examination of archival documents provides the units, main dimensions, tonnages, partial scantlings, shipbuilding sequence, and outfitting details of the galleons. The analysis of the archival data and its comparison with the hull design and construction methods described in contemporary Iberian shipbuilding treatises, archaeological parallels, and iconographic evidence reveals a particular method to design the ship's master frame. This design is characterized by the use of a single arc to define the shape of the master frame despite the variations observed in the proportional ratios between the main dimensions of Iberian vessels since the second half of the 16<sup>th</sup> to the late 17<sup>th</sup> century. This study will produce an approximate model of *the Twelve Apostles* to understand their design and construction, and to conduct comparative ship analysis between contemporary similar European vessels.

**Li-wen Chia**

Archeo Cultures, Taiwan

## **The Treading and Technology of Dye-root in East Asia – A Focus on Fishing Net, Sailcloth and Clothes Preservative**

Dye-root is the most representative traditional preservative in China. It is a perennial vine whose roots are rich in tannin, and has the function of colour dyeing, preservative, waterproof and cooling. It distributes over southern China, Taiwan, Vietnam and Ryukyu. In this paper, the uses of Dye-root in various regions are discussed. The procedures of Dye-root dyeing are also described in the last part.

In ancient China, Dye-root showed up in documents as a medicine named “Zhekui”. It was used as tanning material in southern China in the Sung Dynasty. In Ming Dynasty, it was used quite often as the dyeing stuff and also used by fishermen to dye clothes and fishing net in Fujang and Gwandong. In Qing Dynasty and later on, not only in Fujang and Gwandong, but also in Zhejiang and Guangxi, Dye-root was used as a preservative. The cloth called Gambiered Guangdong Silk with Dye-root was used in making summer clothing and became popular in Gwandong. Dye-root were plentiful in Fujang, Gwandong and Guangxi, but the using amount was so large that imports were still necessary.

In Taiwan, during the Dutch and Spanish Occupation period, Chinese businessmen might have already gotten Dye-root from aborigines and traded them to China. In Qing Dynasty, the Han people still used Dye-root as dyeing stuff and preservative and continued the Dye-root business with China. In the late of Qing Occupation period, umber Dye-root clothes had become an identification of Taiwanese fishermen. During the Japanese Occupation period, Japanese did a lot of researches of Dye-root and found it can be the ink and ship preservative coating. Because of the need of tanning material, Japanese government tried to introduce it to mainland Japan. In the late of Japanese Occupation period, for the same reason, Japanese government transplanted the Gwandong Dye-root to Taiwan.

In Vietnam, the documents in 18th to the middle of 19th century showed Dye-root been used to dye clothes wildly. It had been traded to China during Qianlong period, and Vietnam is the most important import area of Dye-root in China in modern times. There are some trading routes, one is flowing to Gwandong by Shi River, and the other is to harbor in Vietnam by river or train first, then transport to China by ship. The latter route handled much more business.

The Dye-root preservative technology which based on the combination of scientific theory and practice experience is described in the last chapter. Cold dye is often used in modern times. There are several kinds of tools to grind Dye-root. Brand new fishing nets need to be dyed for many times, usually more than three, the old ones need not. The ratio of water and Dye-root, is about 3. Dye-root residues need to be removed or it will be stuck on after drying up. The excess Dye-root can be covered by sands to prevent from rot.

**Chelsea Colwell-Pasch, Andrew Roberts, Peter Harvey,  
Wendy Van Duivenvoorde, Jonathan Benjamin**  
\*poster

## **The Archaeological Investigation of the Leven Lass: A 19th Century Scottish Brig Wrecked in Australian Waters**

Built in 1838 in Scotland, the brig *Leven Lass* was a typical British merchant vessel at the end of the era of wooden ship building in Scotland. Within 50 years, the vessel type would become obsolete, replaced by steam engines and iron and steel construction. At the time of her construction, she represented the culmination of several centuries of British shipbuilding tradition. The *Leven Lass* wrecked in shallow water off the north shore of Philips Island in South Australia 1858. The vessel was tentatively identified in the 2012 Flinders University Maritime Archaeology Field School and the excavation of the intact hull remains has become the central focus of the 2015 field school. This poster presents the initial results of the hull analysis and places it within context of Scottish shipbuilding.

**John S. Davis**

Ars Nautica Institut, Croatia

\*poster

## **The problems involved in reconstruction the original hull shape of a 15th-century Venetian galley**

In the context of a publication project of archaeological data on the 14th century galley shipwreck found in the lagoon of Venice near the submerged island of San Marco in Boccalama, and excavated in 2001, the work team charged by the Soprintendenza per i Beni Archeologici has posed the opportunity to insert the study of reconstruction of original hull shape. Usually it would be possible, combining the material evidence of archaeological sources with the contemporary iconographical and historical written sources, as some cases of shipwreck excavations have been.

In the case of the Venetian galleys however, it is well known that the technical written texts only appear from the beginning of the 15th century and therefore they cannot be utilized on the study of the wreck of San Marco in Boccalama. In any case I considered it interesting to begin a research as a reference guide to verify which differences can emerge between a model of a merchant galley of the 15th century described in the texts with the observation notes and the photogrammetric data taken during the excavation of the shipwreck of san Marco in Boccalama.

The poster aims to describe the results of my research from the methodological and practical point of view highlighting in particular which types of difficulties must be confronted on the iconographical and historical documentation, the interpretation of written sources and quantity and quality of the information necessary for the construction of a physical model with respect the contains of the texts.

**Katerina P. Dellaporta**

## **Ships in Greece Byzantine Iconography**

The paper attempt a retrospection of ships evidences represented on manuscripts, ceramics, churches frescos, graffiti, icons dated from the early to the post Byzantine art.



## ***KARAVOI*: Documentation of Ship Graffiti on the Medieval and post-Medieval Monuments of Cyprus**

Graffiti depicting ships are known throughout the Mediterranean from the third millennium BC onward. The archaeological record of such graffiti is rich, as they have been found on the walls of monuments of different character (caves, temples, public buildings, fortifications, churches) dating to various periods. They have been interpreted as *ex votos* (by sailors or their families), signs of human interaction with the living environment, 'signatures' of travelers etc.

The existence of ship graffiti on the walls of medieval churches and secular monuments of Cyprus has attracted the attention of several (but not many) scholars, thus far. At least four, almost contemporaneous, surveys have been conducted on the island during the past 20 years and have provided a significant body of evidence, documented by different teams in different ways: more than 30 monuments with at least 120 ships' graffiti have been recorded but the data remain scattered and only partly published. Moreover, graffiti is a particularly vulnerable kind of evidence, exposed to the decay of the buildings but also to restoration processes; very often-unrecorded graffiti go unnoticed and thus have destroyed by mistake during restoration works.

The purpose of this paper is to discuss the first results of a research programme, entitled '*KARAVOI*: The Ship Graffiti on the Medieval and post-Medieval Monuments of Cyprus: Mapping, Documentation and Digitization'. The project is funded by the Leventis Foundation and the University of Cyprus and aims to contribute to the broader study of the Maritime Cultural Landscape of Medieval Cyprus. The different methods and tools (digitally and manually), used for the documentation of the graffiti allow for a comprehensive approach, such as: spatial analysis both at a micro- and a macro- scale, medieval ship types, human behavior and identity.

## **Thomas Dhoop**

University of Southampton, United Kingdom

### **Ships, Harbour Installations and the Maritime Townscape of Medieval New Winchelsea, UK**

New Winchelsea in East Sussex (UK) was a major planned royal port which flourished for half a century from the date of its refoundation in the 1280's following severe coastal erosion to its original site. During this period of prosperity, New Winchelsea, a prominent member of the Cinque Ports Confederation, can claim to have been one of the principal international ports of the realm. What is more is that its pre-designed nature offers us a glimpse in the mind of the medieval surveyor, laying out a maritime townscape.

New Winchelsea figures as the main case study in the author's PhD research posing the question 'How do changes in shipping reconfigure urban structure and social life in 12<sup>th</sup> to 14<sup>th</sup> century northwest Europe?' Taking note of Jan Bill's (1999) pioneering work on the relationships between ships and medieval towns in Denmark, this study strides forward and explores more quantitative approaches to the topic, taking advantage of computer-based technologies such as space syntax (Hillier & Hanson 1984) and GIS-based spatial analysis.

Drawing from recent geotechnical fieldwork at the medieval waterfront of New Winchelsea by the author, the ship-graffiti recorded in St. Thomas church and analysis of the town-plan, an entangled picture will be presented of medieval people, the ships they built and sailed, the cargoes these vessels carried, the waterfronts they used, the city where people lived, relaxed, stored goods and conducted business.

**Daniel G. Dwyer**

Charles Darwin University, Australia

## **External stern-lashings on Southeast Asian Watercraft: new evidence for early technological regionality in boat construction**

External stern-lashings are currently unique to whaling boats from the village of Lamalera in eastern Indonesia. However, late first millennium archaeological evidence from the Philippines and motifs on early first millennium Bronze Age artefacts from Vietnam suggests this technology was once one of a suite of technologies long used across the region. Bronze artefacts dating from around two thousand years ago are found scattered from northern Vietnam and southern China through mainland and insular Southeast Asia as far as the island of New Guinea, attesting to a widespread trade network operating in the region from the early Common Era. External lashings would appear to have developed from vice-like clamps used to force together the edge-dowelled strakes on lashed-lug vessels during construction: evidence for this can be found in both contemporary practices in Indonesia and historical records from the Philippines.

On the Lamalera whale boats the lashings hold the stern planking together, foregoing the need for strong internal attachments to provide the structural integrity required to withstand regular beach launching and surf conditions, as well as the buffeting encountered in marine hunting of large game. The recent discovery of external stern-lashing indications on a 9th century Tang-era trading vessel wreck, quite possibly Cham, found in a roadstead near Quang Ngai in central Vietnam, further supports the regional hypothesis. These finds, along with others, point to a maritime tradition that appears to have persisted from at least the Bronze Age Dong Son culture into contemporary times broadly across Southeast Asia. Persistence of the external stern-lashing only at Lamalera is perhaps due to both its technological fitness and the conservative nature of the dangerous marine hunting practices. Some of the other features of the suite of technologies that have had widespread regional use, such as bi-pole masts, quarter rudders, and double-outriggers, are also discussed.

## **Beñat Eguiluz-Miranda**

University of Wales Trinity Saint David, United Kingdom

\*poster

### **The Atlantic shipbuilding and the new transition in the Iberian Cantabrig tradition, 1560-1680**

New discoveries made in the early modern ages led to further Oceanic expeditions during the 16th-17th centuries. India, Newfoundland and Europe were many of the major destinies for Cantabrig ships. The Cantabrig area was placed on such privileged position, with abundance of raw materials for the shipyards, connected to the main northern merchant routes and with a long shipbuilding tradition acquired during the medieval times, became strategic for the interests of the crown.

The shipbuilding industry of the Spanish Empire was very much based on the northern Cantabrian shore. Oaks were abundant and accessible in this area were most of the Oceanic ships were dispatched across the seas for the Spanish Kingdom. This Iberian shipbuilding tradition from the northern area was mainly composed by cargo ships from the early 16<sup>th</sup> century, the so called Naos. However, a conflict of interests reshaped the timbers of such type of merchant vessel mostly used for the Newfoundland fisheries, India and European trading routes.

The lack of a permanent fleet for the Kingdom of Phillip II led to a major involvement of the kingdom on the shipbuilding Iberian industries. New "Ordenanzas", "Cedulasreales" and many other laws oriented a deep change from the old Iberian traditional industry. Furthermore, this new initiative that was originated from the Empire's core was forced by major political conflicts, that required, according to the King's political approach, a military answer.

The Galeon, different from the Nao vessel, fulfilled the interests and necessities of the Imperial elite. Major changes for the shipbuilding tradition attempted to adapt the fleets for the Imperial purposes. Military and merchant purposes merged in a vessel type that evolved from the transatlantic Nao, but was more capable for guarding fleets and protecting the valuable cargo from the India.

In this poster proposal I am going to explain a new research, part of a major European project. This research is a ForSeadiscovery Marie Curie fellowship (PITN-GA-2013-607545) part of a large team of different disciplines that from a Multidisciplinary approach we aim to give more details to the question: What is an Iberian ship?

This poster will explain further in detail the multidisciplinary approach of this research that combines underwater archaeology, history and dendrochronology.

**Michael T. Ekenstedt, Adam Collins**

University of Southern Denmark

\*poster

## **Quern stones and Edutainment: The shiesty business of Captivating an Audience**

The general public largely misunderstands maritime archaeology. They are either unaware of it's existence, or are unable to distinguish archaeology from treasure hunting. This issue is not a small one. With increasing industrial exploration being implemented in order to access and utilize maritime resources, along with the misuse of advanced technology, these irreplaceable archaeological resources face threats on a scale hitherto unknown. Attempts to educate the public about both the existence and importance of submerged cultural heritage are, however, being made. Efforts by organizations such as the Mary Rose, The Nautical Archaeology Society, and The Thunder Bay National Marine Sanctuary have done tremendous work in this area. Due, however, to the regional nature of these organizations, the public needs to take the extra step of actively seeking them out in order for their message to reach any kind of wider audience. The world of "edutainment" in the digital age offers a solution. Using him model of educated, passionate individuals in the field in order to reach, educate, and excite the public with quality based educational multimedia entertainment. This model has been implemented successfully in other fields by professionals such as Dr. Bill Nye, Dr. Neil de Grasse Tyson, as well as on the much loved show Myth busters. This model allows widespread public outreach and overcomes the need for specialized skills such as scuba training, or technology like ROVs or submersible vehicles. The purpose of this poster will be to demonstrate this model through looking at quern schist stone trade during the Viking Age. These stones are a common everyday item, but in the context of their time and place prove more valuable to an archaeologist and tell a richer tale than Tintin's secret of the unicorn.

## **Jonas Enzman**

University of Kiel, Germany

\*poster

## **Arbeitsgruppe für Maritime und Limnische Archäologie**

AMLA, which stands short for “Working Group of maritime and limnic Archaeology”, was founded in 1997. The members of AMLA are European Scientific Divers, and are mostly archaeologists on different levels of education, but there also members from related sciences like biology, geology or oceanography.

The primary task of the AMLA is to conduct research on the Underwater Cultural Heritage and bring it more into focus of the terrestrial archaeology. On the other hand the AMLA wants to create a public awareness of the Underwater Cultural Heritage, which is endangered due to the building of pipelines, offshore wind parks and the deepening of rivers for economic purposes. Another important aim is the education of the next generation of archaeologists in the special conservation situation underwater and the training of methods for excavation, investigation and interpretation in Maritime and Underwater Archaeology.

