



Međunarodni simpozij / International symposium

POMORSKA ARHEOLOGIJA I POVIJEST SREDNJEGA I NOVOGA VIJEKA

Ars Nautica

**MARITIME ARCHAEOLOGY AND HISTORY OF THE MIDDLE AGES
AND THE POST - MEDIAEVAL PERIOD**

Dubrovnik
Centar za mediteranske studije, 7.-9. rujna 2009.
Centre for Mediterranean Studies, 7-9 September 2009

MAESTRO

Cover:

Front - Ragusan galleon belonging to Ohmučević family; Franciscan church in Slano near Dubrovnik; 16 century

Back – Detail of the Ragusan ship's flag with the representation of st. Blaise, the holly protector of Ragusa (Dubrovnik); Maritime Museum of Dubrovnik; around 1800

CROATIAN COMMISSION FOR UNESCO

The Croatian Commission for UNESCO was created as an advisory body of the Government in July 1992. Since 2004 it is attached to the Ministry of Culture and its department for UNESCO, which operates within the Directorate for International Cultural Cooperation.

The Croatian National Commission consists of the following bodies:

- The General Assembly
- The Executive Committee, which is composed of 7 members (Chairperson, Deputy Chairperson, and Chairpersons of the Programme Committees of the Commission)
- Five Programme Committees dealing with:
 - o Education
 - o Natural Sciences
 - o Social Sciences and Humanities
 - o Culture
 - o Communication and Information

The National Commission is composed of 17 members representing various governmental departments and ministries, institutions, agencies and individual experts. The Commission meets in plenary more than five times a year. The President of the Commission is Academician Vladimir Marković, and the Secretary General is Rut Carek.

Besides being active in all fields of UNESCO, we consider the organisation's normative work very important and have been working on promoting and facilitating the ratifications of UNESCO conventions and declarations:

- Convention on the Protection of the Diversity of Cultural Contents and Artistic Expression (ratified in May 2006)
- Convention on the Protection of the Intangible Heritage of Humanity (ratified in May 2005)
- Convention on the Protection of Underwater Cultural Heritage (ratified in December 2004)
- Convention Against Doping in Sports (ratified in October 2007)

As the third country to sign the Convention on the Protection of the Underwater Cultural Heritage, Croatia has committed itself to promoting and protecting this type of heritage. It has founded the International Centre for Underwater Archaeology in Zadar, which will provide education in the field of conservation, restoration and exchange of knowledge of underwater findings, and in these ways contributes to international cooperation in that area. The Centre will operate respecting the principles of the Convention and its annexes and it will contribute to building relationships in other countries in the region and the world. It will also promote the ratification and implementation of the 2001 Convention. Ministry of Culture and Croatian Commission for UNESCO have coordinated together the procedure and we were grateful to the UNESCO and member states of UNESCO for the support given while proclaiming the International Centre for Underwater Archaeology as the UNESCO Category II Centre.

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The Symposium is part of the “Educational Programme in Nautical Archaeology and the History of Navigation, sixteenth – seventeenth centuries”, a project supported by the UNESCO Participation Programme 2008-2009. It is headed by the University of Zadar, in partnership with the University Ca’ Foscari of Venice and the University of Zagreb’s Centre for Mediterranean Studies in Dubrovnik.

The Issue:

The complex nautical history of the Adriatic Sea in the medieval and post - medieval periods has never been sufficiently studied through archaeological finds and historical sources. The period of Venetian domination in the Adriatic was a very dynamic one, particularly along the eastern Adriatic coast where the Republic of Dubrovnik had developed its own independent naval power. Aside from a limited number of archival sources and artistic representations, little is known of the types of ships that sailed in this period.

An interest in post-medieval shipwrecks signalled the beginning of a programme of organized research and protection of Croatia’s underwater cultural heritage. The first underwater archaeological operations took place in 1949 on an eighteenth century wreck in the bay of Veliki Molunat, south of Dubrovnik. Three other shipwrecks dating to the sixteenth and the seventeenth century were explored in the late 1960s and 1970s. After this first enthusiastic period, when the wrecks had been partially excavated, interest in the study of post-medieval wrecks ceased, and the excavations were never completed. This hiatus has led to the loss of the most valuable information on post-medieval Adriatic shipbuilding, seafaring and trade, while free access to the sites and the aggressive action of wood-eating molluscs (*Teredo navalis*) have seriously endangered the remains left on the seabed.

The shipwrecks from the sixteenth – seventeenth centuries—so rich in the volume and variety of their cargoes and ship’s equipment, as well as their complex hull arrangement—present serious problems of excavation, accurate documentation and the conservation of raised or *in situ* archaeological finds.

In order to glean as much information as possible from this material, and to place these shipwrecks in a broad historical context, collaborations with experts in various fields must be organized.

Activities:

The central activity of the project is focused on a well preserved shipwreck near the promontory of Ratac. The organization of a training course for students is combined with a short term seminar at the University of Zadar, visits to other relevant sites, and a research programme focused on gathering all the available documentation. The activities are designed mainly for students from the universities who are involved in the organization of the project, but they are also available to other interested students.

In order to share our experience, learn effective practices from other countries and hold discussions at the academic level, an international symposium will be organized and its results published in a final publication. A proposal for a long-term project focusing on the research and protection of medieval and post-medieval naval heritage in the Adriatic region will be prepared using the data we gather in the course of these activities.

The project consists of the following activities:

- expert surveys of selected sites;
- a seminar at the University of Zadar;
- a training course on the Ratac Promontory wreck;
- a symposium in Dubrovnik;
- a final publication of the project's achievements and the proceedings of the conference.

Aims of the Project:

One of the main aims of the project is to gather together a group of experts at the interdisciplinary level and to raise their awareness of the medieval and post-medieval period by drawing attention to the variety and volume of information that can be culled from systematic archaeological and historical research. By involving existing experts and students we will establish a high-quality team capable of designing and accomplishing a long-term project focused on the research and protection of the Adriatic's nautical heritage in the medieval and post-medieval periods.

The project also aims to revive the attention and interest of scholars and organizations responsible for the research and protection of underwater cultural heritage to sites that have been abandoned. These sites still hold great potential, but they are rapidly disappearing. They could serve for the elaboration of pilot projects for future work.

By involving experts in the conservation of finds the project aims to demonstrate the complex and demanding conservation processes resulting from the variety of archaeological material. These conservation processes will be identified for future work.

Finally, in accordance with the UNESCO Convention on the Protection of Underwater Heritage, the project aims to arrive at the best solutions for the protection of sites, either by raising the archaeological material or by protecting it *in situ*, taking into consideration the possibilities of its whole or partial presentation to the public.

About the Shipwrecks

Islet of Gnalić near Biograd

Although officially registered in 1967, the site was discovered in the early 1960s and in the interim much of the material found its way into private collections in Belgium. The first three excavation campaigns were organized in 1967 and 1968, while the next two followed in 1972 and 1973. A short rescue campaign took place in 1996 in order to renew the excavation and initiate protective measures of the wreck site. Due to administrative complications the attempt remained without success.

The ship proved to be a round merchantman approximately 40 m in length, armed with guns and laden with a volume and variety of finished and semi-finished products and raw material of mostly Italian and German origin. Two large iron anchors and eight bronze guns were raised from the seabed. The most significant is a pair of sakers (length 3,5 m; calibre 91 mm) produced in Venice by Giovanni II (Zuan) Alberghetti in 1582. Three of the remaining guns were identified as *petriere da braga* (swivel-guns), one as *moschetto da braga* (large breech-loading musket) and two as *passavolante*. The last mentioned guns are not of Venetian origin, but of probable German or French manufacture.

The wooden remains of the ship's hull, identified in several trenches, have yet to be excavated and studied in detail. A large portion of the raised material is on display in the Municipal Museum of Biograd. The latest archaeological survey was undertaken in 2005 and confirmed the presence of a large quantity of small archaeological finds in the surface layer and exposed wooden parts of the hull.

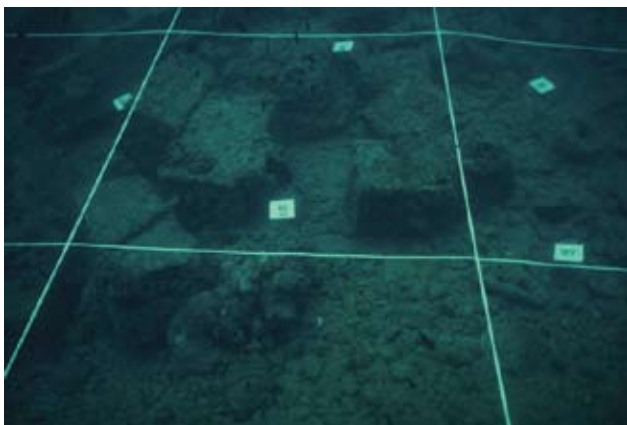
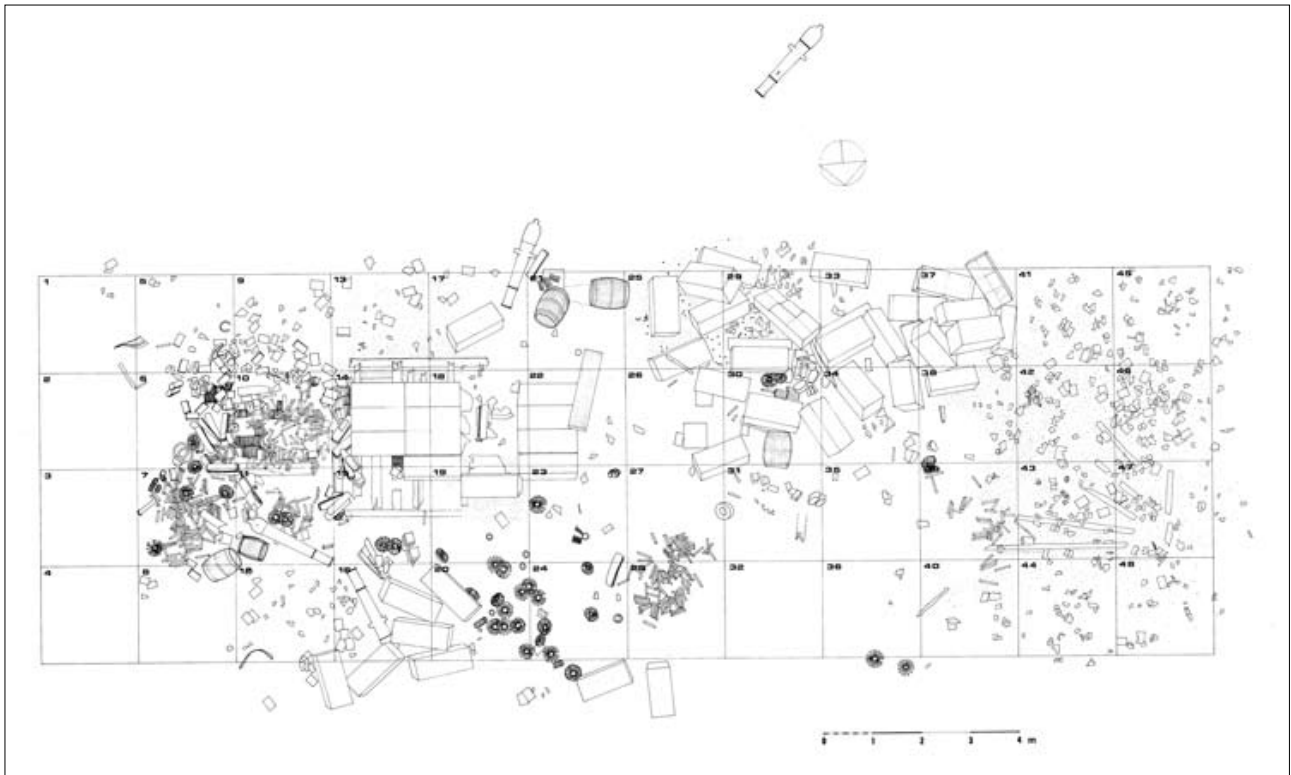
Research in the State Archive of Venice has led to the suggestion that the ship was the *Gagiana*, which sailed from Venice in 1583 and sank in an area south of Biograd (Zara Vecchia). The identification remains uncertain.



Drevine in the Channel of Koločep

Three brief campaigns at the site of Drevine took place in 1972–1974. Finds raised from the seabed include wooden barrels filled with iron nails, 47 wooden cases full of small objects such as knives, sleigh bells etc., as well as four guns made of cast iron and other objects of the ship's equipment. Unfortunately, the material has never been studied in detail and just a small portion of it has been conserved. Over the course of excavations pages from sixteenth century books, reused as elaborate knife binders were discovered. The reckoning counters (jetons) produced by Cornelius Lauffer in Nuremberg from 1686 to 1711 dated the ship to the end of the seventeenth or the beginning of the eighteenth century.

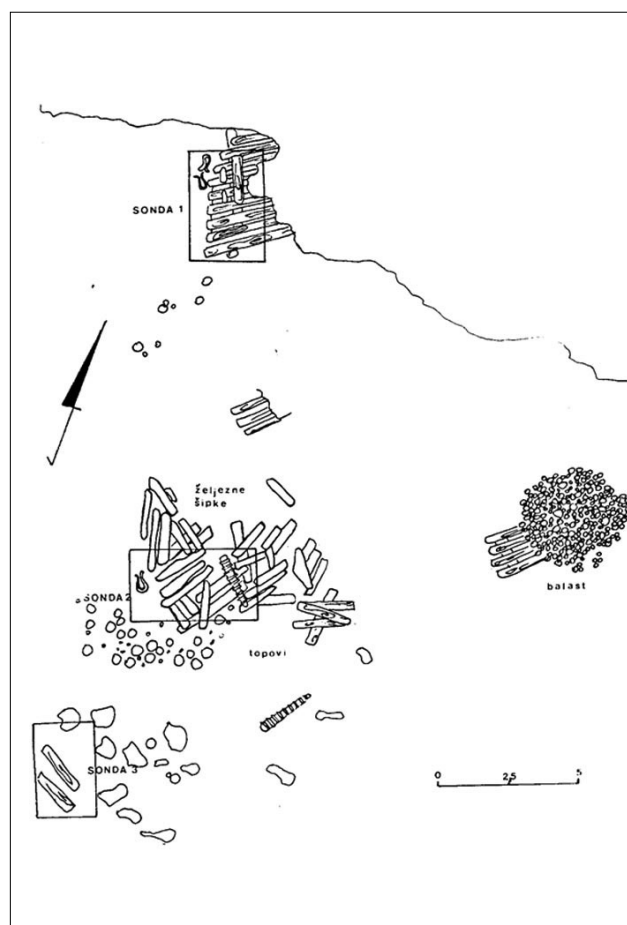
The length of the ship itself was estimated at 25–30 m. The survey conducted under the UNESCO Participation programme 2008–2009 affirmed the existence of the ship's hull, with clearly visible frames and planks in the surface layer, covered with stone ballast. The wood has been seriously damaged by *Teredo navalis*.