The majority of AMLA members were trained as Scientific Divers by the Centre for Scientific Diving at the Institute of Geology at the Christian-Albrechts-University. Another cooperation exists with IFM GEOMAR Institute, which allows the AMLA to conduct regular field trips with the research vessels FB Polarfuchs and FK Littorina into the Kiel Fjord, to survey, monitor and document wrecks. Together with the Lighthouse Foundation the AMLA has built an archaeological park under water, where students and recreational divers can be trained in proper diving methods at archaeological sites. The AMLA maintains a close cooperation with the State Department of Archaeology and the State Museum in Schleswig. Over the past decade members of the AMLA took part in projects from the Lower Saxony Institute for Historical Coastal Research and the Maritime Archaeology Program of the University of Southern Denmark in Esbjerg.

Since 2004, the working group’s internet site is available at [www.amla-kiel.de](http://www.amla-kiel.de). The visitor will find general information as well as news about on-going research projects and articles of completed excavations.

**Miran Erič**

Institute for the Protection of Cultural Heritage of Slovenia

## **New contribution to understand development of Rivers/Lakes shipbuilding tradition in 1st century AD: the case of Sinja Gorica barge, Vrhnika, Slovenia**

Preventive underwater archaeological surveying in the Ljubljanica riverbed, conducted at Sinja Gorica in 2008, revealed the remains of an Early Roman wooden barge from the beginning of the 1st century AD. Detailed documentation of the 4.5m long and 2.8m wide section of the boat followed in October 2012 and included photogrammetric three-dimensional modelling. Its construction characteristics and size reveal a boat of the Mediterranean shipbuilding tradition, elongated oval in shape with a flat bottom and vertical sides, constructed using the shell-first technique and planks fastened with iron clamps, while the hull was reinforced with floor-timbers in a way not yet known in literature. The barge is mostly built of beech wood, which is dendrochronologically dated to AD 3. The wood is very poorly preserved. The barge was presumably used to transport cargo between Nauportus and Emona.

In comparison with the barge from Lipe (Müllner's "Pontonium" from 1890), the newly-found vessel from Sinja Gorica shows several technological differences, which, on the one hand, indicate the development of the regional building of cargo boats and, on the other hand, a hitherto unknown type of framework in the form of slender floor-timbers set into grooves cut into the bottom planks and protruding through the walls of the chine-girders. At this stage of research, however, it is not possible to determine either the exact shape of the floor-timbers' cross section (rectangular, trapezoid?) or to check the possibility of the timbers and corresponding grooves to taper slightly so as to provide additional stability of the joint

Keywords: Roman period, the Ljubljanica river, Sinja Gorica, Nauportus, Early Roman barge, underwater archaeology, photogrammetric 3D model.

## **Miran Erič**

Institute for the Protection of Cultural Heritage of Slovenia

\*poster

## **Initiative "Early Watercraft – A global perspective of invention and development"**

**Ambassadors of Initiative** is a lifelong project, based on 20 years of development which was summarized in an article presented at the World Cultural Heritage Conference EUROMED 2014 (supported and organized by ISPRS, CIPA, ICOMOS, ICOM, ICCROM) in November 2014 in Lemessos, Cyprus. The article was selected as the best paper at the Conference and received the Werner Weber Award.

Findings of prehistoric vessels (i.e. logboat from Pesse, Netherland), logboats and dugout canoes as well as other early forms of watercraft (reed-, skin-, plank-, bark- boats, rafts, etc.), which can still be found in use all over the world, mark the beginning of shipbuilding and transportation traditions. This early watercraft had a far-reaching significance for navigation, mobility, orientation, networking, conquering, colonization, travelling and consequently also for other inventions. Even without any material findings, anthropological theory claims that watercraft has been in use for at least 60.000 years, or possibly even for 800.000 years by Homo Erectus.

The mission of the Initiative "**Early Watercraft – A global perspective of invention and development**" is to study and revive the prehistoric navigational tradition and promote the significance of prehistoric watercraft.



## **Niklas Eriksson**

Södertörn University, Sweden

### **Riksäpplet: a neglected wreck that comes into favour**

The 84 gun ship *Riksäpplet* (The Sovereign's Orb) was launched in 1661 and was the first ship in the Swedish navy to be built by English Master Shipwright Francis Sheldon. After the battle of southern Öland in 1676, where both *Kronan* (126 guns) and *Svärdet* (86 guns) were sunk, *Riksäpplet* and the rest of the navy fled back to Stockholm. During a gale *Riksäpplet* came adrift hit a rock and sank.

As the ship came to rest in about 15 meters, the guns were soon salvaged. In 1868 the wreck was blasted using dynamite in order to recover black oak and in the 1920s a salvage company undertook another operation, where a lot of the ship's structure was demolished and removed. After these expeditions the Swedish Navy have used the site for the education of divers. All together a lot of artefacts have been recovered from the site through the years.

However, regardless of the large number of divers who has visited the wreck and despite the huge quantity of ship timbers, sculptures, cannonballs and other artefacts that has been recovered, the efforts made in order record what remains of the ship at the seabed are negligible.

The aim of this paper is to present some results from an ongoing project that aims to describe the many hundreds of finds from the site that has been scattered in museums, private collections, gardens, churches and so on, during the past 150 years. A minor fieldwork has also been carried out in order to produce the first proper plan of the wreck-site. The result so far shows that the wreck, despite the salvage operations, is surprisingly well-preserved, but also that the ship comprises an interesting mix of Dutch, English and Swedish naval architecture and ship-decoration.

**Klara Fiedler**

Denmark

## **Large clinker built cargo vessels in Northern Europe in the late medieval period – The Mönchgut 92 wreck in context**

In 2010 the remains of a large clinker built cargo vessel containing a cargo of copper ingots and iron stored in barrels, were discovered and excavated at the entrance to Greifswalder Bodden off the German Baltic coast. The planks of the vessel have been dated through dendrochronology to 1448/49 AD and their provenance determined to the region around the southern Baltic sea. The relatively coherent wreck section comprises a

8.4 meter long keel fragment, 15 partially preserved port strakes, 12 frame stations, a fragment of the keelson, a stringer, and ceiling planking. Although only a 3.4 x 8.7 meter section of the lower port side of the wreck is preserved, the dimensions of the timbers used for its construction indicate, that the vessel may have originally had a total length of over 20 meters.

At present a relatively large group of clinker build cargo vessels with a length of 15-30 meters and sharing a high amount of constructional features, all dating from 1333–1541 AD have been excavated in northern and western Europe. Among these wrecks are the W-5, the Newport ship, the Aber Wrac’h I and the Skaftö wreck. These wrecks have never thoroughly been compared.

With the presentation of the construction details of the Mönchgut 92 wreck as a starting point, a comparative analysis with 22 other large clinker built vessels of the late medieval period has been conducted. The focus in the comparison is on raw material, timber conversion, construction details, size and provenance. Finally vessel usage, similarities and differences in construction and design are discussed within the social and economic context of late medieval Europe.

## **Wojciech Filipowiak**

Institute of Archaeology and Ethnology of the Polish Academy of Sciences, Wolin

### **Early medieval shipbuilding of Wolin**

Early medieval Wolin was one of the biggest cities on the Baltic shore. It's power and wealth depended especially on its connection with sea. Wolin played a major role in early medieval trade and slavic warfare on the Baltic sea. For this reason, shipbuilding artefacts and wrecks found during 60 years of excavation in Wolin are very interesting. Some of them were published earlier, but author would like to attempt to gather all the published and unpublished material to answer research questions related to slavic and non-slavic shipbuilding in Wolin, and also related to the city itself.

Apart from ten wrecks found in Wolin, author will discuss also loose fragments of hulls found in culture layers, as well as ship related artefacts. Especially interesting are fastenings – rivets and treenails, found in large numbers.

Apart of questions related to shipbuilding itself, author would like to present, what could ship artefacts tell about the city, it's development and topography, with focus on port districts. Presented results are outcome of 5 years of PhD research.

**Cristóvão Fonseca, José Bettencourt,  
Tiago Silva, Inês Coelho, Patrícia Carvalho**

Portuguese Centre for Global History

\*poster

## **The early modern Belinho Ship (Esposende, Portugal): a first report**

In June 2014 the Portuguese Centre for Global History (CHAM) developed an assessment mission of ship timbers found scattered over Carruagem beach (Belinho, Esposende), during the winter storms that affected the northern Portuguese coastline in 2013.

This first evaluation, considered an analysis of the most important timbers, through description, drawing and photography that allowed some preliminary conclusions about the type of construction and the ship's chronology.

The study was based on the record of the keel, sternpost knee, floor timbers and futtocks, that were best preserved, and of a sample of the hull planks. It confirms that those timbers come from just one ship, sharing features normally associated with early modern Atlantic vessels, from Iberian countries, between the sixteenth and the beginning of the seventeenth centuries.

The artefacts, also found in the Carruagem beach, confirm the context's date, giving it a high scientific and heritage value, enabling the increase of our knowledge about early modern shipbuilding and navigation, particularly in the north of Portugal.

**Jorge Freire**

Portugese Centre for Global History

## **Cultural identities and Maritime Communities: The Maritime Cultural Landscapes of the Seixal Bay (Portugal)**

Geographically, the Seixal Bay is part of the Tagus River estuary. In a large-scale analysis, the development of Seixal has always been closely linked to Lisbon. In a more regional view, the long term analysis, allow us to identify an identity and an unique maritime culture, that is still visible in the local community.

The present communication intends an early approach to Seixal maritime landscape, with the secular economy observed from the tidal mills, shipyards and the remains of traditional boats, as a historical view. It also intends a view at the network of small ports that allowed the circulation and the transportation of people and goods, between both banks of the River Tagus. Finally, a look at the use of wetland resources.

## **Pablo de la Fuente de Pablo, Marcel Pujol Hamelink**

Vistula University in Warsaw, Poland / ESCRBCC, Spain

### **Triunfante: a Jorge Juan's 68-gun ship of the line**

The ship of the line *Triunfante* was a Spanish man-of-war wrecked in the gulf of Roses (Catalonia, Spain) in 1795.

The location of wreck, close to the coastline has been known to local fishermen and divers for a long time. But the ship was not excavated until 2007, when the authors proposed to run a comprehensive project on the archeological operation. The proposal was accepted and put into life by the Spanish ministry of Culture and the Centre of Underwater Archeology of Catalonia.

The reason for running the project was that *Triunfante* was a ship designed by Jorge Juan Santacilia, a naval officer and outstanding mathematician, astronomer and naval engineer, author of *Examen Marítimo*, published in 1771, one of the most brilliant treaties of the theory of the ship, quickly translated to other languages. Juan was a pioneer in applying Newtonian mathematics to the design of warships. His main success was the 68-gun, the Spanish version of the French or British 74-gun. Another remarkable aspect was that Juan was also the most significant spy of the Spanish Secret Service of the 18th century. He recruited in England the shipbuilders of these ships. The result was the 68-gun – a hybrid between the Juan's design and the English techniques of shipbuilding.

Another interesting feature regarding *Triunfante* is the fact that it is the only archeological trace of Jorge Juan's ships. This paper aims at demonstrating to the international scientific community a sum up of the final results, which at least in three points refers to the goals of this conference: recent discoveries of remarkable ships; studies in ship construction and research methods.

**Maria Jose García-Rodríguez, Jose Luis Gasch-Tomás,  
Ana Crespo Solana**

Spanish National Research Council

\*poster

## **Development of a GIS for Iberian ships in the Age of Discovery in ForSeaDiscovery Project**

The development of a Geographic Information System (GIS) applied to maritime archeology is an essential tool for integrating and managing large and heterogeneous sources. GIS enables editing, querying, visualizing, and representing data in graphics and maps that allow further analysis and the ability to understand past historical events. In this poster, we present a GIS model to be used in the multidisciplinary Marie Curie – ITN Project ‘ForSeaDiscovery’ (PITN-GA-2013-607545), coordinated by Dr. A. Crespo, and also in future research on maritime archeology.

‘ForSeaDiscovery’ is an international research project which investigates whether Iberian forest resources could sustain the increasing demand of the Spanish and Portuguese empires for sound timber or the wood was imported from elsewhere, and whether the lack of raw material forced the technological changes occurred in Iberian shipbuilding during the early modern era. In the framework of ForSeaDiscovery, we have compiled data on sixteenth- to eighteenth-century Iberian ships and shipwrecks in a database. The database is designed from a theoretical model, belonging to a historical project GIS previously developed in the project “Dynamic Complexity of Cooperation-Based Self-Organizing Networks in the First Global Age (Dyncoopnet)”, coordinated by Dr. A. Crespo. The model is designed to gather information about the lifecycle of ships involved in the commercial operations at the time in the Atlantic, which includes every single trip detailing port of departure, port of arrival, the commercial transactions carried out on each of those ports, and the incidences that took place in each trip. This factor – incidence – has to do with the occurrence of a mishap in trips which did not reach the destination port. Many of the Spanish Indies Trade’s wrecks occurred either during the ocean journey or near the departure or the destination ports. This may have been due to different causes, such as climate, tropical storms and hurricanes, attacks of enemies, and poor construction or repair of vessels, among other reasons.

This model is extensible and scalable, so that we intend to extend it to other more detailed information, such as timber used for ship construction and subsequent dendro/chemistry and wood-anatomy analysis. The implementation of a GIS will allow further analysis of attributes, and spatial and temporal aspects, which will open new perspectives in understanding the behavior of maritime archeology and also navigation in the First Global Age.

**Michał Grabowski**  
University of Gdańsk, Poland

## **Another double-planked vessel from Poland. A local tradition of converted planking shipbuilding as adaptation for shoreline condition**

Presented paper is an attempt of reconstruction and analyze of double-planked shipwreck found on the southern coast of Baltic Sea, in Gulf of Gdansk. Solutions used in hull's construction can be connected with characteristic shoreline conditions in that part of Baltic region.

In February 2011, after storm, archeologist from the National Maritime Museum in Gdansk carried out an inspection of wooden ship remains wrecked on beach area near Gdynia Redlowo. Short examination revealed information about construction details. Underneath (inner) clinker planking was found another (outer) layer of caravel planks. It's a second example of that type of vessel found in Gulf of Gdansk. Few years earlier in the same region was excavated another wreck with double-planked hull's construction, dated on the beginning of 17th century. Presence of two similar constructions with very close chronology could be related to the economical situation of region in the past centuries. Existence of brickyard in nearby village Kolibki has created a need to secure fragile cargo in sea transport. Poorly developed harbor's infrastructure in nearest beach areas: Orlowo and Redlowo could be another indicator of use additional layer of planking.

Despite of poor preservation of hull's structure construction features of wreck from Redlowo beach shed perhaps a new light on use of mixed clinker and caravel planking technique in northern European shipbuilding.