Bay of Suđurađ on the island of Šipan

In 1972–1974 the Naval Museum of Dubrovnik led the rescue excavation of a shipwreck situated near Mali reef at the entrance to the bay of Suđurađ. A short term rescue excavation was undertaken in 2000, although no site protection was formulated or put in place. The remains of the ship's hull suggest that the vessel's length is about 25 m. Various objects belonging to the ship's equipment and a limited amount of cargo in the form of raw materials were recorded on the seabed. Among the raised objects were two Spanish coins of Philip II (1556–1598) and one of Ferdinand V (1478–1516). Near the bow a small iron gun was found while two larger forged iron bombards were found in the area of the stern. In the 1960s two bronze guns were raised from the site and ended up in private collections. The Naval Museum managed to produce a copy of one of them, which was decorated with the emblem of the Ragusan family of Primoević (Primi). During the campaigns of the 1970s, two large anchors were recorded while the 2000 report mentions the remains of 5 different anchor pieces.

The identification of the ship as the nava *S. Hieronimo*, which sank in 1576, is demonstrated by archival documents as belonging to Jere Primoević, a famous merchant from Dubrovnik. The documents describe the salvage by divers in 1607 and 1608 of 11 different guns and a part of cargo. Conserved finds from the site can be seen in the Naval Museum of Dubrovnik.



Ratac Promontory on the island of Koločep

In 1997 local divers pointed out the position of a well-preserved post-mediaeval shipwreck with six iron guns clearly visible on the seabed. A short term rescue excavation campaign the following year revealed the presence of a cargo composed of glass ware, metal tools, other metal products such as wire or sheet, semi-finished products and raw material. Although the site is well preserved and easily reachable by divers, and therefore exposed to looting, the site was left without any particular attention until recently.

The official registration of a private collection and new information given by the local divers reveals that the ship contained a great variety of interesting forms of ceramic, glass and metal objects, while the survey organized under the UNESCO Participation programme 2008–2009 has revealed some well preserved remains of wooden elements of the ship. The work of documenting the site in detail is in progress.



Ars Nautica

Dubrovnik
Centre for Mediterranean Studies, 7-9 September 2009

... nema tako zabitna i došljacima tako nepristupačna dijela Europe gdje nećeš naići na Dubrovčane kako trguju.

(Paladije Fusko, Opis obale Ilirika, Venecija, 1540.)

... there is no such secluded part of Europe or one so inaccessible to the newcomers, where you will not encounter Ragusans practicing their merchant activity.

(Palladius Fuscus, De situ orae Illyrici, Venice 1540)

MONDAY, 7 SEPTEMBER

- 08.30 – 09.00 Registration
- 09.00 – 10.45** Opening session
09.00 – 09.30 Welcome addresses
09.30 – 10.30 Keynote address:
Filipe Castro - Reconstructing an early seventeenth-century Portuguese Indiaman
10.30 – 10.45 Discussion
- 10.45 – 11.15** Coffee break
- 11.15 – 13.30** Session 1 - Chair: **Sauro Gelichi**
11.15 – 11.50 **Fred Hocker** - Shipwrecks as national icons: Vasa and the origins of modern maritime archaeology
11.50 – 12.25 **Christopher Dobbs** - Excavating, raising and displaying a historic wreck - A case study: The *Mary Rose*
12.25 – 12.45 **Irena Radić Rossi** - A discussion on the protection of post medieval shipwrecks in Croatia
12.45 – 13.05 **Carlo Beltrame** - Venetian shipwrecks of the Mediterranean and Atlantic Ocean
13.05 – 13.30 Discussion
- 13.30 – 15.00** Lunch
- 15.00 – 17.00** Session 2 - Chair: **Filipe Castro**
15.00 – 15.20 **Đivo Bašić** - Shipping in Dubrovnik between the fifteenth and seventeenth centuries
15.20 – 15.40 **Ivana Burđelez** - Maritime consulates of Ragusa
15.40 – 16.00 **Anica Kisić** - The significance of the sixteenth-century Ragusan vessel from the bay of Suđurađ on the island of Šipan
16.00 – 16.20 **Vinicije Lupis** - The material remains of shipwrecks from the sixteenth to eighteenth centuries and the cultural heritage of the wider Dubrovnik area
16.20 – 16.40 **Igor Miholjek, Igor Mihajlović & Mladen Pešić** - A sixteenth-century wreck near the island of Mljet, Croatia
16.40 – 17.00 Discussion
- 17.00 – 17.30** Coffee break
- 17.30 – 19.30** Session 3 - Chair: **Fred Hocker**
17.30 – 17.50 **Irena Lazar** - The Gnalić wreck and its glass cargo
17.50 – 18.10 **Caroline Jackson** - Compositional analysis of the glass from the Gnalić Wreck
18.10 – 18.30 **Marco Morin** - The ship's ordnance from the Gnalić wreck in relation to other contemporary finds
18.30 – 18.50 **Marko Petrak** - The legal protection of the underwater cultural heritage in Croatia
18.50 – 19.10 **Domagoj Perkić** - A legislative perspective on diving on underwater cultural heritage sites
19.10 – 19.30 Discussion

TUESDAY, 8 SEPTEMBER

- 09.00 – 11.00** Session 4 - Chair: **Ivana Burdelez**
- 09.00 – 09.20 **Marinko Petrić** - Sailing along the Eastern Adriatic coast in the fifteenth century according to pilgrim travel journals
- 09.20 – 09.40 **Milorad Pavić** - Difficulties in Adriatic seafaring in the Italian itineraries of the sixteenth and seventeenth centuries
- 09.40 – 10.00 **Mateo Bratanić** - The Eastern Adriatic in the reports of British travelers of the sixteenth and seventeenth centuries
- 10.00 – 10.20 **Ante Batović** - Shipwrecks in the twentieth century Adriatic as examples of maritime disasters in modern times
- 10.20 – 10.40 **Zdenko Brusić & Mate Parica** - Shipwrecks from the sixteenth and seventeenth centuries in the area of Zadar and Šibenik
- 10.40 – 11.00 Discussion
- 11.00 – 11.30** Coffee Break
- 11.30 – 12.45** Session 5 - Chair: **Irena Radić Rossi**
- 11.30 – 11.50 **Sauro Gelichi** - Mediaeval and Post-Mediaeval pottery and shipwrecks in the Adriatic; An archaeological perspective
- 11.50 – 12.10 **Luca Lo Basso** - Genoese ships and navigation at the end of the seventeenth century
- 12.10 – 12.30 **Renato Gianni Ridella** - Bronze cannons of Genoese manufacture from the Croatian seas: Identification and dating methods of ordnance recovered from wrecks
- 12.30 – 12.45 Discussion
- 12.45 – 13.30** Presentation of the Project "Nikola Sagroević (Nicolò Sagri), *Il Carthiggiatore*"
- 12.45 - 12.55 **Filipe Castro & Irena Radić Rossi** – Introductory remarks
- 12.55 – 13.30 **Lilia Campana** - The Nicolò Sagri Project
- 13.30 – 15.00** Lunch
- 15.00 – 16.40** Session 6 - Chair: **Carlo Beltrame**
- 15.00 – 15.20 **Charlotte Björdal & David Gregory** - WreckProtect – A European project to protect historical wooden shipwrecks against shipworm attack in the Baltic Sea
- 15.20 – 15.40 **Paola Palma** - Environmental study for the *in situ* protection and preservation of shipwrecks: the case of the Swash Channel wreck
- 15.40 – 16.00 **Carlo Beltrame & Mariangela Nicolardi** - Ordering and interpreting complexity: The use of GIS in the investigation of a modern wreck, the case of the *Mercurio*
- 16.00 – 16.20 **Renata Andjus** - Conservation of ship ordnance from the area of Dubrovnik
- 16.20 – 16.40 Discussion
- 16.40 – 17.10** Coffee break
- 17.10 – 18.30** Session 7 - Chair: **Christopher Dobbs**
- 17.10 – 17.30 **Tatiana Villegas** - Coastal military defensive fortifications and their relation to underwater cultural heritage
- 17.30 – 17.50 **Luciano Keber** - Architectura Navalis Adriatica
- 17.50 – 18.20 **Željko Peković** - A medieval casting house in the historic core (Old Town) of Dubrovnik
- 18.20 – 18.30 Discussion

18.30 – 19.00 General discussion and concluding remarks

20.30 Symposium Dinner

WEDNESDAY, 9 SEPTEMBER

09.00 – 12.00 Visit to the archaeological site of a medieval foundry
Visit to the City walls

15.00 – 17.00 Optional diving on the seventeenth-century wreck near the Ratac Promontory on the island of Koločep

Renata Andjus

Conservation of ship ordnance from the area of Dubrovnik

Six bronze guns under the care of the Society of Friends of Dubrovnik Antiquities arrived for conservation at the Dubrovnik Museums Laboratory. The guns belong to the movable petriere type. They measure from 100 to 108 cm in length and were covered by a thin lead coating. The lower part of each gun includes an open breach for a removable chamber. Five chambers are preserved, and one is missing. The iron supports for fixing the guns on the gunwale are also absent.

The guns can be classified into two different groups. Those from the first group are decorated with an engraved coat-of-arms, while the others bear numbers and initials. The first group has semicircular terminations, the second octagonal. We reckon that there were twelve guns in all, with six belonging to each group.

After their detailed documentation the guns were desalinated in the appropriate basins. After the elimination of the chlorides, a programme of conservation was undertaken under the direction of the author, in collaboration with Chiara Piani from Palazzo Spinelli in Florence and with the help of students from the Department for the Conservation of Metal at the University of Dubrovnik. A gun was assigned to each student to practice their conservation abilities under the supervision of the author and Mrs. Piani. The stability of the patina was determined with the help of a wet chamber, after which the guns were divided into zones. All the zones were photographed before and after the conservation, and samples were acquired for analyses.

We were all very excited to discover that the chambers were sealed, and that a cannonball full of small lead beads was retained in the mouth of one of the guns. The questions that arose from these objects made the work more interesting and dynamic. At the end of the conservation process we proposed to the Society of Friends of Dubrovnik Antiquities a presentation on those 'little jewels' in the ground floor of St. Francis tower. A simulation of the ship's deck will be realized, while the background sound and video representing the sea battle will inspire visitors to the city walls to feel the excitement of the past.

Đivo Bašić

Shipping in Dubrovnik between the fifteenth and seventeenth centuries

Dubrovnik was first mentioned as a community in 1181, and as a Republic around 1430. The patron saint of Dubrovnik, St. Blasius (Sv. Vlaho), presided on both land and sea over many centuries and symbolized the city's tradition of freedom, as did the Latin word "Libertas," displayed on flags and used in mottos everywhere.

The city's farsighted laws helped elevate it to one of the outstanding centres of the western world in economic terms. Trade in slaves was abolished in Dubrovnik in 1416, and the publication in 1568 of Dubrovnik's (*Ordo super assecuratoribus*) ranks among the oldest in the world. The "Argosy," a type of ship mentioned in William Shakespeare's *The Merchant of Venice* and *The Taming of the Shrew*, refers to a vessel of Dubrovnik (from Italian the Italian name for Dubrovnik, *Ragusea*, i.e. (*una nave*) *Ragusea*). In the second half of sixteenth century there were 50-60 consular bodies maintained by the Republic of Dubrovnik all over the Mediterranean and in Western Europe. In 1551 a Dubrovnik tribunal, issued a judgment forbidding the application of the *Consolato del Mare* law code in Dubrovnik. One preserved transcript (on parchment) of the maritime law *Ordines Artis Nauticae Secundum Consuetudinem Civitatis Ragusii* (1557) served as a manual for the city's consuls and is now possessed by Biblioteca Nazionale Centrale of Florence.

In the sixteenth and seventeenth centuries galleon had become the main type of sailing-vessels used by the people of the Republic of Dubrovnik. In general terms, the construction of a small ship lasted eight to nine months, and two to three years for a larger one. In the sixteenth century, the crews numbered some 3,500 to 5,000 men, with as many as 250 captains, nearly all of whom came exclusively from the territory of the Republic of Ragusa. The largest ship launched in 1568 at Gruž (the "official" shipyard of the Republic from 1525-1526) had 1100 *carri* and 140 sailors. In 1540, the Ragusan merchant navy was valued at 200.000 ducats, and by 1570 700.000 ducats. By the seventeenth century the total value more than tripled to around 225.000-233.000 ducats. Each ship paid its taxes in proportion to its tonnage.

Ante Batović

[Shipwrecks in the twentieth century Adriatic as examples of maritime disasters in modern times](#)

The nature of Adriatic shipping in the twentieth century changed greatly in comparison with earlier periods. With the introduction of power-driven vessels shipping was no longer dependent exclusively on weather conditions, unlike sailing vessels. Consequently, the main cause of shipwrecks shifted from bad weather to human factors and mechanical faults.

Austro-Hungarian rule and the first Yugoslav state saw the introduction of steam and internal combustion engines, which radically changed the nature of maritime activity on the Adriatic. Vessels became larger and safer, and the construction of a lighthouse network along the Adriatic coast eased navigational challenges. With the First World War came the first major maritime disasters of the twentieth century in the Adriatic, caused primarily by naval mines. In the Second World War the merchant fleets of both sides of the Adriatic were completely destroyed. The new Yugoslav state made significant efforts to rebuild its merchant and passenger fleet by salvaging wrecked ships in the

aftermath. The introduction of modern technology and the establishment of efficient rescue services greatly reduced the number of ship accidents caused by bad weather, human factor and mechanical faults. Despite that, the evidence of shipwrecks proves that the Adriatic is still a very demanding sea.

Carlo Beltrame

Venetian shipwrecks of the Mediterranean and Atlantic Ocean

The aim of this paper is to present the results of research on Venetian wrecks and to offer ideas on the methodological approaches to the study of post-medieval wrecks. Research on the wrecks of Venetian round vessels, both from publications and from new and unpublished discoveries, has yielded a total of about 13 wrecks distributed both in the Mediterranean and in the Atlantic Ocean.