## **Philipp Grassel**

Germany

\*poster

### **Reused medieval ship timbers found at the *Frankenhof*, Stralsund (Germany)**

From April to December 2010 an area of about 5000 m<sup>2</sup>, called *Quartier Frankenhof*, was excavated in Stralsund, Germany by the *Landesamt für Kultur- und Denkmalpflege Mecklenburg-Vorpommern*. Different archaeological finds and structures were exposed which dated from the 14<sup>th</sup> century to the *Great Northern War* (18<sup>th</sup> century). The most interesting medieval structures were a small shipyard and two wooden conduct systems. The shipyard and the conduct structures were mostly built of reused former ship timbers and have been analysed in two master theses at the Christian-Albrechts-University of Kiel. In both structures over 170 timbers were discovered and analysed. The remains of the shipyard itself consist of almost 150 timbers and measured 15x5 m. The timbers could be identified as former planks, futtocks, knees, beams and more. Smaller finds like rivets, rests of caulk, nails, wooden pins and a fireplace underlined the utilisation of this building as a shipyard and even the proximity of the building to the former shoreline as well as the fact that one "wall" could be moved and opened like a gate evidenced this interpretation. The conduct system was built, rebuilt, and expanded during different time phases and were clearly used as a drainage-system for the whole area and as a possible overflow-system for some close-by small lakes.

It was impossible to allocate the ship timber clearly to some known medieval ship types. Only conformities and connections mostly to smaller boats and ships could be compiled. But the amount of the reused ship timbers provide a good overview of the building techniques of smaller medieval boats and their importance within the medieval harbour system. The remains of the shipyard itself allow a good overview of the organisation and facility of a small medieval shipyard.

**Marc Guyon**

INRAP, France

\*poster

## **The barge of the 2<sup>nd</sup> c. AD *Lyon Saint-Georges 4 (Rhône, France)***

During a preventive archaeological excavation executed by INRAP as required by the Ministry of Culture were discovered in 2003, in Lyon (France), in an ancient right bank of the river Saône, near the confluence with the river Rhône, six Gallo-Roman (1<sup>st</sup> to 3<sup>rd</sup> c. AD) wrecks of barges.

At the time of the 11<sup>th</sup> ISBSA (Mainz 2006), we (M. Guyon, E. Rieth) had made a presentation which had highlighted some architectural characteristics particular to these barges «bottom-based» built. These characteristics had been interpreted like «archaeological fingerprints» specific to a regional sub-group of the «bottom-based» shipbuilding Romano-Celtic tradition so called «Rhône-Saône» sub-group.

In 2009, at the time of the 12<sup>th</sup> ISBSA (Istanbul), we (M.G. and E.R.) had given a presentation on the wreck *Lyon Saint-Georges 8*. Two functional hypothesis will be considered: that of the wreck like a ferry and that of the wreck like a lighter.

Today, the «jointed-monoxyllous built» wreck *Lyon Saint-Georges 4* is being restored in the goal of its exhibition to the public in late 2016 at the Gallo-Roman Museum Lyon-Fourvière. After dismantling, the wreck reveals some aspects of its use through a multitude of repairs that we had not recorded during the excavation in 2004.

The subject of the communication is to do a focus on those repairs. Unfortunately, it will not be possible to give a full review during the symposium as many analyzes are ongoing and will give their results only in 2016.

**Taner Güler**

Istanbul University, Turkey

## **Construction Features and Reconstruction of Yenikapı 20 Shipwreck**

Marmaray-Metro railway transfer station excavations which have been started at 2004, revealed largest Medieval Shipwreck collection in Yenikapı-Istanbul/Turkey. Harbour of Byzantine Emperor Theodosius I or *Portus Theodosiacus* discovered by good fortune because of these excavations. The Harbour includes 37 shipwrecks and most of these shipwrecks has been studying by Istanbul University, Department of Marine Archaeological Objects experts. YK20 shipwreck has been found in east side of the Metro Construction Site, at level of -0.70,-1.00 m. and it extended in the east-west direction. It is most probably dated to the early 10th century AD based on radiocarbon analysis. The hull survived up to turn of the bilge. Preserved length of the vessel is about 8.76 m. and the width is 2.30 m. Hull remains include 29 extant frames, a keel, a mast step, fragment of a stringer, and 21 planking strakes. Planks were secured to frames by both iron and tree nails and joined together by edge dowels up to the first wale level. Molded dimension of the frames was about 5-7 cm, the sided was 7-8 cm. Like most of the Yenikapı ships that dated to the 9-10th centuries, YK20 has its planking strakes below the waterline leveled off with their edge-joints in the form of small coaks. This coak system possibly represents the last ring in the transition to skeleton-first construction for it was used minimally. As the Yenikapı shipwrecks are better preserved than those uncovered from under the sea we will able to understand clearly the edge-joint systematic and their building technology. A 3D drawing equipment "Faro Arm" has been used to document and determine reconstruction of this trading vessel.

**Fred Hocker**

Vasa Museum in Stockholm, Sweden

## **Ships, shot and splinters: field-testing a 17<sup>th</sup>-century 24-pounder naval gun**

In order to better understand the ballistic performance (range, accuracy and effect) of the new lightweight naval ordnance developed by several countries in the 1620s, the Vasa Museum constructed and test fired during 2012-2014 a replica of one of the bronze 24-pounder cannon cast in Stockholm in 1627 for the warship *Vasa*. This gun is typical of northern European attempts to develop lighter guns for land warfare, and similar guns saw much use in the Thirty Years War as well as naval service. Over 50 rounds were fired on a fully instrumented proving range, recording velocity, sound levels, recoil force, internal breech pressure and fall of shot. This provided statistically relevant data on the range and accuracy of the piece, and gave a practiced gun crew the chance to explore the ergonomic aspects of risk, rate of fire, and battle space environment. As part of the test program, the museum also built a replica section of the ship. Different types of ammunition (round shot, spike, scissor and chain shot, plus canister) fired at this construction revealed not only the effectiveness of the gun, but how well the ship could withstand the punishment of artillery fire. This paper focuses on what the test program revealed about the strength and durability of warship construction, including several surprising and counterintuitive findings regarding the resistance of different kinds of construction and the damage caused by splinters. Among these are that solid oak construction is less effective at stopping projectiles than hollow construction, and that the vast majority of splinters caused by cannon shot were probably not lethal or even likely to cause serious injury, which helps to explain the relatively low casualty rates in some naval battles of the period.

**Patrik Höglund**

Södertörn University, Sweden

## **Ships and Space – the spatial arrangement of *Vasa* 1628**

The 17<sup>th</sup> century marks the heyday of the Swedish “four estates society”. Everyone in society had their god given place – nobles, priests, burghers and peasants. The harmony of the four estates was not to be questioned. People’s status was displayed in a very visible way, in clothing, housing and ways of living. The practices of social difference-making were strong. A naval ship was a kind of floating representation of power and the exterior displayed ideological messages. But the ideas of the four estate society were also visible inside the ship.

This paper discusses the social hierarchies and the division of space onboard naval ships, with a starting point on the warship *Vasa* (1628).

Warships in the 17<sup>th</sup> century were extremely crowded. Even the officers lived in crowded, shared small spaces. *Vasa*’s overall spatial arrangement is very similar to contemporary English and especially Dutch ships. But is *Vasa* really representative for a warship in Europe in the 17<sup>th</sup> century? By using the ship itself, as well as other archaeological material, historical sources, paintings and ship models, we can get a better understanding of the interior of early-modern warships. How did people live on the ships – where did they sleep and eat, who were the “cabin-people” and who did the admiral share his bed with?

**Wen-Ling Hong, Jeng-Horng Chen,  
Jr-Ping Wang, Meifang Kuo**  
National Kaohsiung Marine University, Taiwan

## **The Technology Development and Mixing of Taiwan's Traditional Wooden Boats**

With the rapid modernization since the late 19<sup>th</sup> century, Taiwan's traditional technologies have disappeared or evolved with western technology quickly. Shipbuilding technology is also following this trend. As a western Pacific island situated off mainland China, there have been many kinds of wooden boats and ships from different regions and sources. Techniques and designs range from tactical knowledge of aboriginal tribes, junk building of Chinese immigrants, and Japanese colonial modernization technology transfer, to post-WWII western technology import. Wooden boat building technology in Taiwan has reshaped its outlook, design methodology, building method, and technician skills. This article used historical literature, existing boat survey, collected oral history, and naval architecture analysis of several wooden boats: "sampan" at Kaohsiung, "king boats" at Tung Kang, "double oar boats" at Taipei, *Free China* at Keelung, and *Taiwan Cheng Kung* at Tainan to illustrate the traditional technology evolution and mixing with various modern technology sources. It shows the richness, vivid development, creative variation, and core technology values of traditional junk-like wooden boats in present Taiwan.

**Yaacov Kahanov**  
University of Haifa, Israel

## **The Ma'aganMikhael replica project**

The Ma'aganMikhael ship was discovered off the coast of Israel in 1985, and excavated in 1988 and 1989 by the Leon Recanati Institute for Maritime Studies at the University of Haifa. The ship was dated to 400 BC. The bottom of the hull was well preserved, including the keel, the false keel, end posts, two knees, sections of 12 strakes to starboard and seven to port, 14 full frames, the mast step, and several other internal components. Because of the significance of the archaeological find, the remains were completely excavated, retrieved from the seabed, conserved, and are now on display in the Hecht Museum at the University of Haifa.

The original merchant ship, as reconstructed, was 14.4 m long, with a beam of 4.24 m, and 2.6 m depth amidships. Fully loaded with a cargo capacity of 15.9 tons, she displaced 22.9 tons, with a draught of 1.4 m. She was driven by a single square sail. The hydrostatic characteristics of the proposed design were tested by the Israel Administration of Shipping and Ports.

The construction of a sailing replica of the ship is in progress. It is the final stage of this generation-long enterprise. The replica design is based on the archaeological find. Iconography was used to supplement missing information, and comparisons were made with the reconstructions of contemporary shipwrecks. Research models were made to clarify details of the reconstruction. A complete set of hull lines was generated by computer-aided design and model-building.

The work team consists of maritime archaeologists, naval architects, experienced craftsmen and sailors. Building the replica using the techniques of the ancient shipwrights is a challenging task, which provides essential information on ancient shipbuilding techniques.

**Dmitry Kobaliya, Andrew Denysenko**

National Reserve Khortitsa, Ukraine

\*poster

## **Investigation and restoration of the “baidak” type boat on Khortitsaisl. (Ukraine)**

In summer of 2010 after flood a big boat was found on the bank of Desna river north-west from Kiev. The find was examined by the team of archaeologists of the Kiev National University. The boat was built in the beginning of the XX cent. and served as a ferry. It's made of wood and is about 14.5 m long and 2.5 m width. Despite the fact of relatively young age the construction was built by archaic technology used on Ukrainian rivers in XVIII – XIX cent.

In October 2010 the boat was twice investigated by the archeology department of the National reserve “Khortitsa” and transported to the Khortitsaisl., Zaporizhzhya city. From that time it was preserved and restored with the support of the Embassy of the USA. The main block of restoration takes place in 2014 and 2015.

Because of the high scientific interest and it's good attractive properties the “baidak” will join the collection of ancient wrecks of the National reserve “Khortitsa”.



**Ida Koncani-Uhač, Marko Uhač, Giulia Boetto**

Archaeological Museum of Istria, Croatia / Ministry of  
Culture, Croatia / Aix-Marseille University, France

## **Sutiles naves in Istria: preliminary results of the study of the ship finds from Zambratija and Pula (Istria County, Croatia)**

The presentation provides preliminary results of two archaeological excavations undertaken in 2013 in the Istria County, by the Archaeological Museum of Istria in collaboration with the Ministry of Culture of the Republic of Croatia and the Centre Camille Jullian (Aix-Marseille University – CNRS).

In Zambratija (Umag), the seabed preserved the remains of an exceptional vessel from the Proto Historical Period. The ship, preserved up to the gunwale for about 7 m, belongs to the family of the assembled logboats. The hull is entirely constructed by using the sewing technique, according to the ancient technique used by the local tribe of the Histri and that survived in Roman time.

In Pula the silted harbour of the Roman city preserved the remains of two maritime vessels, Pula 1 and Pula 2, from the Early Roman Imperial Period. The ships belong to diverse functional ship types, and present different patterns in the sewing technique used for the outer shell assembly.

**Lars Kröger**

German Maritime Museum

\*poster

## **Within the network of fluvial ports. Efficiency and infrastructural development of inland waters and their vessels**

As a rule, trading centres depend on their infrastructural links to regional and transregional traffic systems. The research on ancient overland routes already has a long tradition. In contrast there is a considerable lack of studies concerning waterways that eventually transformed trading centres into harbours. Navigation on seas and larger lakes required human interference with nature only for the creation of landing and transshipment points. However, in order to make navigation possible on rivers, much larger infrastructural changes were required: river beds had to be cleared, towpaths to be created, and already existing disturbances in the cultural landscape (such as mills and fishing weirs) had to be removed. When, how, and on whose account these measures were implicated in Central Europe is currently not known.

An upcoming three year project starting in the fall of 2015 at the Deutsche Schiffahrtsmuseum in Bremerhaven and founded by the German Research Association (DFG) aims to fill this gap by collecting a suitable amount of data, especially concerning the findings of inland vessels, but also combining them with written and iconographic sources. The focus will primarily be on data from the early medieval times until the 17<sup>th</sup> century. Only an integration of insights gained from these sources makes it possible to demonstrate larger developments. By comparing and contrasting the usage histories of the rivers Main and Neckar in Southern Germany differing patterns of developments will be demonstrated and integrated into the binary correlation of ships and harbours. Moreover, a catalogue of archaeologically researched inland vessels in Central Europe is in preparation, which will help to establish a chronological typology of boats and ships on a larger scale from which more insight into their impact on harbour shapes will be gained. Taking the Carolingian flat-bottomed boat Krefeld-Gellep III as an example to apply modern measuring and testing methods, which are common in modern ship construction, we will be able to determine the performance of Early Medieval transportation systems. The project aims at establishing a model of anthropogenous river development and transport in the Early and High Middle Ages, which will form a solid basis for our understanding of harbour structures of this age.

## **Victor V. Lebedinski, Sergey Zelenko, Julia A. Pronina**

Russian Academy of Sciences / Taras Shevchenko

National University of Kyiv, Ukraine

\*poster

### **Results of the latest underwater archaeological investigation near the Crimea**

Now in coastal waters of the Crimea there is a number of underwater archaeological objects belonging to the Antiquity, the Middle Ages, the Modern and Contemporary History. Studying of these objects permit to extend our understanding of the history of navigation, maritime trade, as well as coastal buildings and structures in the area.

Near the south-eastern coast of the Crimea the International Research Group of Russian-Ukrainian scientists conducts underwater archaeological exploration. As a result there were discovered the traces of shipwrecks dating from the X and XIII centuries, the remains of an ancient pier of Kafa, near the Cape Malchin - ancient anchorage at the source of fresh water.

In coastal waters of the Heracleian peninsula (administrative territory of Sebastopol) there were explored underwater archaeological monuments which included both flooded buildings of Chersonesos settlement and its chora, and remains of shipwrecks. Now part of ancient buildings of Chersonesos settlement, as well as the manors and other agricultural structures of chora are under water. The depth of location of the monuments is 0.5 m – about 4.5-5 m. We conduct attempts to study these flooded structures, and to reconstruct the ancient coastline. In particular, we study the dynamics of abrasion and flooding of the cultural stratum, revealing the ancient coastline and its reconstruction with the help of the map data. During this research, we use the data of field research and also calculations and reconstructions of clares of agricultural district (chora).