Carlo Beltrame & Mariangela Nicolardi

Ordering and Interpreting Complexity:

The use of GIS in the investigation of a modern wreck, the case of the *Mercurio*

The reconstruction of the features of a shipwreck, starting from a correct spatial interpretation of its structural remains and of its content that lie on the seafloor, is one of the more interesting research topics in marine archaeology. During its sinking, a ship moves from a highly structured and architecturally organized system to an apparently chaotic distribution of artefacts. More specifically it moves through three general phases, pre-depositional (cultural), depositional (causes of the shipwreck) and post-depositional (natural factors, including chemical, physical and biological, as well as cultural factors). Identifying the grouping characteristics of archaeological *patterns (clusters)* related to certain types of finds, in some cases, reflect the same spatial associations that the objects themselves had on board the ship before wrecking. In the same way, such identifications can also shed light on the dynamics of the shipwreck, particularly those concerning the destruction of the hull and the agents that “disturbed” or “removed” artefacts during the post-depositional phase. The latter factors are among the most responsible for the alteration of the original spatial structure of the ship and the formation of wreckage evidence that archaeology faces at the moment of discovery. By focusing attention on the position of the finds inside a wreck, an original method is proposed for managing excavation data using the emerging technology and structure of a GIS. The shipwreck employed as a case study is the *Mercurio*, a *brick* belonging to the Italic Kingdom. The *Mercurio* exploded due to unknown causes during the Battle at Grado in 1812, which was waged between two small fleets, one Franco-Italian, the other English, over the rule of the Upper Adriatic. Grado lies about seven miles from Punta Tagliamento, to the north of the Veneto Region. Since 2001 the wreck has been the object of excavations supervised by Carlo Beltrame of the University of Venice Ca’ Foscari.

GIS and its recording methods are particularly suited to the management of the vast amount of data produced during the excavation of a modern shipwreck. Indeed, the wreck and its cargo stand out not only for its much wider range of materials and typologies compared to those that mark a Classical-age wreck, but also for the considerable complexity in the recomposition of the internal compartments of the hull. The latter depends on the ability to decode the intricate distributions of objects that make up the wreck's palimpsest. What makes this work original is the proposal to experiment using an innovative archaeological investigative approach, through the use of selection *queries*, topological *overlays* and 3D visualizations, all aimed at producing new interpretative contexts related to understanding the depositional and post-depositional processes of the *Mercurio* wreck. Our interrogations of the spatial *database* have yielded particular archaeological *patterns* that are represented in synoptic maps with a strong cognitive component. These allow us to understand and decode the distributions of mobile finds on the bottom of the sea and therefore within the archaeological deposit.

Charlotte Björdal & David Gregory

[WreckProtect – A European project to protect historical wooden shipwrecks against shipworm attack in the Baltic Sea](#)

Wooden shipwrecks are subject to biological degradation in marine environments. Specialized fungi and bacteria degrade the lignocellulytic material present in the cell walls, but this degradation is very slow compared to the aggressive behaviour of marine borers like the shipworms. In the Baltic Sea, the conditions of preservation for shipwrecks are unique due to the absence of marine borers. The Baltic's low salinity has excluded marine borers, and today this sea contains a unique collection of well preserved historical shipwrecks and other ancient wooden structures. Unfortunately, there have been recent indications of a spread of marine borers (*Teredo navalis*) into the Baltic, and climatic changes could be one of the reasons. A new project within the EC-7th framework programme has begun to provide stakeholders, archaeologists and conservators with guidelines in order to predict its spread. The new project also proposes methods for the in situ preservation of wooden structures and shipwrecks.

Mateo Bratanić

[The Eastern Adriatic in the reports of British travelers of the sixteenth and seventeenth centuries](#)

Taking notes while travelling is a very old practice, and one which provided historians with a fountain of information that cannot be found in customary sources such as diplomatic documents, letters etc. Travel reports thus provide valuable data of different varieties with the personal touch of the author.

The aim of this paper is to present a number of British travellers who passed along the eastern Adriatic coast during sixteenth and seventeenth centuries and recorded their journeys. The accounts of these journeys supply us with information on the eastern Adriatic coast, its main ports, the routes used for sailing, and dangers to ships and crews. We also learn of the local inhabitants, their customs and behaviour, and the political and economic situation. All of this data create a panorama of the eastern Adriatic from the point of view of British travellers.

Zdenko Brusić & Mate Parica

Shipwrecks from the sixteenth and seventeenth centuries in the area of Zadar and Šibenik

When we speak of the maritime zone of Šibenik and Zadar and navigation through that area we refer to the navigation route along the Adriatic coast. By mapping of shipwrecks that occurred in antiquity, as well as in the Middle Ages and in modern times, it becomes clear that shipping through the Zadar and Šibenik archipelago ran in a well-established direction. This evidence from shipwrecks, as well as from rare written documents, is supplemented and confirmed by the sequence of Byzantine forts built in the 6th century to secure the main navigation route through this archipelago. The largest concentrations of shipwrecks and Early Byzantine forts are located along the inner side of the island of Žirje, via the Murter Sea, and also near the island of Vrgada up to the Pašman Channel via Zadar. Furthermore, ships of the Middle Ages and modern times sailed near the islands of Silba, Olib, Ilovik via the top of the Istrian peninsula.

Within the context of the shipwrecks we should take into consideration a significant maritime activity that was recognizable in Zadar and Šibenik area. Among the shipwrecks the most important include one near the island of Gnalić, another on the southwest side of the island of Murter, and yet another near the island of Bisage in the Kornati Archipelago, which presumably carried its cargo via Venice. Other shipwrecks dating from the post mediaeval period are Drvenik, Smokvica, Opat and Grebeni near Silba. All of these sites are mostly unexplored or have been heavily looted.

Ivana Burđelez

Maritime consulates of the Republic of Ragusa

Archeological excavations bring to the surface the material evidence of the past, which helps us reconstruct the historical events and life of our ancestors. Yet, in order to confirm the conclusions based on the material record we use secondary sources as important information in our underwater research.

Two important archival series—consulates and maritime insurances—detail many shipwrecks, as

well as the types of cargo they carried, and therefore cannot be omitted in the reconstruction of archeological sites. This paper uses archival documents to show their importance in archeological research.

Lilia Campana

The Nicolò Sagri Project

Nicolò Sagri, or Nikola Sagroević († 1573), was a mariner from Dubrovnik. His extensive seafaring experience led him to author two treatises on tides and floods: the *Ragionamenti sulla varietà dei flussi del mare Oceano Occidentale* (Venice, 1574) and the *Discorso dei flussi e dei reflussi del faro di Messina* (Venice, 1580). Sagri, however, has attracted the attention of naval historians primarily for his presumably lost treatise *Il Chartiggiatore* (ca. 1570). Until recently, the only extant information about this manuscript was a brief reference by Bartolomeo Crescenzo, an engineer from Rome, who, in his *Nautica mediterranea* (1601), mentions Sagri's formula to calculate the building proportions of a galleon. Thanks to the Centre of Maritime Conservation and Archaeology (C.M.A.C.) at Texas A&M University, a digitized copy of the *Il Chartiggiatore* was recently acquired from the collections of the University of Minnesota Library, and is now readily accessible for scientific scrutiny. Our knowledge of the manuscript is no longer confined to Crescenzo's brief mention.

By expounding the historical and technical contexts in which *Il Chartiggiatore* was written, this paper focuses primarily on the content of the manuscript, and discusses the figure of Sagri as a representative exponent of practical naval knowledge in the Late Renaissance. The paper will also present a formal outline of "The Nicolò Sagri Project" — to be conducted under the aegis of C.M.A.C. — the aim of which is to convey to the scientific community a comprehensive study of *Il Chartiggiatore*.

Filipe Castro

Reconstructing an early seventeenth-century Portuguese Indiaman

During the sixteenth century, Portuguese Indiaman sailed to the Atlantic Islands, the Gulf of Guinea, Brazil, Mozambique, Madagascar, the Persian Gulf, India, Sri Lanka, Burma, Malaysia, Indonesia, China, and Japan. These ships were among the most complex machines of their time, built to endure the hardship of long voyages, and yet not much is known about the way they were conceived, built, and sailed.

In cooperation with the Unit of Marine Technology and Engineering at the Instituto Superior Técnico in Portugal, we are recreating one of these vessels at the J. Richard Steffy Ship Reconstruction Laboratory. Our efforts are based on contemporary documents and data retrieved from the Pepper Wreck, a small hull portion excavated near Lisbon between 1996 and 2001. Following the excavation

of the hull remains, a tentative reconstruction of the ship's hull and rigging has been developed and plausibility analyzed and refined through computer models, and completed with tow tank and wind tunnel tests of physical models. The main objective of this project is to create a comprehensive model that will allow us to map our ignorance and identify the gaps in our knowledge of these sailing, transporting, and inhabited machines.

Having studied the ships' hull shape, construction sequence, internal space divisions, cargo distribution, rigging arrangements, intact stability, and sailing performance, we are now planning to analyze the ship's structural strength, develop plausible mechanisms of collapse, and test the routes described in coeval documents against what we know about the wind and current patterns in the Atlantic and Indian Oceans. We are also working on a virtual model to aid in reconstructing the ship's interior space and understanding the possible ways in which it was appropriated and used. To reconstruct life aboard one of these ships is the ultimate goal of this project. We are studying the composition of the crews, soldiers, and passengers, the lists of victuals necessary for a six- to eight-month trip, the cargos carried to and from Asia, and the armament and spares and equipment necessary to outfit a ship for such voyages.

We want to understand the principles that ruled the conception of ocean-going ships and its evolution throughout the sixteenth and early seventeenth centuries, the shipbuilders' knowledge and the ways in which it was acquired and transmitted, and how innovation was perceived and implemented in the royal shipyards. Another objective of this study is the evaluation of the ships' cost and the analysis of the economic efficiency of this portion of the Asian trade. We believe that, as data becomes available, it will be interesting to compare these ships with other merchantmen of their time.

Christopher Dobbs

[Excavating, raising and displaying a historic wreck - A case study: The Mary Rose](#)

When organisations interested in promoting maritime cultural heritage look for ideas on how to achieve their aims, they may be tempted to think that raising and displaying a historic wreck would be a good idea. Certainly there are advantages to this approach, but there are also considerable drawbacks – mainly in terms of finance and resources. This presentation will present the background to the *Mary Rose* project and consider both the advantages and disadvantages of the approach.

The presentation will briefly cover the excavation, raising and display of this ship, ordered by King Henry VIII exactly 500 years ago, and will also outline plans for the future museum, whose construction begins this month. It will also present the income sources used to finance the project and will contrast the work of the early days with more recent excavations carried out between 2003 and 2005. The presentation will also include the author's warnings and views on undertaking such a project, and will propose a funding model for future regions or nations that may contemplate building a museum or centre around an important example of maritime cultural heritage.

Sauro Gelichi

Mediaeval and Post-Mediaeval pottery and shipwrecks in the Adriatic: An archaeological perspective

This paper analyses the relations of a well-defined geographical region (the Adriatic) and a category of objects (pottery) that is widely represented in the archaeological contexts of shipwrecks. The period is temporarily restricted to the Late Mediaeval and Modern period for two main reasons—their historical congruity and the visibility of the phenomenon caused by well-documented shipwrecks belonging to these periods.

To contextualize the phenomenon and deduce from it some general observations regarding significance of the pottery found on the Adriatic shipwrecks) the paper is divided into three main sections. The first systematically presents the technological and typological aspects of the main pottery types of the Late Mediaeval and Post-Mediaeval period, placing an accent on those circulating in the Adriatic between the fifteenth and eighteenth centuries. The second section discusses the phenomenon from a more delineated prospective, i.e. concentrating on the Dalmatian coast, taking into consideration also the contexts documented in urban and rural settlements. The third section analyzes the phenomenon in the light of nautical archaeology, evaluating their specific manifestation in shipwrecks.

Fred Hocker

Shipwrecks as national icons: *Vasa* and the origins of modern maritime archaeology

In the late 1950s and early 1960s, a number of spectacular ship finds were located, raised and placed on display in museums in northern Europe and the Mediterranean. These projects came about because the ships represented the glorious pasts of their respective countries, and thus received lavish public support. In the process of recovery, conservation and exhibition, they created the public and professional ideal of what maritime archaeology was and should aspire to, an ideal that has endured for more than two generations. Most prominent among these projects was the recovery of *Vasa*, built in Stockholm in 1626-1628 and sunk on its maiden voyage. Its size, elaborate decoration and astounding preservation made it an international sensation, and since its conservation it has become the centerpiece of the most visited maritime museum in the world.

This paper will examine why *Vasa* and other iconic shipwreck projects have been able to receive public support, what the advantages and disadvantages of iconic status are, and how it is possible to integrate an archaeological perspective into ship recovery projects carried out for non-archaeological reasons. The focus will be on *Vasa* as an extreme example, but with reference to smaller scale projects in Denmark, Germany, England and Cyprus.

Caroline Jackson

Compositional analysis of the glass from the Gnalić Wreck

This paper (to be presented by Irena Lazar) discusses the wealth of material remains found on a shipwreck dating to the late sixteenth century and found just off the rocky islet of Gnalić, Croatia, a location situated along a busy shipping route. The rich cargo of glass on board, including many luxury vessels, was originally assumed to have been produced in or around Venice. However, the majority of the glass finds consisted of plain goblets and flat pieces of glass destined to be made into windows or mirrors, which had no characteristic features to show where they may have been produced. Other glass vessels were typically English or Islamic in style.

An initial scientific analysis of the glass was undertaken by Robert Brill in 1973 to explore and establish the glass compositions. From the eight samples he analysed, he found that the compositions of glasses—ranging from plain goblets, windows and flasks to highly coloured and decorated vessels—were quite uniform, and all the glass could have been made in the same factory. The present study was initiated to extend the data published by Brill, and to investigate whether any compositional groups could be identified with newer and more extensive analyses. Compositional analysis was undertaken of over 200 vessels, window and mirror glasses to determine if the stylistic groups identified within the assemblage were indeed compositionally similar. Such analysis may indicate a common provenance, as Brill suggested, or slight compositional differences could be teased out of this larger data set to suggest different manufacturing sites for some glasses. These results are presented here as part of an ongoing project of glass analysis.

Luciano Keber

Architectura Navalis Adriatica

Reconstructive ship modeling is a type of historical data research, in our case of the traditional Croatian boats. It encompasses the activity of measuring, drawing and consulting historical documents, leading to the final goal of building a replica to full size.

The basic models are ten times reduced in size; they are floatable and can be remote controlled. Constructional drawings give a detailed presentation of wooden boat anatomy. The models that accompany the basic ones are reduced in scale by a factor of thirty, and with their diversity give their contribution to the given theme. A free artistic approach has its documentary value, but at the same time it is easily recognized in the ship portrait. Regardless of the basic research goal, the artistic expression is clearly visible and reflects the author's intimate feelings and his individuality.