## **Paweł Litwinienko**

University of Gdańsk, Poland

\*poster

### **New anchors founds in the Gulf of Gdańsk**

Every year the Maritime Office in Gdynia conducts an action of sweeping modern anchorages in search for any obstacle that may threaten the shipping. As a result, many artifacts are raised from the bottom of the sea, among them anchors, both modern and historical. Modern ones, from 20<sup>th</sup> century are a majority and are sold to private persons, but those dated on earlier times are kept as artifacts and may become part of museum collection, like in 1970s, when Admiralty anchors discovered in Gdańsk and Gdynia anchorages were given to Central Maritime Museum in large quantities.

There are six historical anchors kept today by Maritime Office on Westerplatte – they were found in 2010 and 2011, together with 24 patent anchors from 20<sup>th</sup> century. There are three small Admiralty anchors from 19<sup>th</sup> century, two big Trottman anchors and one older anchor – probably the Old Longshank Type, which could be dated on 16<sup>th</sup>-17<sup>th</sup> centuries, similar to those found on Mary Rose.

The fact that anchors, both historical and modern are still found on the bottom of Gulf of Gdańsk in large numbers confirms that Gdańsk was a huge harbor in the past. By knowing the exact localization of these finds we now have the possibility to estimate where historical anchorages of Gdańsk harbor were and where new shipwrecks may be located.

## Alessandro Luciano

Naples National Archeological Museum, Italy

### The maritime landscape of Naples in the Byzantine period

The recent archaeological researches carried out during the building of new Metro stations have shown that the coastal area of Byzantine Naples (Southern Italy) was affected by the restoration of the defensive walls, the reorganization of the port and the construction of new public buildings.

Even at the time of the Vandal raids, Valentinian III restored the walls, while the villa of Lucullus, on Mount Echia and its slopes, was fortified; known as *Castrum Lucullanum*, hosted the exiled Romulus Augustus after the fall of the Roman Empire. In that area, the patrician Liberius built the famous monastery of St. Severinus.

In the early fifth century the port basin between Municipio square and Bovio square silted and sanded up; consequently, the port moved towards South/East. During the Gothic war, the fortifications of Naples were restructured several times. According to the historical sources, Belisarius built seven towers while Narses, at the end of the war, restored the walls destroyed by Totila, connecting the port to the city.

After the Byzantine conquest, glass and a metal workshops, a street leading to the town and a warehouse complex were built at the port area. A squared tower, reusing ancient marbles, came to light during the excavations of Bovio square.

During the Duchy time, Naples was a very important maritime city. A document of AD 1018 recalls two distinct ports, the *Vulpulum* and the smaller *portus de Arcina*, with an arsenal connected to the *Praetorium* (Ducal Palace). It was located near the actual monastery of St. Marcellinus and housed the Mint. In this period, the coastal area was equipped with a rampart on the beach, the *baricorium*, while a *Castellione Novo* was built near the *Vulpulum*. Many ecclesiastical buildings, such as the *diaconiae* at *imma plateia* and the monasteries between Megaride and Pizzofalcone, occupied the maritime landscape at the end of the Duchy period.

## **Sabrina Marlier**

Arles Museum of Antiquity, General Council of the Bouches-du-Rhône, France

\*poster

### **The gallo-roman barge Arles-Rhône 3**

Discovered in 2004 in the Rhone River, in Arles (south of France) and lifted in 2011, after seven years of excavation, the Arles-Rhône 3 shipwreck has already been presented in the previous ISBSA symposiums (in 2006 in Mainz, in 2009 in Istanbul and in 2012 in Amsterdam). At present, after being restored, the shipwreck of this 31 metres long unique gallo-roman barge, is exhibited within the Arles Museum of Antiquity (Muséedépartemental Arles Antique). A new museum gallery was specially built to accommodate the hull of the vessel together with ca. 480 objects related to the sea-river activities of the harbour city of Arles in the roman era (*Arelate*).

In parallel with the restoration and the reassembly of the barge (July 2011 – October 2013), a series of interdisciplinary studies and analyses, were undertaken by about twenty different specialists (nautical archaeologists, dendrologists, ceramologists, a numismatist, an epigraphologist, geologists, a geomorphologist, an anthracologist, palynologists, a biologist, a mycologist, experts in corrosion, as well as an expert in the study of ancient textiles). The diverse studies have now been completed and allow us to reconstruct and comprehend the history of this boat.

This last and final presentation dedicated to the shipwreck proposes the discussion of the synthesis of the main results achieved from the holistic study of this barge revealed almost complete (the preserved remains represent a little over 93% of the hull to which one should must add all its wooden interior fittings). The barge sank in the *Arelate* port around the beginning of 70 AD with its cargo of 21 t of stones, interior equipment's and furnishings (cooking utensils, ceramics and tools), navigational fittings (the steering oar and the towing mast) and its votive coin. The construction date of the barge, the reasons of its sinking, as well as its origin, function, on-board living area and its geographical zone of navigation will be also discussed. Finally, the barge will be interpreted within the context of the Gallo-Roman water transport.

## **Adolfo Martins**

University of Wales Trinity Saint David, United Kingdom

\*poster

### **The Anatomy of Trees & Ships: How can we see trees in their timbers?**

During winter storms of 2013/4, a large number of ship timbers were washed ashore on the North Portuguese coast close to the city of Esposende. Associated artefacts included hundreds of pewter plates believed to date to the 17<sup>th</sup> century. Further timbers have been collected during the winter of 2014/5. As part of the Marie Curie Actions ForSEAdiscovery Project (PITN-GA-2013-607545), the timbers are being recorded by traditional 2D means but also using 3D digital recording methods (for the first time in Portugal).

The usage of 3D digital timber recording techniques has increasingly been used to accurately document ship timber assemblages, and to develop hypothetical reconstructions. These techniques could also contribute for a better understanding of how trees were cut and converted into timbers for shipbuilding.

My main research plan involves the usage of 3D digital techniques such as recording with Faro Arm and laser scanning, integrated with wood science studies (wood anatomy for species/genus identification, and dendrochronology). The aim is to develop an integrated methodology which allows reconstruction of the trees exploited for the production of ship timbers. *Some of these techniques were used in the past especially in the northern countries of Europe, but as far known at the moment this is a completely new approach that combines archaeology, dendrochronology and computing.*

Within these techniques in order to find answers for our main question: how the carpenters convert trees in timbers? We believe that by developing digital techniques for 3D reconstruction of the growth pattern, age structure and morphology of parent trees employed in ship timbers in the Iberian shipbuilding of the Age of Discoveries; we will have enough data beginning to reconstruct the Iberian past forestry.

## **José Manuel Matés Luque**

Arqueocean, Spain

\*poster

### **Away from the sea, close to the water: the recording of some flat bottomed boats in Spanish inland rivers**

There are lots of boat types in Spain but those used on inland rivers and with flat bottoms have not been properly researched. They have been used until recently but little is known about their origin. Last year, we managed to record three different types of boats which have some interesting features in their boatbuilding; so have the oars some of them use. The boats are different in sizes and shapes from each other. Shapes are a) rhomboidal; b) triangular with the top tip flattened; and c) square with the bottom curved upwards on both ends. Their oars remind us of Celtic types, although such oars are also slightly different from each other.

In 2015 new types of boats will be recorded in new places that we have learnt about, some of them with features which can be compared to the other three types. All boats, however, are different from each other and the purpose of the research is to analyze each type and be able to identify influences from other regions and boats. Since such boats are placed in some places (more than 150 kms away from the coast) on Spanish inland rivers, they seem to be the evolution of unidentified local and ancient types and/or the results of old seagoing ships which might have left some of their features in them. However other possibilities might also exist and we would like to share our ongoing research and results.



**José Manuel Matés Luque, Oskar Moral Goirigolzarri**  
Arqueocean, Spain

## **3D Laser scanning of a mid-20<sup>th</sup> century Basque fishing vessel: the Antxustegi, a model for the digital recording the Basque traditional fleet**

The Basques have been famous in shipbuilding and sailing from the Middle Ages. Documents on their maritime history have also helped to identify shipwrecks which have helped us to understand their shipbuilding, like the one regarding the lost of the whaler San Juan, Red Bay, Canada, in 1565. Other wrecks (like the Newport ship, Wales) are allowing us to understand shipbuilding in the Basque maritime history. Unfortunately, current shipbuilding in the Basque country is mainly done in metal and the knowledge on building timber ships is disappearing. Therefore, recording with as much details as possible of some timber built Basque vessels is a task which will allow us and future generations to understand the last ships built in the 20<sup>th</sup> century which still share some features in common with their predecessors, some having been excavated elsewhere. Unfortunately the 3D laser scanning was done in a badly damaged fishing vessel, the *Antxustegi*, built in the 1950's before further damage could have made it impossible to do such recording. Despite her state, the laser scanning was achieved and we think that the results show the usefulness of such technique for the quick recording of such heritage at risk, something that should have been done before the vessel reached such a bad state. This paper will show the results of such recording and the story of such vessel, hoping that this project becomes a benchmark for further digital recording of a Basque maritime heritage that is neither fully nor properly recorded from the point of view of the maritime archaeology.

## **Laure Meunier-Salinas**

Arc Nucléart/CEA Grenoble, France

\*poster

### **Interdisciplinary collaboration on a 2<sup>nd</sup> c. AD barge project, archaeology and conservation of *Lyon Saint-Georges 4* (Rhône, France)**

The wreck was found during a preventive archaeological excavation, near Lyon, before building an underground car park and it has been kept 10 years in temporary storage in a lake.

In 2014, starting conservation in ARC-Nucléart facilities, we teamed up with the archaeologist who initially excavated the wreck and organized a scientific survey, including archaeologists, conservators, wood specialists and many more. Badly altered, the boat had to be dismantled for conservation purposes. This became a unique opportunity to collect a maximum of scientific data. Hence, we tried to schedule our own work to allow interventions of specialists at any step of the process they can take advantage of. Each point of view being complementary, the mass of personal and global knowledge dramatically increased. Furthermore, this global vision also allowed us to select considerable amount of appropriate samples for future scientific studies.

I presented this approach in September 2014 in a WOAM (Wet Organic Archaeological Materials) symposium, a conservator's international working group. The well-known importance of interdisciplinary work re-enlighten, conservator's board decided half a day should be spend on tied collaboration projects during 2016 next meeting.

The subject of this communication is a comforting example of how scientific gain can be achieved by enlarging the concept of "working together".

**Maria Molina Intxaustegi**

University of Basque Country, Spain

\*poster

## **Shipbuilding in the Spanish Colonies During the 18th Century: The Havana Shipyard and their Ships**

During the 18th century, the Spanish shipbuilding industry developed and overcame all the handicaps of the previous century. In this context, the Havana royal shipyard played a special role with its ships being widely celebrated. However, if we delve deeper into the subject, we realise that shipbuilding in the colonies during the 18th century (a scarcely researched topic) was significantly different from the metropoli shipbuilding. There were four royal shipyards in Spain: Ferrol (in Galicia), Guarnizo (in Cantabria), Cartagena (in Murcia) and La Carraca (in Cádiz), although none was as productive as Havana's. During the 18th century, all of them together built approximately 113 ships while only in Havana were built more than 185 ships.

In this dissertation we will discuss the differences between the Spanish and the Havana shipbuilding methodology and we will attempt to answer some questions. For example, why did vessels constructed in Havana continually received negative evaluations from Spanish officials, when they first arrived to metropoli ports, while they were generally considered more effective than metropolis built vessels?

Bearing in mind that the Caribbean colonies were a great distance from Spain and it's control, that the island of Cuba had excellent shipbuilding lumber (much better than that available in Spain), and also considering foreign influences, we believe it is relevant to undertake research comparing archaeological and archival sources.

**Aleydis Van de Moortel**

University of Tennessee, USA

## **A new typology of Bronze Age Aegean ships and boats: developments in Aegean shipbuilding in their historical context**

Our understanding of Bronze Age ships and shipbuilding in the Aegean has long suffered from a dearth of actual wooden ship remains. Apart from the stain of a small Middle Bronze Age boat found at Mitrou, in central Greece, on which I reported at the 12th ISBSA, and some boat remains that may or may not be Aegean, current evidence is limited to close to 400 boat and ship representations, most of which are small and schematic and do not give much detail. Michael Wedde (2000) published the most comprehensive compilation of those images to date. In his study he proposed a typology of 6 wooden boat and ship types, which he presented as steps in an evolutionary process. Addressing the long-standing debate on the directionality of Early Cycladic longboats, Wedde argued on the basis of iconographic consistency that the high end must be the stern, and not the bow.

In the present paper, a new typology will be proposed for Bronze Age Aegean ships and boats. It will be argued that this new typology is more relevant to the study of ship construction because it is based on significant differences in the construction of hulls. In addition, recently discovered iconographic evidence will be presented that shows beyond a doubt that the high end on Early Cycladic longboats was the bow, and not the stern. The new ship and boat types and the information they give about changes in ship construction will be placed in the context of historical and socio-political developments in the region as these are currently understood by Aegean prehistorians. Within this historical context, issues of the transfer of shipbuilding technology will be addressed.

## **Lislore An Muis**

Periplus Archeomare BV, Netherlands

\*poster

### **Remarkable find of the wreck site by Hasselt, the Netherlands**

In 2013 a rather large wreck was found in a relative small river near the city of Hasselt, Netherlands. After an archaeological assessment in 2014, archaeologist proved it to be a large seagoing vessel, dated early 16<sup>th</sup> century, completely clinker built with an overall length of approximately 35 meters. Although more clinker built wrecks are found in the Netherlands, only one be compared in length, date and construction. In Europe only a few similar wrecks are known and many questions are still unanswered. Their typology is unknown as is their origin, which makes these wrecks very remarkable finds. The wreck find at Hasselt might be another link to an archaeological source of which not much information is known.

## Emmanuel Nantet

University of Le Mans, France

### **The accuracy of the tonnage formula and the correcting coefficient**

Patrice Pomey and Eric Rieth consider that there are three ways to measure the tonnage of a ship from her remains. You can either add the weight of any piece of merchandise (1), or submit a graphic reconstruction of the hull lines (2), or use a tonnage formula (3). The latter (3) is a simple mathematic formula which was conceived and used in the Modern Age to measure quickly the tonnage of a boat. They considered the ship as a parallelepiped. To take into account the skew lines of the ship, they used some coefficients to reduce the volume. Archeologists have adapted the modern tonnage formula suggested by Paul Gille and applied it to ancient shipwrecks.

The purpose of the submitted presentation is to compare the results of that tonnage formula (3) and those of the graphic reconstruction (2), most reliable, in order to measure the accuracy of the tonnage formula. The application of the tonnage formula seems to give fairly reliable results for ships of Hellenistic, Imperial and Early Middle Ages. However, in some cases, it could be necessary to use a correcting coefficient of 0,5 - for instance for the ships of the Archaic Period.

Thus, the tonnage formula (3) must be considered as an efficient tool to measure quickly the *approximate* tonnage of the shipwrecks, *only when a graphic reconstruction (2) is not available*. Moreover, if the result given by the tonnage formula (3) is much higher than the weight of the cargo (1), it might show that a part of the merchandise disappeared, or the ship was not fully loaded or the cargo was heavily looted. Last but not least, the use of a correcting coefficient for some kinds of ships would suppose architectural features implying strong economical consequences.

**Nigel Nayling, Ana Crespo Solana, Ignacio García González**  
University of Wales Trinity Saint David, United Kingdom

## **ForSEADiscovery – Forest Resources for Iberian Empires: Ecology and Globalization in the Age of Discovery**

In the Early Modern Age (16th-17th centuries) the construction of ocean-going ships was paramount to the development of cultural encounters in what became the Age of Discovery and European expansion. In the case of the Iberian Empires, the establishment of new trade routes brought the need for armed merchantmen, galleons and smaller vessels, placing unprecedented demands on Iberian forests for the supply of construction timber. Forestry and sea power became inextricably linked, creating new geopolitical tensions, alliances and forest regulations. Key questions in this context are: could Iberian forest resources sustain the increasing demand for timber, or was wood imported from elsewhere? If so, how were the trade networks organized? How did domestic forestry practice and timber supply develop and adapt?

This paper will outline the methodologies, objectives and preliminary results of a major multidisciplinary project funded through a Marie Curie Initial Training Network grant (2014-18) which sees a collaboration of universities, state research centres, and maritime archaeology companies working together using a combination of historical, archaeological, dendrochronological and earth science approaches to address these questions whilst training the next generation of mobile European researchers. At this early stage in the project, there is a real opportunity for conference delegates to influence research direction and promote site selection.

**Mariangela Nicolardi**

Venice, Italy

\*poster

## **Archaeological and historical perspectives on merchant shipwrecks' national identity: late 16<sup>th</sup> century Venetian ships case-study**

The study of the material evidence of a post-medieval merchantman shipwreck (e.g. cargo, personal objects belonging to the crew and ship's armament) and the analysis of the available written sources could provide some information regarding the ship's national identity, which is an appropriate archaeological goal. What does it mean to establish a national affiliation of a ship from the archaeological and historical perspective?

According to current international navigation rules, a ship's nationality depends upon the state in which its registration took place, and is reflected in the flag it flies. Is this concept applicable to earlier historical periods? Before the middle of the 17<sup>th</sup> century this subject was not regulated by any set of specific laws; therefore, identification of the nationality of a ship is quite a complicated task for modern historians, just as it was for the people of the past. For merchant ships, it was customary at the time to change their flag in the course of navigation, based on the various circumstances, such as the risk of a pirate/corsair attack, or to evade custom laws. In the case of the Venetian merchant fleet, the obligation to fly the Saint Marc's flag was introduced only in 1689. Many ships built abroad completed the so-called process of naturalization, and enjoyed the same "Venetian" (meaning the ships built in the lagoon area) ships' privileges, which were not applied to other ships built in the Venetian Commonwealth.

Based on exhaustive archival research, this poster describes disputes and documents ambiguous historical records which highlight the difficulty in classifying ship nationality for late 16th century Venetian merchants. At the same time, it highlights risks linked to a superficial and careless evaluation of archaeological remains that can lead to incorrect conclusions about the nationality affiliation of an excavated shipwreck.



**Xenius Nielsen**

Canada

## **Dock Island's Wreck 3: New Studies into the Clinker Construction and Origin of a 15<sup>th</sup> -Century Ship Find from Copenhagen's Harbour**

The Baltic Sea's maritime landscape from the 13<sup>th</sup> -century forward is intimately intertwined due to increasing trade ties, dwindling forest resources, and transfer of ideas. Regional differences in hull construction techniques seen in the Viking Age are hard to distinguish in the Late Medieval Period. Ship finds indicate construction techniques are a mix of past traditions and contemporary construction features. The increased diversity in ship design thus results in the reduced value of traditional nomenclature classification. Intensive coastal development along the Baltic's seaboard is seen as a catalyst for this innovation in hull construction. A "paradigm shift" is used to describe the adoption of large vessel construction features into small vessel design.

In 2012 my Masters Thesis project included completing a post-excavation analysis of Dokøen 3/Dock Island's Wreck 3 (c. 1420-1425). The small cargo vessel was excavated and documented by the Copenhagen Museum in 2001, but time and money constraints prevented a comprehensive analysis from being completed. Extensive work, however, went into scanning each individual piece of timber associated with the wreck using a 3D scanner, which paid-off in dividends considering their delayed analysis. In addition, questions that could not be answered by the colourless 3D images alone were either directed to the 1:1 digital photos taken or the ship remains still housed in Copenhagen.

The over-arching intent for completing Wreck 3's timber catalogue and hull description is to make Wreck 3's construction details more accessible for future comparative studies. Little comparative material limits our present knowledge on ship construction in the Baltic during the Late Medieval Period; therefore, those ship finds that do exist must be well-documented, published on, and available to researchers. A discussion will be presented on Wreck 3's construction features and inconclusive Polish origin, along with my new dendrochronological inquiry and comparative research.

**Juan Pablo Olaberria**

University of Southampton, United Kingdom

## **A new proposal about the conception of hull shape in Dutch-flush construction. Re-reading Arnauld 1670 and Witsen 1671**

Hasslöf (1957-8) proposed two opposite approaches to building a wooden ship's hull: shell-first and skeleton-first (1963). Subsequent publications (e.g. Hasslöf 1966; 1972), reinforced this definition. The shell/skeleton paradigm has been used to study the techno-practical approaches of societies to ship construction, but most importantly, it has provided an insight into the mental approach to the definition of hull-shape. Thus, shell-built hulls were built without a pre-established design procedure, whilst skeleton-first followed a pre-design process (e.g Hasslöf 1957, 1972; Hocker 2004; Pomey 2013).

The shell/skeleton divide has been used to study the social arrangements of the societies that followed either approach to ship construction (e.g Maarleveld 1992), with specially relevance in Nordic clinker construction (e.g. Christensen 1972; Godal 1990; Crumlin-Pedersen 2004; Indruszewski 2004).

Hasslöf's proposition is often taken at face value without a critical analysis of the underlying concepts. In two recent IJNA papers I have challenged the idea that ancient-Mediterranean and Nordic-clinker builders had no means of pre-designing hull-shape (Olaberria 2014; Dhoop and Olaberria 2015). Both papers present evidence showing that Hasslöf's proposal and subsequent ideas postulated by others (e.g. Steffy 1994, Maarleveld 1992.) should be reviewed.

My presentation will offer a distinct view of the last remaining unchallenged European shell-first tradition: Dutch-flush. The presentation will analyse two contemporary documents in which most of the claims about conception of hull-shape in Dutch-flush are based: an account by the French envoy Arnauld (1670) and Witsen's treatise as translated by Hoving (2012).

An analysis of both documents, and especially of Hasslöf's variable translations of Arnauld's text will expose weaknesses on Hasslöf's proposal, and their contents will be used to propose that Dutch-flush shipbuilding had a very strong idea of pre-design.

**Sergey Olkhovskiy**  
Russian Academy of Sciences

## **The Phanagorian shipwreck: continuation of study**

In 2012, during underwater excavations of ancient time harbor structures in Phanagoria we found 15-meter wooden ship. First clearing of inner volume of the ship has determined that hull's planking collected by the method «mortise-and-tenon». We had little time for study the ship in situ, so we decided to perform a photogrammetry and collect detailed information about the hull during post-processing of 3D model. It was found that applied method of the ship's fixation is effective, but making a full 3D model fails due to some «white gaps» in the ship's structure. It became obvious that we need clear the ship again and fully remove accumulations of ballast inside the hull.

In 2014 we have gathered required resources and improved equipment for second clearing and fixation. In addition, we have planned to clear the part of the ancient pier near the ship. During this clearing, in ship's bow area we discovered a massive bronze item, looks like a ship's ram. On both sides of the ram deposited emblems of Bosphorus king Mithridates VI Eupator, it permits dating this find as the 1st cent. BC. After clearing we performed photogrammetry again and collected a new data for constructing large-scale «cloud of points». Now this «cloud» is a main source of exact information about all ships' details and a reliable basis for 3D modeling of feasible look of the ship.

**Waldemar Ossowski**

National Maritime Museum in Gdańsk, Poland

\*poster

## **Shipwrecks from the Vistula River near Gdańsk as examples of *longue durée* of transport system**

In the years 2008–2014 were carried out rescue underwater archaeological excavations at the final section of the Vistula (now called Martwa – eng. Dead) Vistula near Gdańsk. Here were revealed 6 wrecks that sunk during the siege of Gdańsk in 1734 by the Russian and Saxon troops. Four wrecks are remnants of local ships called *Bording*, intended for the loading and unloading of large seagoing ships, who could not reach the Gdańsk harbour, due to the deep draught. They were also used for local sailing on the Vistula Lagoon. Two other wrecks are remnants of large river craft.

The aim of the presentation is to demonstrate those wrecks in comparison to other finds from Poland. The newly discovered wrecks are examples of long-term structural solutions used continuously, with slight modifications, from the medieval period. They constituted an important component of the existing until the beginning of the early nineteenth century transportation system based on floating goods with the Vistula River to Gdansk. The aim of this paper is also to present more general conclusions on the causes of long duration in shipbuilding in Gdansk and attempts to identify factors influencing the *longue durée* of the forms of ship construction.

## **Alice Overmeer**

The Netherlands

### **A missing link in a period of change: shipwreck U34 in Flevoland, the Netherlands**

In the middle of the 16th century, a clinker-built giant of 33 m long sailed the Zuiderzee and beyond. It appeared to be an early-modern vessel, with its three-masted rig, two decks, lidded gun ports, and its transom stern. But looking closer, this ship had many typical medieval elements. The hull was completely clinker-built from keel to gunwales. The overlapping strakes were connected by a combination of rivets and very small treenails. The seams were caulked with moss, moss lath and iron sinters, and rising deck knees were standing on top of the deck beams.

The period AD 1450 to 1600 is a period of change in the Netherlands. In this era of explorations and colonisations, important changes in ship design took place, such as the enlargement of ships and the extension of the rigging, the introduction of guns on board, and the transition from clinker to carvel hull construction.

Unfortunately, shipwrecks from this period are rare. But between 1955 and 1999, in the Dutch IJsselmeer polders (formerly the Zuiderzee), seven shipwrecks were found which all date from this period. They share some striking construction features: completely clinker-built, riveted, straight sternposts and curved stems, flat-bottomed amidships with flaring ends. One of these wrecks is that clinker-built giant, named *U34*.

This paper presents a first interpretation of the excavation data of *U34* and other clinker wrecks. Clearly, *U34* is a transition ship, a missing link in the Dutch maritime history, hovering between Middle Ages and the Early Modern Period. But what did this large ship do at the Zuiderzee? Why did the shipwrights held on to that clinker-built technique, when carvel building already was widely adopted for nearly a century? Why all the efforts in making gun ports in the lapstrake hull, while the Dutch, lacking a central government, rather invested in the construction of merchant vessels. The study of *U34* will shed some light on this Dutch period of change.

**Taras Pevny**

Ukraine

## **Beyond *La Belle*. Longitudinal design concepts in frame-first construction: reassessment and implications**

The archaeological remains of *La Belle*, built in Rochefort, France in 1684, present the most extensive and complete set of shipwrights' design marks documented to date. The distinguishing features of the distribution, number, and placement of *La Belle's* surmarks associate it with a graphic design system of "geometric fairing with diagonals", which was in use in French shipbuilding in the late seventeenth and eighteenth centuries. It will be argued that this system actually expanded on the basic concepts of Mediterranean moulding—a non-graphic design system of geometric fairing that was in use in European shipbuilding for centuries prior to *La Belle's* construction—in the process of adapting them to the methods of orthographic drawing. *La Belle's* surmarks, as those found on other vessels, are associated with construction sequences in which the frames are raised first, and these transverse structural elements define the hull shape during the construction stage of the vessel. However, this paper will present the view that in the corresponding shipbuilding traditions the surmarks located on the frames are actually direct evidence for the quantification of longitudinal curves, and although the restrictions or rules placed on the transverse geometry—e.g. using templates—are important, it is the definition of longitudinal curvature that actually quantifies the change in hull curvature along the length of the vessel. Analyzed from this perspective, the design methods that allow for the predetermination of frame shapes for frame-first construction do not equate with frame-first design, and the development of these design methods was not necessarily a complete conceptual shift from the design principles involved in shell-first construction. It will be argued that the idea of quantifying longitudinal curves originated with adjusting and regulating curvature along the runs of planks or ribbands at transitional points on the shell of the hull.

## **Patrice Pomey, Pierre Poveda**

Aix-Marseille University, CNRS, France

### **Prôtis Project: *Gyptis* sailing trials**

*Gyptis* is the sailing replica of an archaic Greek boat of the 6th century BC which was built and launched in 2013, on the occasion of “Marseille-Provence, European capital of culture 2013”, as part of the programme of experimental archaeology «Prôtis project».

This replica is the outcome of twenty years of research carried out by the Centre Camille Jullian (Aix-Marseille University, CNRS) since the discovery in 1993 in Marseilles of the Greek archaic wreck *Jules-Verne 9*. The boat, built “shell first” by the Greek settlers from Phocaea, in the Aegean Sea, who founded Marseilles, is a “sewn boat” fully assembled by sewing and lashings.

According to the reconstruction study (based on models and 3D restitutions), the sailing replica *Gyptis* is a large coastal boat used for fishing and for light transport. The boat is 9.85 m long and 1.88 m wide with a mixed propulsion by a square sail and oars. The steering system is made of quarter rudders.

After the official launching in Marseilles, the boat was rigged and equipped to be able to sail in November 2013.

After preliminary sailing trials in the bay of Marseilles, in order to evaluate and handle safely the vessel, the *Gyptis* has undertaken longer experimental journeys, sailing for several days along the coast of Provence. In 2014, the boat continued its coastal navigation and has participated in many public demonstrations on the occasion of various maritime events.

In 2015, a scientific programme of experimental navigation and sailing trials has been implemented. It aims at studying the behaviour of the vessel, its evolving capacities and performances, and its nautical characteristics according to different configurations of wind, sea and loading. *Gyptis* being a multipurpose coastal boat, different experiments of use will be undertaken: sailing with a cargo of amphorae; fishing. It is also especially planned to explore the possibilities of the ancient square sail handling.

This paper will present the main results of the sailing trials and navigations, and will discuss the sailing capabilities and nautical qualities of the vessel.

The “Prôtis” project was supported by the Aix-Marseille University, the French National Centre for Scientific Research (CNRS), The Region Provence-Alpes-Côtes d’Azur and the urban community Marseille-Provence-Métropole. The boat was built in Marseilles on the Borg traditional shipyard with the help of the association Arkaeos.