The significance of the sixteenth-century Ragusan vessel from the bay of Suđurađ on the island of Šipan

About 50 metres from the shore of the bay of Suđurađ on the island of Šipan a vessel from the sixteenth century sank against three smaller reefs in the middle of a cove at a depth of 30 metres. The island was home to a slipway of a small shipyard and two stately Renaissance villas built by Stjepović Skočibuha, a rich seafaring family. The site of the wreck itself has been subject to devastation for years, until protective research was carried out from 1972 up to 1974 by the Maritime Museum of the then Yugoslav Academy of Sciences and Arts (now HAZU, the Croatian Academy of Sciences and Arts), along with the Institute for the Protection of Cultural Monuments in Zagreb. The vessel appears to have struck a rock and sank, stern first, with its bow toward the west, coming to rest at onto the foot of the reef. All of her weight shifted aft during sinking and upon striking bottom, and the entire aft superstructure buckled into the silt.

Due to equipment deficiencies, we were able to investigate only 20-30% of the site, and our probing of the wreck revealed even more information about the vessel. The frames were 15 to 20 cm thick, with an equal amount of spacing between them. Boards which served to enclose these frames, together with parts of their lead sheathing, were also found. The vessel was without cargo, but carried ballast stones and wrought iron cannons, two of which, of the *bombard* type, were raised. The bronze *petrieri* (mobile cannons) with a stamped coat-of-arms of the Primojević family of seafarers, remain under private ownership. Stone and lead balls of various sizes, which were cast onboard, were recovered together with pieces of lead and the smelting mould. Also recovered were a bronze shovel for cleaning cannons and several earthenware ball-like jars with a compound of gun-powder, used as hand bombs. The two pairs of bronze compasses, quantity of coarse and fine ceramic crockery for use on board, two silver coins issued by Philip II and an older one issued by King Ferdinand and Queen Isabella, undoubtedly, place this vessel in the sixteenth century. The coat-of-arms of the Primojević family on the bronze *petriere* verify its Ragusan origins. Its length is estimated at 30 metres, its carrying capacity at 600 *carri*. The excavation was carried out under the direction of Zdenko Brusić and the author, and the results were published in 1975.

In 1987 Stjepan Vekarić accidentally found several documents in the State Archive of Dubrovnik from which it was evident that the Primojević family had engaged three Greek divers in 1607 to recover 7-8 cannons of various calibres from the «St Jerolim», which was owned by Jero Primojević and reported as wrecked in the bay of Suđurađ.

In 2000, the author initiated a re-examination of the site, and concluded that further excavation in the silt layer may reveal parts of the vessel, as Brusić suspected. The excavation, however, was discontinued due to budgetary constraints.

As these are the oldest preserved remains of a Ragusan trading vessel from the zenith of the Republic of Dubrovnik, its material remains have the potential to produce data on shipbuilding that can be compared with contemporary historical accounts by Nikola, Bartolomeo Crescentio, Pantero Pantera and Petar Damjan Ohmučević.

Irena Lazar

The Gnalić Wreck and its glass cargo

The shipwreck bears the name of the rocky islet of Gnalić, which is located off the eastern Adriatic coast of Croatia and situated at the southern entrance to the Pašman Channel, along a well-used shipping route known from ancient times onward. The remains of the ship were discovered purely by accident in 1967, and it soon became clear that this was a fully laden merchant ship. Based on the finds from the ship, and two cannons bearing the date 1582 in particular, the wrecking probably occurred in the 1580s.

The objects discovered on the shipwreck were first illustrated and discussed in the journal of the Museum in Zadar and exhibited in 1970-1971. The first description of the glass finds was published by Sofia Petricioli in 1973 in volume 15 of the *Journal of Glass Studies*, together with some limited chemical analysis by Robert Brill that same year.

After these initial reports, work on Gnalić material did not continue until 2004, at which time a new study of the material began as a part of an international project entitled *The Heritage of Serenissima*. The project was joined by Slovene, Italian and Austrian Universities at the end of 2004, and the main portion of the project was completed in 2005.

The glass was an important, if not the most important, part of the ship's cargo. We can now estimate that the amount of the excavated objects totals in excess of 5,500 pieces. This is by no means all of the original cargo: it is likely that the majority of the material remains unexcavated.

Vessel glass from the Gnalić wreck was made of naturally and synthetically coloured glass. In addition to vessel glass, over 1,300 pieces of flat glass (nearly 25% of the cargo) were recovered. The flat glass is of two separate types. Over 700 of these are circular window glass 'crowns,' while the rest is flat glass from mirrors. Two different mirror shapes were found, circular and rectangular. Interestingly, not only are finished examples of rectangular mirrors present in the assemblage, but the ship was also carry a number of 'sides,' or cast but ungrounded mirror plates. These were presumably being traded with the intention of finishing them later and elsewhere.

The glassware, including the highly decorated articles (such as the engraved vases) probably produced in Venice, seems to have been destined for a luxury market, perhaps Constantinople or even Dubrovnik. Most of the simple forms (such as the goblets, bowls, jars), however, were made for everyday use, and we may well ask whether all of them were really produced in Venice. Some examples from the wreck also give evidence of the long popularity of some Gothic shapes, for which previously we had only indirect evidence.

Caroline Jackson has been responsible for sampling the glass using ICPS for chemical analysis. The numerous broken fragments combined with multiple replications of some of the forms has enabled us to take in excess of 200 samples. These will prove crucial in aiding a comprehensive characterisation of the whole assemblage.

Luca Lo Basso

Genoese ships and navigation at the end of the seventeenth century

In one of his well known works Fernand Braudel posited the hypothesis of an economic boom, bolstered by international circumstances, among Ligurian dealers in the 1670s. The reasoning of the famous French historian, however, was based on presumptions unsupported by historical accounts. On what basis, then, did Braudel make the claim? In effect, between the 1660s and 1680s, Genoa and the Genoese lived in a new golden age, after the critical caesura of the Great Plague of 1656-1657. The prosperous period that followed the epidemic lasted at least until the French bombardment of 1684. The characteristics of shipping in this “new small century of the Genoese” may be articulated in the following points:

In 1662 Ambrogio Lomellini and Domenico Grillo (marquis of Clarafuente) were awarded the *assiento dei neri*, a charter provided by the king of Spain to sell African slaves in the Americas, which they maintained until the first years of the 1680s.

With the *assiento dei neri* the Genoese controlled the flow of silver coming from the New World directly to Cadiz (the private team of Ippolito Centurione provided the armed escort of the Canary fleet), and from there the convoy of the Republic returned to Genoa. In that context numerous vessels built in Liguria ended up operating on the routes of the Carrera de India.

In 1665, thanks to the action of the Durazzo family, the Republic of Genoa signed the *capitolazioni*, an agreement with the Sultan of Istanbul.

From 1666 to 1675, thanks to the accords with La Porta, the Genoese entered into circulation in the Ottoman Empire an enormous quantity of faux French silver coins (‘luigini’), with notable consequences for the Ottoman economy.

It was due to these activities that the investments in shipbuilding, maritime exchange and insurances were. Protagonists of these favourable circumstances were not only the investors belonging to the city’s aristocratic class, but also a multiplicity of maritime operators (captains, sailors, mediators, insurers, etc.) that were known for their abilities and competences in many ports around the world.