## **Iwona Pomian**

National Maritime Museum in Gdańsk, Poland

### **Latest archaeological researches led by National Maritime Museum in Gdansk – new challenges**

Noticeable in the last decade, the growth of investment in the Polish zone of the Baltic Sea has caused very intense work to identify obstacles on the bottom in areas under development. The result is a significant increase in the amount of underwater archaeological sites. The scale of revealed findings in the face of the lack of preservation services prepared for their verification and the protection may result in total destruction. The only exception to this are trying to create a system for the management and monitoring of the maritime archaeological heritage in the waters adjacent to the province of Pomerania. These activities are based on the experience resulting from many years of cooperation in maritime authority with the National Maritime Museum in Gdańsk and the examples derived from other European countries. They inscribe also into actions Ministries of Culture and National Heritage targeting the ratification of the Convention UNESCO Paris 2001 about protection of the underwater cultural heritage.

National Maritime Museum is also trying bring in the concept of underwater cultural heritage to the papers on maritime policy of the Republic of Poland this applies to maritime policy of the Republic of Poland, which is an expression of the implementation by the Republic of Poland Polish Republic which is expression of the realization through the Republic Poland directives formulated in documents the "Integrated sea-politics of European Union" and in conclusions of European Council.



**Yftinus van Popta**

University of Groningen, Netherlands

## **Dynamics of the maritime cultural landscape of the *Zuiderzee* between 1100 and 1400 AD**

Despite the strong maritime character of the Netherlands, now and in the past, maritime archaeology has become a threatened research specialism: the nature of archaeological studies is frequently too narrowly focused on terrestrial archaeology, the discipline has a relatively small amount of active scholars and is still perceived to be engaged in antiquarianism. Archaeological studies that do target the maritime past are particularly focused on shipwrecks that are often documented as isolated and material objects, without considering historical, political, social and geographical context. It means that there is an urgent need for new interdisciplinary approaches in modern day maritime research. To bridge these boundaries, several researchers, including Christer Westerdahl, proposed to use a new tool, called the maritime cultural landscape: *“the whole network of sailing routes, with ports, havens and harbours along the coast, and its related constructions and other remains of human activity, underwater as well as terrestrial”*. This concept, based on Scandinavian archaeology, had a profound impact on maritime archaeology as the maritime cultural landscape approach is suitable for spatial studies instead of only studying individual sites or major excavations.

Changing the focus from object- and shipwreck orientated maritime archaeological studies to more integrative and spatial studies on the maritime cultural landscape forms the core of my PhD-research. The study area in this research is defined as the province of Flevoland, a reclaimed part of the former *Zuiderzee* with a highly dynamic past: from land into lake, into sea, into polder. Flevoland is often referred to as ‘the largest ship graveyard on land in the world’, as it contains over 420 remains of wrecked ships. I will focus on the interrelation between landscape development (geomorphology), occupation (eroded settlements and former islands) and shipping (wrecks) from a spatial point-of-view between 1100 and 1400 AD. A density analysis (ArcGIS) of wrecks in Flevoland has already shown distinct patterns and relations between wreck sites, seaports and submerged settlements. Examining these patterns in a GIS will lead to a better understanding of the landscape of the former *Zuiderzee*.

## **Marcel Pujol i Hamelink, Pablo de la Fuente de Pablo**

Vistula University in Warsaw, Poland / ESCRBCC, Spain

\*poster

### **The English shipbuilding in the Spanish shipyards (1749–1767). How to identify the Spanish and English construction details in shipwrecks from the mid-18th century**

In the 18th century Spain was still a Colonial Empire, but it was unable to protect its colonies from their competitors, mainly Great Britain and France. The Marquis of La Ensenada, Minister of Finance, War, the Navy and the Indies (1743–1754) wanted to create a strong army and reorganize the navy by building a great number of man-of-war and introducing the English technology.

He sent Jorge Juan to the Royal Navy shipyards in England (1748–1750) in a spy mission. In spring 1750 it was foiled and he had to escape from England. However, the result was a success, more than 50 British shipbuilders were moved secretly to the Spanish shipyards.

In 1749 the English construction is commenced in Spain (1749–1755). The best British shipbuilders (Rooth, Bryant and Mullan) assumed the direction of the Spanish shipyards of Ferrol, Cadis and Cartagena.

In June 1754, La Ensenada fell into disgrace, allowing his opponents to modify the English construction under the supervision of the Naval Board of Cadis. They decided to return partly to the traditional Spanish construction method. At the end of 1754 the shipyards started to build hybrid ships using some Spanish and English elements. As a consequence of the Third 'Pacte de Famille' between the French and the Spanish Bourbons, François Gautier took control of the Spanish Navy and its shipyards. The idea was to create just one Navy, joining French and Spanish ships. That meant the end of the English construction in Spain (1763–1767).

We would like to show you the difference between the Spanish and the English construction details found in the Spanish ships from 1749 to 1767 (longitudinal hook and butt scarf on the keel, deadwood, chocks, knees, massive frames, treenails instead of iron nails, etc.). All these construction details will be of great help for naval archaeologists, as they will allow them to identify the shipbuilding tradition and to date a wreck.

**Irena Radić Rossi, Mariangela Nicolardi**

Univeristy of Zadar, Croatia / Venezia, Italy

## **The Post-Mediaeval Shipwreck of Gnalić (Croatia) in the light of new discoveries**

Officially discovered in 1967, and partly rescued in 1973, the shipwreck of Gnalić (south of Zadar, Croatia) yielded plenty of evidence on the composition of cargoes in the late 16<sup>th</sup> century. Based on the various recovered finds – some of them extremely rare or even unique – it is considered one of the most important Renaissance shipwrecks in the Mediterranean.

Despite its cultural, historical and scientific importance, the site, until recently, remained unexplored, due to the lack of adequate financial and logistical resources. Restarting the underwater archaeological excavation in 2012 stimulated additional historical research in the State Archive of Venice, and offered the opportunity to involve experts from other scientific fields. The results immediately exceeded all expectations, and the efforts culminated in the project “The Shipwreck of Gnalić – Mirror of Renaissance World”, promoted by the University of Zadar, in collaboration with the Ministry of Culture of the Republic of Croatia, and Texas A&M University.

Starting from several documents discovered by Astone Gasparetto in the 1970s, the tentative identification of the shipwreck was confirmed through the correspondence of the Venetian ambassador in Constantinople, Giovanni Francesco Moresini, with the Senate of the Republic of Venice. During the past three years, more than a hundred documents have been discovered which reveal the important events in which the ship was involved between its launching in 1569, and sinking in 1583, and the important people that took part in its story.

The paper presents the results of the recent underwater excavation campaigns, and the study of the archival resources, evoking the extremely rich cultural, economic, political and historical context. It also presents a comparison of the results of the archaeological and historical research, to demonstrate the evidence used to confirm the identification of the ship.

## **Morten Ravn**

Viking Ship Museum, Denmark

### **Viking Age War Fleets. Resource management and military organisation in late Viking Age Denmark**

The military operations of Scandinavian societies in the Viking Age depended on their ships. Different types of ships were used in order to transport troops and war supplies. Some ships were designed to conduct the speedy transport of large numbers of troops; others were specialised cargo vessels used in military operations as carriers of supplies, and in some cases also troops. Not only were different types of ships involved in naval transport, the size of the fleets were also varied: some fleets consisted of only a few ships, others of several hundred.

Using the immense amount of empirical data resulting from building full-scale ship reconstructions at the Viking Ship Museum in Roskilde, it is possible to compare the amount of resources necessary for building and maintaining the different ship types with the different fleet sizes.

It becomes evident that a small war fleet (up to 10 vessels) was manageable for a single magnate or king. Managing a medium size war fleet (up to 60 vessels) demanded a powerful magnate or king, and in most cases a medium size fleet was likely to exist as a joint enterprise between several magnates and the king. Establishing a large war fleet (more than 60 vessels) was only possible through collaboration between several magnates and a king.

Finally, this experimental archaeological insight is compared and discussed with the written evidence for Viking Age military organisation.

**Edoardo Riccardi, Virgilio Gavini**

Italy

## **Naval construction in 5<sup>th</sup> century AD: evidences from the architectural analysis of the Wrecks R1 and R2 from the Port of Olbia**

In this paper, the authors present for the first time to an international audience the final archaeological analysis of the two wrecks excavated and recovered from the Port of Olbia, together with a general study of their archaeological, stratigraphic and topographic context.

From an archaeological point of view, the complete study of the Wrecks R1 and R2, unburied between 2000 and 2001 and now exposed in the new Museum of the city of Olbia, allows us to put in evidence some specific features of the Roman naval construction of the 5<sup>th</sup> century AD. In fact, the possibility to date these finds both on the base of their stratigraphic position and ceramic association, and of the archaeometric analysis held on some of their wooden elements; permitted the author to point out that during the 5<sup>th</sup> century AD shipbuilding in Olbia seems to have reached a sort of stalemate.

The study of wooden assembly and of the hull profile, both possible thanks to the great number of planks and frames discovered still in connection, permit the author not only to propose a general interpretation of the two hulls, but even to read these forms and proportion in the wide evolution of shipbuilding Mediterranean tradition. As perfectly shown by these well-preserved hulls, in fact, the roman shipwrights of this century seem to have adopted in the construction of these ships some solution coming from previous forms, together with new elements that will be typical of the following century, but, in this precise moment, without a proper strategy.

In conclusion, the two wrecks R1 and R2 from the Port of Olbia can be considered two direct evidences of the evolution in shipbuilding dating to the 5<sup>th</sup> century, the moment of transition from shell-based to skeleton-based structure.

**Eric Rieth**

National Navy Museum, CNRS, France

## **The EP 1-Epagnette wreck of the middle of the XVIII<sup>th</sup> century: an inland “flat-bottom” boat of the river Somme (France)**

The EP 1-Epagnette wreck, located in the river Somme, northern France, is the subject of a programmed underwater excavation since 2011. The paper proposed for the ISBSA is about the main results of this excavation carried out according to the problematics of river nautical archaeology in which the shipwreck is studied not only as an object of boat archaeology, through its structure, its morphology, its function, but also as an object of nautical waterway archaeology, through the various and diversified relations maintained with the fluvial environment and the geo-historical riverine landscape. The hull of the EP1-Epagnette wreck is ‘bottom based built’ with clinker planking sides. The flat bottom was composed of carvel strakes assembled by longitudinal half-lap notches shaped in their edge and locked by small pegs. The seams of the bottom strakes were waterproofed by means of a mixed material composed of animal hair and vegetable (straw, brushwood) which could be interpreted as a regional ‘architectural fingerprint’. The shipwreck, dated to the middle of the XVIII<sup>th</sup> century, has preserved most of its cargo of three models of tiles in place, making it possible to study in detail the organization of the cargo. A hypothesis of historical interpretation of the architectural characteristics of the wreck in relation with the regional typology of inland boats and the water transport economy is proposed.

**Jennifer Rodrigues, Jun Kimura, R. John  
Watling, Masako Marui, Anna Bradley**

Western Australian Maritime Museum / Field Museum of Natural  
History, Chicago, USA / University of Western Australia / Sophia  
University, Tokyo, Japan / University of Western Australia  
\*poster

**Scientific analysis on lead ingots from the  
Western Australian Museum's Ko Shi Chang  
and Pattaya shipwreck collections**

The Western Australian Museum's Maritime Archaeology Department was engaged in underwater archaeological excavations of shipwrecks in Thailand in the 1970s and 80s. Excavations of the Ko Shi Chang and Pattaya wrecks revealed important results in the study of hull construction of Thai Gulf Traders as well as seaborne ceramic trades during the 15–17th centuries in the South China Sea. However, methods of scientific material analysis applicable for archaeological artefacts were not as advanced as they are today. Thus, in recent years, researchers from institutes in Japan, the United States and Australia sought to reassess selected resources from the Museum's collection. The team conducted elementary analysis on the lead ingots from these Thai shipwrecks using X-ray Fluorescence (XRF) and Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry (LA-ICP-MS) analysis and also initiated lead isotope analysis. The objective was to obtain qualitative and quantitative information on the ingots in order to study their provenance. Although this project is ongoing with further lead samples being sought and research being conducted, this poster presents the advancement on the study of the metal artefacts with consideration on applicable methodologies, and international collaboration on the South East Asian regional study of shipwreck cargo.

**Emilio Rodríguez-Álvarez**

University of Arizona, USA

\*poster

## **Deep blue sea: diving in the ancient Mediterranean**

The aim of this research is to create a comprehensive set of evidence for diving and divers in the Ancient Mediterranean, in order to analyse their techniques, practices and their role in ancient economy and warfare. Direct archaeological evidence of diving in antiquity is rather scarce. With the exception of some inscriptions and archaeological finds, most of the information on divers has been preserved in classical authors. These texts refer to the use of divers for the harvesting of sponges, the salvage of cargoes and military operations. Most of the studies on divers rely on these sources, and present a literary approach to the topic.

This research intends to transcend the limitations of the textual analysis and rely on other disciplines to compensate the low visibility of the divers in the archaeological record. In order to achieve this, the present work relies on past and present evidence from the archaeological and the ethnographic record. The use of middle-range theory allows archaeologists to infer from present records past human behaviours. Thus, while experimental studies on ancient metallurgy and rope making can provide information on the tools of the divers, the biology of sponges can provide data on depths and other diving conditions. This evidence can then be contrasted with the extensive literature on the physiology of breath-hold diving, while the social aspects can rely on the cross-cultural comparison with ethnographic studies.

By approaching the topic in this multidisciplinary manner it is possible to present a more complete picture of diving in ancient times. Although the low visibility of this activity in the archaeological record cannot be improved, the application of a middle-range theory approach offers a more coherent picture of this activity in ancient times, something the literary evidence alone cannot achieve.



## **Maili Roio**

National Heritage Board, Tallinn, Estonia

### **The preliminary research results of the Kadriorg shipwrecks**

In May 2015, during construction works in Kadriorg in Tallinn, two shipwrecks were found inside the sediments of the former seabed. The wrecks were at the depth of approximately two meters from the ground. The excavations of the wrecks were carried out in two months and during that time supporting structures were built around the wrecks, so that it would be possible to lift the wrecks in one piece.

The first excavated wreck, so called "Viljo wreck", probably belongs to a 16th or 17th century merchant ship. One side with a small part of the bottom has preserved from the ship with Nordic shipbuilding characteristics. Unfortunately there is nothing preserved in the find material that would give a clue about the goods that were transported with the ship.

The other wreck, so called "Peeter wreck" from 14th century, has preserved as a more complete site. This is a medieval merchant ship, a cog with rich find material. Many everyday items made of metal, wood, birch bark, leather, textile, clay and stone, have been found both inside and around the ship. The presentation will provide an overview of the preliminary research results and progress of works.

## **David Ruff, Irena Radić Rossi**

Texas A&M University, USA / University of Zadar, Croatia

\*poster

### **Roman Ship in the Ager of Ancient Salona, capital of Roman Dalmatia – Preliminary Results**

The gulf of Kaštela is a well-defined geographical area between ancient Tragurium and Salona, the capital of the Roman Dalmatia. It is situated north-west of Split (Roman Spalatum) on the Croatian coast, and holds evidence of a dynamic past. It was densely populated in Roman times, and exploited by a number of economic estates (*villaerusticae*).

One of them occupied the present-day Trstenik in the ager of ancient Salona, just outside the city walls. Some chance finds in 2002 pointed to the existence of a partly submerged archaeological site, endangered by industrial progress in the gulf. The wooden structures made of poles and planks, big perforated dolia and groups of globular amphorae of the Dressel 20 type are what remains of the operative coastal installations of the Roman villa.

A survey in 2006 revealed the presence of a well-preserved ship, filled with rocks and intentionally sunk adjacent to the wooden waterfront, acting as a caisson for its reinforcement. The overall length of the preserved part of the hull is about 13m, and the estimated original width about 4m. The original position of the vessel contributed to the preservation of the ship's lines on the northern half of the hull. On that side, the ship is preserved up to the wale.

Excavation of the ship continued in spring 2015. The poster presents the most recent results of the underwater excavation, photogrammetric documentation and the preliminary study and interpretation of the find.

**Zeeshan A. Shaikh**

University of Southampton, United Kingdom

## **Ramponchem Vode: A Regional Boat type of Goa, India**

James Hornell in his historic work *The Origins and Ethnological Significance of Indian Boat Designs* (1920) mentioned about *Rampon* – the boat type that form the identity of Goan fishermen. According to him these boats are found on the southern region of Konkan and dominate on the Goan coast and are mostly employed for beach seining (Hornell 1920: 21). Nothing more is mentioned by him and not much is known about these regional boats which are still been used along the coast of Goa but at the verge of decline. There is no established antiquity for these boat types. How they originated in the subcontinent, how they are constructed, who construct them and how they are technologically different from other regional boat types of Goa and what makes them unique to serve as a Goan identity.

This article is, thus, an attempt to investigate these regional craft of Goa locally called as *Ramponchem Vode* and present the results of the survey and recording. Emphasis is on the technology and its construction method. Comparison of these boat type is also been made with other regional craft types of Goa and its distribution pattern. This study, thus, is a humble attempt to throw more light on the construction method, usage of these regional boat types and to find out how it's different from other boat types of Goa and their vital role in Goan society and culture.

**Petr Sorokin**

Russia

## **The medieval vessels in the northwest Russia on written and archaeological sources**

We can admit as certain the existence of several main constructional types of vessels on the territory of medieval North-Western Russia on the basis of the available archaeological materials. They probably comprise the main part of the distinct types of vessels, known from written sources. The Comparison of various sources and identification of medieval terms are main problems for study of medieval boats. The consideration of these problems have based on the interpreting information of the written sources and on the etymological analysis of the boat's terminology.

## **Maik-Jens Springmann**

Germany

### **The building and metrology of ships in the medieval – free creativeness or constructional and standardised building?**

Metrology and measure relations are not only of a natural quality but even more of a social one. They have determined our lives since the beginning of human cohabitation and can be considered as an epitome of socialisation and an indicator of a just community. It is relatively vague since when the largest measure of capacity – the watercraft has been standardised and planned. My presentation puts a primary attention on this vessel.

For many centuries ships have transported goods and merchandise in storage containers. When the transportation of bulk goods increased the cargo hold had to be redesigned and of dimensional accuracy. By this development the constructional designing of ships became the centre point of naval architecture. Hence, the size accuracy in shipbuilding was the first step towards standardisation.

The maritime trade is not the only reason why it must have been essential to standardise the building of ships. The connection of cultural areas would be another motive of scaling. Landing bridge space, the size of water locks, the moulding, depth and maintenance of port entrances, the size of dockyards and therefore payment of customs duty are only a few aspects of the cultural perspective. Research history backgrounds are the reason why the question of standardisation of naval architecture had been omitted and the typological nomenclature had been of major interest. However, typology in the technical as in the economical sense is the essence of scaling and planned approach, which must have preceded any typology.

On the basis of selected studies of ship wrecks and complemented with written and figurative sources the different methods of determination of the measure of capacity shall be depicted as well as their assumed benefit for naval architecture. This can be a significant contribution to the studies of transition from empirical to constructional building and therefore to the typology of vessels.

**Roderick M. Stead**

University of Southampton, United Kingdom

## **The Building and Development of Philippine Logboats**

When the Spanish colonialists settled in the Philippines they found a vibrant maritime culture in place. This included various types of plank-built galleys which were built using a dowel technology and the lashed lug technique. However by far the most numerous vessels were logboats, the Volkswagan of the Philippines. These were manufactured in a wide variety of styles with a bewildering collection of names reflecting the different language groups in the Philippines and local traditions in individual islands.

The logboats were used in on rivers and lakes, but also on the sea in the sheltered waters between the islands. They provided local transportation and also a means of harvesting the rich marine resources, a key part of the local diet. When used offshore they usually employed single or double outriggers of wood or bamboo to provide additional stability.

These logboats were carved from a single log, but sometimes were extended by attaching additional strakes of wood or woven bamboo. There is little evidence that these logboats were expanded by the use of heat or steam. The logboats were powered by paddles, oars and sails.

These logboats are still in use today, often powered now by outboard motors, and so not considered by Filipinos as necessarily archaeological artefacts. This is one factor in the very limited range of examples identified and preserved in the archaeological record. This information must be amplified by literary sources and ethnographic studies to achieve a proper understanding of the logboats' range and evolution.

There has been very little academic study of these logboats and their development over time and so this is a novel environment for research.

## **Simon Stephens**

National Maritime Museum, Greenwich, United Kingdom

\*poster

# **The Ship Model Collection at the National Maritime Museum, Greenwich: A Rich Resource for Maritime Researchers**

In Britain, the first 'true scale' ship models started to appear from the mid-17<sup>th</sup> Century onwards and were used both as three dimensional aids alongside the developing science of naval architecture as well as desirable works of art in a commemorative role. The purpose of the ship model still remains the same today and is produced for a number of reasons whether as part of the process of ship design or to promote or commemorate a specific ship or event. This poster will give a broad overview of the design and development of ship model from the earliest surviving examples of the mid seventeenth century, through to examples produced for the maritime community today. It will also touch upon the many methods and styles of model construction and also reveal how the use of current medical technology has opened up a whole new area of study and interpretation. With the availability of endoscopes and CT scanning we have been able to explore the models internally. For example, the sailing navy models from 1680-1860 have revealed a whole range of constructional features used for the ship itself, some of which are completely hidden from view.

However, the central theme running throughout the poster is the value of ship models to the researcher. My many years of curating this world class collection have shown me how versatile these objects are and that most observers are able to interpret them regardless of age or education. Models also illustrate the form and layout of a ship including the numerous fittings on deck, superstructure and cargo space. I will include examples of how particular models have been used to further the understanding of a number of high profile wrecks ranging from the flattened remains of a wooden sailing ship through to the deteriorating and incomplete ships of both World Wars.

**Pat Tanner**

Traditional Boats of Ireland Project, University of Southampton, United Kingdom

## **The testing and analysis of Hypothetical Ship Reconstructions**

Once a vessel has been excavated and recorded, the process of hypothetical reconstruction commences. In such cases, since there may be more than one valid solution, the problem is to determine one or more minimalistic ways to complete the hull and point to the most likely means of propulsion and steering for the vessel. In the paper *Experimental Boat and Ship Archaeology: Principles and Methods* (Coates et al. 1995), the authors discuss the need to produce one or more hypothetical, fully functional reconstructions, which have to be tested to be tenable.

In the paper *The Re-Assessment and Reconstruction of Excavated Boats*, McGrail suggests that in order to establish a boat's original form, structure, propulsion and steering and, hence, her most likely operational role, a model is formed of the boat and the hull rotated to its deduced attitude when afloat. In order to establish a floatation condition, the weight of the boat with and without loads, and the positions for centre of gravity and floatation all need to be established using detailed calculations, before static stability calculations can be examined. All of these calculations create a "snapshot" of the vessel in a single particular floatation condition, and it would be required to repeat all of the individual calculations as the floatation condition is altered by the addition or repositioning of crew, cargo or ballast.

The use of specialised CAD and Naval Architectural software, using an accurate graphical representation of the vessel, will rapidly and simply complete all of these required calculations to provide real-time hydrostatic data, which is updated for each floatation condition.

Using a case study, this paper presents the methodology used to accurately 3D record the recovered material, in the form of 3D laser scanning, combined with an iterative process of modelling and testing, and the examination of external influences such as ballast, cargo, crew, wind loading on rigging and hull and sea conditions, in an attempt to produce a more definitive reconstruction.



**Katryn Thier**  
United Kingdom

## **The early cogs – ships and words at home and abroad**

In the historical record, the medieval cogs are strongly associated with the Low Countries, and are known to have widely operated in the Baltic sea region. At the same time, the earliest archaeological evidence of the kind of ship now known under this name comes from the western parts of the Baltic sea. The name itself appears very suddenly in the 12th century, which roughly corresponds to the date of the earliest archaeological finds. By the 13th century, however, the word is found in places as far apart as Novgorod and Egypt, where archaeological evidence is still lacking.

As part of the research project outlined at ISBSA 13 (trying to trace the origins of the ship type through its name), this paper will examine the earliest references to ships called *cog* in different languages and regions in their historical, textual, and linguistic context, and then attempt to interpret this evidence in connection with the archaeological and pictorial evidence. By putting the rapid geographical spread of the word into context, it aims to come closer to the project's ultimate goal of understanding what kind(s) of ship medieval writers envisaged when they wrote about *cogs* – in the Low Countries, in the Baltic, and beyond.

**Francesco Tiboni**

Aix-Marseille University, France

## **Repairs on ancient hulls: direct evidences of bow section's reconstruction**

In 2011, the complete excavation of a roman wreck discovered in the waters of western Sicily (Italy) has permitted the author to obtain some important information about the life and death of a ship dated to the III century AD. According to the analysis held on hull, here presented for the first time to an international audience, it is possible to identify this ship with a *romanoneraria* built following the rules of the so-called 'Western Mediterranean tradition'.

During the excavation, the disassembling in sequence of ceiling, framing and planking, has permitted the author to recognize some particular features in the construction techniques of the Marausa Wreck, possibly linked to the long life of the boat, as well as to identify some interesting elements concerning ancient repairs. Particularly, together with usual plank substitution or lead-sheeting in correspondence with hull breaks, the analysis of the fore section has showed traces of a complete repair of that part of the hull, involving keel-post-stem structure, framing and keel-garboard connections.

In this paper, after a short presentation of the wreck, the author will discuss the possible repair's techniques used on the Marausa ship in the light of parallels with other cases of study, particularly with the Siciliano wreck from Northern Sardinia. Further, the study will focus on the possibility to propose a taxonomy for ancient hull repairs, grouped in accordance with some objective criteria: what is the object of repair, when did the repair take place, what is the function of the repaired object.

Far from being a definitive goal achieved through these cases of study, the proposal is here presented as a starting point for a classification of these particular features of ancient shipbuilding that can be of help for further studies on this specific topic.

## **Ana Rita Trindade**

Spanish National Research Council

\*poster

### **Written sources in the study of timber provenance in Spanish shipbuilding: the 18<sup>th</sup> century Andalusian case**

The dialogue between historical written sources and the Archaeology and Dendrochronology and Wood Anatomy studies is an essential task when it comes to the question of timber provenance for shipbuilding purposes in the Early Modern Age.

More than a “floating forest”, each 18<sup>th</sup> century Spanish Navy ship can be seen, as well, like a map of the economic, political and administrative strategies of the Spanish Empire in the beginning of the Bourbon Dynasty, for the great amount of timber of different origins required in its construction. From the regional forests supplies, acquisitions from other Spanish regions, and colonies, to the importations from Northern Europe, the geography of timber resources reflects the trade networks, geopolitical relations as well as the natural resources management capacity, within the Peninsular and Overseas territories. Such a wide range of timber provenance reflects, as well, the availability and scarcity of the different types of timber required for each part of a ship.

What were the main regions that supplied timber to the Andalusian shipyards? Which were the most required species and for what specific technical purposes? What were the quantities and costs of that supply? How was organized the management of this supply, in terms of administration, forestry and transport?

This poster aims to present the applied methodology and preliminary results on addressing that questions, based on the archival sources research, within the framework of the individual project *Timber supply for Andalusian shipbuilding in the 18th century*, as part of the project ForSEAdiscovery – *Forest resources for Iberian Empires: Ecology and Globalization in the Age of Discovery* (Marie Curie Actions ITN).

**Grace Tsai**

Texas A&M University, USA

## **Abstract: Comparative Archaeological Analysis of Ship Rigging during the Sixteenth and Seventeenth Centuries**

The first two decades of the seventeenth century saw a period of rapid technological advancement in shipbuilding. However, rigging is often overlooked during archaeological analysis because little of it survives. Even so, rigging is the ship's means of propulsion, and therefore is essential to understanding ships.

This paper analyzes the changes in rigging seen in artifacts excavated from wrecks spanning from AD 1545 to 1690. Compiled from the most recent publications and/or personal correspondences, the list of artifacts include: blocks, sheaves, pins, deadeyes, chain plates, parrels, cordage, sails, and other miscellaneous parts. These remains will be analyzed to provide an archaeological timeline of when certain rigging features began appearing, such as changes in building material, wood grain, size, shape, and other features.

Many have noted technological changes that occurred during the early seventeenth century including the addition of the spritsail topmast with topsail at the end of the bowsprit, the increased use of the fore and main topgallant sails, and the introduction of a mizzen topsail and crossjack yard. This period also saw the elimination of the bonaventure mast, the outlicker, and high forecastles (Moore 1912: 269 and Anderson 1982: 1-320). However, these features were noted using historical and iconographic sources and ship models—not archaeological material.

This paper concludes with the applications of rigging and how these changes affected sailors' lives, because a large part of understanding past humans is to study their activity. For sailors, adjusting and maintaining the rigging were some of the main activities performed on board. As such, rigging played a large role in the daily lives of those living and working on ships.

**Darina Tully**

Free University of Ireland

## **Change and Continuity in the Skin Boat Tradition in Ireland**

Ireland has a long tradition of using skin boats, mainly in the form of the currach. Currently, there are up to 1,000 currachs to be found around the coast of Ireland, in around 14 different styles or types, used for various functions. While the general construction of some skin boats seem to have remained similar to that which is described in the Early Christian literature, changes in construction materials and other modifications have been made to some currach types. Some of these changes have been fairly recent, due to the introduction of engines and new fabrication materials such as GRP, moulded plastics and ballistic nylon. The theme of Change and Continuity is one that is consistently explored in Irish Folklife studies, and the Irish currach is a good model for such study.

This paper will discuss the various changes, but also the continuity of the concept of skin boats into the 21<sup>st</sup> Century in Ireland. It will also look at some of the reasons why fishermen and other boat users choose what is effectively an ancient boat type for use in the 21<sup>st</sup> Century. Some of the most recent hydrostatic data on the currach will be included as part of the presentation.

**Evren Türkmenođlu**  
Istanbul University, Turkey

## **Yenikapı 27 Shipwreck: Hull Analysis and Reconstruction**

The Yenikapı (YK) 27 is one of the 37 shipwrecks uncovered during the salvage excavations in Istanbul's Yenikapı district where the harbour of Theodosius (*Portus Theodosiacus*) was situated. A team from the Department of Conservation of Marine Archaeological Objects at Istanbul University carried out the fieldwork and conservation of the YK 27 shipwreck. The hull is preserved over a length of 12 m. and a maximum width of 4.30 m. The post excavation documentation of the well preserved hull remains has recently been completed.

The research indicates that the YK 27 merchantman has relatively strong skeletal structure having closely spaced frames set at regular intervals. The structure was secured with longitudinal supports in the form of wales and stringers. Together with those construction features, a lack of edge fasteners on plank edges and placement of planking joints only under frame stations suggest that at least some of the frames may have been installed before planks.

Hull characteristics of YK 27, a comparative analysis and suggested digital reconstruction of the wreck will be presented in this study.

## **Ingunn Undrum**

Hardanger and Voss Museum, Norway

### **Ropes and rigging from the Barcode excavation in Oslo, Norway**

In connection with the rebuilding of the seaside of Oslo in Norway in 2008, the Barcode project, it was identified 15 boats dated to approximately 1595. Together with the boats, 88 items of ropes and details from rigging was found. In Scandinavia there are few findings from the Renaissance as big as this. Therefore the Barcode represent a very interesting archeological material.

Some very interesting items from rigging were found. Like dead eyes, "vantnål", blocks and thimbles. This excavation has proven to provide a good picture of variation in dimensions and structure in ropes from this period of time. The structure of half of the ropes gave me as a rope maker impression to be made of hemp. Because they consisted of very thin yarns all the way down to 1.5 mm. It was a surprise for me as a craftsman that all the ropes were made of bast from the linden tree. It is much more time consuming to spin thin yarns by hand in bast than in hemp. Did the rope makers get their yarn made of bast spun by local farmers? Why did they choose to do it this way? I assume the main reason to the advantages for the rope maker is to have already spun yarn available in stock. Bast ropes with several thin yarns in the strand was not new in 1600, some ropes are found as early as 1070. The rope makers in Oslo around 1600 delivered some hemp rope, but mostly ropes made of bast. Ropes for larger sailing ships were mainly imported from abroad. Barcode represent a unique collection of rope and nice rig details. Some of the items will be preserved at Norwegian Maritime Museum.

## **Katheryna Valentyrova**

Taras Shevchenko National University of Kyiv

\*poster

### **Unique Finds from the Sunken Medieval Italian Galley. Weapon**

The history of the Crimean peninsula had been closely connected with the Italian maritime republics in the Middle Ages. It was reflected by the archaeological material.

The sunken Italian merchant galley (XIII century) is excavated by the Center for Underwater Archaeology of the Taras Shevchenko National University of Kyiv in the Sudak bay. The object investigated since 1999. It is unique for the territory of Ukraine.

The archaeological material from the shipwreck site is presented by ceramic, wooden, glass and metallic finds. All of these groups are very interesting for exploration. It allows making some assumption about trade relations and cross-cultural contacts in the Mediterranean region. Diversity of material can become the basis for further different research in archaeology, history and art. We can distinguish objects that used and that intended for sale.

Weapon is specific group of the material from Novy Svet's galley. It consists of nine items. In our opinion, the group can be divided in long daggers, short and dagger knives. There is also one sword pommel. It is not numerous, but very important and interesting for studying.

Most of the finds are poorly preserved. However they are very informative. The artifacts, including the pommel, were identified as a crew's personal weapon. The finds of weapon from Novy Svet may be interesting for the archaeology of weapon and for research of the life of medieval seafarers.



## **Caroline Visser**

Vestigia BV, Netherlands

\*poster

### **Wreck from Kampen**

In the Netherlands, Rijkswaterstaat is the government body that is part of the Dutch Ministry of Infrastructure and the Environment and responsible for the design, construction, management and maintenance of the main infrastructure facilities in the Netherlands. These include the main waterways. In light of water management and flood protection, Rijkswaterstaat has over the past years implemented the Room for the River Programme. This programme aims to increase the water discharge capacity of the Dutch rivers and comprises over 30 projects aimed at the strengthening and relocation of river embankments, the creation of high-water channels, the lowering of groynes, 'depoldering', the lowering of embanked river floodplains and the deepening of summer riverbeds. For the IJssel river, a tributary of the river Rhine that flows from the town of Arnhem towards the town of Kampen and into the IJsselmeer, this means (among other things) that part of its summer bed needs to be lowered to increase its water discharge capacity. The planned interventions in the riverbed have been preceded by an archaeological survey using side scan sonar.

During this survey a shipwreck was encountered near the town of Kampen. On inspection by divers, the wreck appeared to be of the 'cog-type' and has been named the 'IJsselkogge'. Based on dendrochronological research of 12 wood samples, the ship's construction can probably be dated to the early 15<sup>th</sup> century. In the vicinity of this shipwreck lie the wrecks of at least two other, smaller ships. It is assumed that the wrecks have been sunk deliberately, either to influence the flow of the river, to dam a river branch, to repair and embankment, or for some other reason. The results of the archaeological surveys have been presented at ISBSA13 in Amsterdam in 2012.

The possibilities to preserve the wreck site *in situ* have been reviewed, but the conclusion was that the wreck site needs to be excavated before the riverbed can be lowered. Over the past months, Rijkswaterstaat has been preparing the tendering of the excavation of the wreck site and the lifting of the wrecks. The company I work for is an archaeological consultancy firm, and together with the engineers of Infram we assist Rijkswaterstaat in this project. Excavation and lifting of the wrecks is planned to take place during the second half of 2015 and needs to be completed before the 1<sup>st</sup> of March 2016. This means the excavation of the wreck site and lifting of the wrecks will probably be well under way during the ISBSA14 in September of this year.

**Jr-Ping Wang, Wen-Ling Hong,  
Meifang Kuo, Jeng-Horng Chen**  
National Kaohsiung Marine University, Taiwan  
\*poster

## **The Conservation and Research Problems of a Pacific-Crossing Junk *Free China***

*Free China* is the last and only existing traditional Chinese junk ever crossed the Pacific Ocean. Her successful Pacific-crossing voyage, starting at Keelung, stopping over at Yokohama, and ending at San Francisco, was the result of a series of social and political chances and international efforts with her crews' expedition courage in 1955. This junk, a Danyang sub-type of Fu-Chuan, was built in Foochow area and used as a near-shore fishing boat and smuggling vehicle across the Taiwan Strait before transferred to these crew. The exact time of her building, estimated to be sometime between 1890's and 1939, is still a mystery. Her crew consist of 5 first-generation fishermen hired by a Taiwan government-owned fishing company and an American diplomat stationed in Taipei. After landing in the Bay Area, she was sold and transferred to several owners, and modified for a couple of times before donated to Taiwanese government in 2012. She was shipped back to its beginning port Keelung, and have been under the management of a national marine science museum, and displayed outdoor with a simple shade roof. Authors are involved in the survey, research, conservation plan design, repairing, and display project since mid-2013. There are several problems related to the objectives of the research, repair, and display as well as methods to achieve, and to which extend of the above work. This article will describe and discuss the aspects of building technology, survey methods, values, academic and administrative concerns, and political issues of the *Free China*.

## **Christer Westerdahl**

Norwegian University of Science and Technology

### **Topography and adaptation. An bird's eye view of the maritime cultural landscapes in a Baltic perspective**

The subject is mainly the geographical prerequisites of maritime cultures. Archaeologists often shy from using the concept adaptation. Curiously, this seems to stem from a misconception, that human adaptation only occurs in relationship to nature. Thus, using such a concept would mean exposure to criticism for been a determinist or even a fatalist. But adaptation is as well applicable to economic, social and cultural conditions. However, in this text I want to show a fundamental adaptation related to topography in a diachronic *longue durée* of general archaeology. My arguments are the distributions of selected archaeological shore-bound or water-bound elements illustrating the main areas and directions.

My results will be as follows: There is a division of the Baltic topographies between a clearly discernible Northern Section and an equally obvious Southern Section. Interestingly, this division has a counterpart in social and cultural evolution and its elements. However, the eastern and western areas of the Baltic sea area often asserts themselves as more or less independent cultural segments. Local maritime cultures, although variable, mostly conform to this picture. Finally, economic factors transcend all these divisions. Maritime cultures depend on the *conjunctures*, the ups-and downs of more or less international markets and their transport systems.

**Laura White**

Texas A&M University, USA

## **An Industry or an afterthought? Archaeological and historical evidence for the production of waterproofing materials for ancient ships**

The goal of this paper is to present the historical, archaeological, and ethnographic evidence for the production of tars and resins, materials commonly used in the sealing and repair of ships. Because ships are composite objects, the industry of shipbuilding, both as a vernacular practice and on a more commercial scale, depended on the success of many “upstream” industries and trades; namely those that produced timber, cordage, textiles, sealants, fasteners, and so on.

Throughout most of history, perhaps the most obvious and traceable commercial relationship in the maritime industry is the one between the timber production and shipbuilding. The connections between these two trades throughout history and in various geographic locations have been examined in detail, much to the enlightenment of the study of ships and shipbuilding. A clear understanding of the procedures associated with the harvest, shaping and commerce of timber has informed the study of ancient and historical ship construction and design. In many cases, however, the more ancillary industries associated with ship construction have not been studied in detail, and their technical, economic, and social connection with shipbuilding trades is often unclear.

Three questions will be considered in detail in this paper. First, how does the production of tar and similar waterproofing materials differ throughout history, and how can difference in manufacture be detected in the archaeological and historic record? Second, to what extent is the production vernacular, and completed by the individual, and to what extent is it completed on the large scale and affected by trade? And third, can it be clearly shown that the industry of the production of tar and resin is driven by, or related to, the industry of ship construction and maintenance? A clearer understanding of these historical details will be of great value in interpreting data that can be gleaned from the scientific analysis of waterproofing materials.

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## **The Sutiles Project: An Investigation of Roman Era Laced Vessels of the Upper Adriatic Sea. The First Two Years of Research**

This paper presents the research activities of the Sutiles Project, a collaboration between the Department of History and Preservation of Cultural Heritage at the University of Udine, the Superintendency for the Archaeological Heritage of Veneto and Friuli Venezia Giulia, and the Nautical Archaeology Program at Texas A&M University, with the purpose of investigating the remains of Romanera laced boats of the upper Adriatic. In the river systems and along the coast of the northwestern Adriatic Sea, a distinct tradition of laced boatbuilding persisted from the Roman late Republic through the Imperial period, with definitive evidence between the 2nd century BC and the 6th century AD. The laced tradition of boatbuilding is not only present in the northwestern Adriatic, but overshadows the archaeological record in this region during this timeframe, presenting a unique nautical landscape as compared to the broader Mediterranean world (dominated by boats and ships constructed using mortise and tenon joinery). This paper will cover the project's first two years of active research, with particular focus on the recent discovery of the Venice Lido III timbers.

In the winter of 2012, fragments of the hull planking of a seagoing vessel bearing the telltale signs of a Romanera laced vessel holes drilled along the plank edges washed ashore on Venice Lido, the barrier island separating the Venice Lagoon from the Adriatic Sea. Several construction features distinguish this timber set from other archaeological remains of the northwestern Adriatic laced tradition, including the sheer size of the lacing system. Currently, the excavated materials of Romanera laced boats of the northwestern Adriatic primarily represent small riverine and coastal watercraft as such, the Venice Lido III timbers provide insight into the nature of the more robust, seagoing watercraft constructed according to this boatbuilding technique.

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## **A Proposed Methodology for Recording and Analyzing Shipwreck Sites Using Multi-Image Photogrammetry**

In recent years, applications of multi-image photogrammetry became popular in maritime archaeology. This technology has been repeatedly tested in archaeological surveys and excavations in dry and submerged environments. Yet, there are still active discussions about the efficiency and accuracy of multi-image photogrammetry models.

A team from the Nautical Archaeology Program at Texas A&M University developed a methodology to record and analyze underwater shipwreck sites with off-the-shelf software, including multi-image photogrammetry. This methodology produced reliable archaeological data, based on 1:1 scale-constrained photogrammetry models, such as 2D site plans, hull lines, and timber catalogues.

This paper details a user-friendly methodology for underwater archaeological recording and explains step by step the tasks required to produce accurate 3D models, geo-referenced high-resolution photo mosaics, section profiles, and high-quality visual tour animations.

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## **Hide boats on the Lower Dnieper River in 16<sup>th</sup> century**

From political point of view lands on the Lower Dnieper River (contemporary Ukraine) in 16<sup>th</sup> century were a borderland between the Great Duchy of Lithuania (after 1569 the Polish-Lithuanian Commonwealth) and the Crimean Khanate. In that restless region a confrontation took place, both military and cultural between Cossacks on the one hand and Tartars and Turks on the other. That place is widely known as a point of departure of maritime military expeditions of Cossacks in boats called *chaikas* against Turks inhabiting coasts of the Black Sea and the Bosphorus in 16<sup>th</sup>-17<sup>th</sup> centuries. Only a handful of people knows that in that area hide boats (called *chaikas*, too) were used. It seems that Ukrainian historians do not mention them in their works. One cannot find any information on them in works of scientists interested in history of traditional boatbuilding, from J. Hornell (*Water Transport*) to S. McGrail (*Ancient boats of N.W. Europe, Boats of the World*). Not surprising, considering that literary sources mentioning such boats, although noticed by some Polish researchers, were not collected, critically investigated, interpreted and represented to a wider audience.

The aim of the present paper is to complete this gap owing to a critical analysis of those literary sources with reference to information on hide boats. The historical-critical method of investigating applied will allow to verify information contained in them. This task is easier because of relatively many sources dated from the same time and referred to the same place. The author will take into consideration works of Polish chroniclers from 16<sup>th</sup> century (M. Strykowski, M. Bielski), a work on military art of a Polish author (S. Sarnicki) and an account of an Austrian envoy (E. Lassota von Steblau). Information contained in these sources will be compared with that one set out by G. Le Vasseur de Beauplan in his "*Description d'Ukraine*" from 17<sup>th</sup> century. In an interpretation of them the author will use later ethnographical sources, too and considerations of linguists. Discussed hide boats will be shown on the socio-political and cultural background of the borderland. Information on an appearance, materials used and construction of these hide boats will be compared with wider known information on this type of vessels from Eurasian area. Presented paper will be connected with a presentation illustrated by old iconography and present-day photographs.