Vinicje Lupis

The material remains of shipwrecks from the sixteenth to eighteenth centuries and the cultural heritage of the wider Dubrovnik area

Figureheads and altarpieces represent a special category of our cultural legacy in the wider area of Dubrovnik. The most significant example is a sixteenth-century statue dedicated to Our Lady of the Rosary from the Parish church in Blato. This Renaissance statue was a figurehead on a vessel and was discovered on the seashore at the end of the sixteenth century. A small chapel was erected on the site of discovery. In the mid eighteenth century an emerald set of earrings with a cross, the only one of its kind in this part of Croatia was donated to this statue; it most probably originated as part of the Spanish goldsmith trade of the late sixteenth or early seventeenth centuries. This is discussed in association with Franjo (Franko) Telenta's gift, which is known from the notarial record compiled on 12 August, 1752. This resident of Blato virtually stated that he had his votive gift made upon his return from America (*nel suo regresso d'America*).

The fifteenth-century alabaster polyptych from Nottingham that found its way to church of St James in Čara was found on the seashore some time later when a vessel wrecked in the seventeenth century. Material remains of the wreck include numerous altarpieces with ship portraiture. Some examples from Viganj (seventeenth century), Podgorje (fifteenth century), Orašac (sixteenth century) and Perast will be analyzed. These remains will be studied in the context of the quantity of shipwrecks which occurred at the end of the eighteenth and the beginning of the nineteenth centuries in the wider area of Dubrovnik.

Igor Miholjek, Igor Mihajlović & Mladen Pešić

A sixteenth-century wreck near the island of Mljet, Croatia

In 2007 the Croatian Conservation Institute began survey on sixteenth century shipwreck, discovered the year before. The wreck lies off the southern coast of the Croatian island of Mljet at a depth between 36 and 46 meters. Visible ship remains consisted of seven bronze cannons, which were retrieved in the same campaign, and several pots, jugs and plates, as well as one iron anchor, all of which date the wreck the sixteenth century. Excavations began in a second campaign in 2008, when one more bronze cannon was located. All cannons were casted and, with one exception, were breech-loaded. Iron breech chambers were heavily corroded and almost completely destroyed and therefore not recovered. Other notable metal finds include one bronze bucket, parts of a chandelier, also made of bronze, and one tin cup. Ceramic finds include both Italian glazed cookware and luxurious oriental Iznik ceramics which were very popular in Western Europe during the sixteenth century. During the 2009 excavation campaign the eighth cannon found with its breech chamber attached to bronze barrel was retrieved. The main goal in the following campaigns will be to document elements of the hull which were also found during excavations in 2008-2009.

Marco Morin

Ordnance from the Gnalić wreck in relation to other contemporary finds

The artillery pieces recovered from the Gnalić wreck—the partial armament of a commercial ship that sank towards the end of the sixteenth century—represent a non-homogeneous group of great interest. The two largest pieces, culverins of Venetian production (ZA 1582, Alberghetti family), are similar to those recovered from commercial ships sunk in the same period (e.g., Trinidad Valencera, Yarmouth Roads, Church Rocks). They can be classified as sakers, even if their length is greater than that of ordinary sakers produced by the Republic of Venice. It will be recalled that artillery pieces built for the state had to keep well delimited dimensional characteristics, above all for reasons of cost and standardization of calibre.

The two polygonal pieces, which were almost certainly produced in a prior period as they show morphological characteristics in vogue in the first half of the century, could have been cast in either France or in Genoa. The weights, denoted in pounds and engraved on the breech, suggest that the former locale. In this case the two pieces were probably produced for private use, as they fail to exhibit a national coats of arms. As an educated guess we may regard them as passavolanti (minions) or large falcons.

The three commercially produced twelve-pound breech-loaders, or *petriera da braga*, are of unknown provenance. They are rather small weapons, and are therefore of simple manufacture and of a typology common to the whole Mediterranean area. One bears the capital letter C in relief under a mask positioned on the chase and may point to a member of the Venetian family of di Conti as the gun's founder.

The origin of the smallest piece, a one-pounder *braga* musket, remains unknown. Perhaps future investigations using fusion will lead to a recognition of the coat of arms on the chase, and the determination of the unit of weight (on the breech side we find engraved the number 87) may provide further clues.

Paola Palma

Environmental study for the *in situ* protection and preservation of shipwrecks: the case of the Swash Channel wreck

The Swash Channel Wreck lies in approximately seven meters of water on a flat sand and shingle seabed immediately adjacent to the eastern edge of the dredged section of the Swash Channel in the approaches to Poole Harbour in Dorset, U.K. Environmental monitoring undertaken by Bournemouth University since 2005 produced results indicating that the site is under threat from both physical and biological degradation that is causing a loss of archaeological material, and consequently information, in a very short period of time. The site is exposed to relatively extreme water movements as a

combination of natural tidal- and wind-generated currents and vessel movements, with serious influence to the physical state of the hull structures resulting in mechanical damage and superficial erosion.

The protection of the site involved the deployment of various site preservation methods to evaluate those that are the most effective and the most financially viable. The project initiated a trial of differing strategies for *in situ* stabilisation, each applied simultaneously in different locations of the study area of the wreck and deployed for a twelve month period to establish the efficacy versus financial viability of each method, deployed for the medium/long term protection of the site.

The methodology had been designed on the experience of several international projects, with the added aspect of scientifically studying the original timber decay and degradation and efficacy of different protective methods, rather than being focused only on sacrificial samples which could offer localised and limited results. In this venue the results of the project will be presented.

Milorad Pavić

Difficulties in Adriatic seafaring in the Italian itineraries of the sixteenth and seventeenth centuries

Among the travel writings and reports on the eastern Adriatic coast the most numerous are those written in Italian. These itineraries were written for various purposes—as pilgrim travel reports, reports penned by emissaries and escorts travelling to the court at Constantinople, and those written by curious people who wished to describe firsthand the grandness of the Ottoman Empire. The high number of reports may be explained from the fact that Venice was, with Marseille and Barcelona, one of the ports of departure for pilgrims travelling to the Holy Land. And the sixteenth and seventeenth centuries was a time when the Venetian Republic, due to its privileges in trade with the Levant and the Ottoman Empire, and its acquisitions in the Ionian and Aegean Seas, was a political power, at least on the margins of the Mediterranean.

The difficulties in navigation described in the itineraries may be placed into two groups, manmade and natural. Manmade difficulties include piracy on the Adriatic (particularly the predations of Uskoci from Senj and the corsairs of the Ottoman Empire) and the activities of four different powers that had influence on the eastern Adriatic coast—the Republic of Venice securing the sailing route to Levant, Austria, the Ottoman Empire and the Republic of Dubrovnik. In this paper I emphasize more the natural factors that made navigation difficult. These include hydrographical and maritime factors that differed markedly from the western Adriatic coast in terms of relief, the number of islands, coves, sea passages, depths, direction and the strength of sea currents, and tides, in addition to the numerous islets, reefs and shallows that held the potential for wrecking). Aside from the numerous bays and islets with harbours, there are other areas with a potential for shipwreck due to poor familiarity with the coast and a lack of attention. Weather also was a preoccupation of seafarers. Wind, particularly the *bura* and southerly winds, often influenced the course and the outcome of the journey.

All itineraries presented here offer its a particular point of view on these difficulties in Adriatic seafaring during the sixteenth and seventeenth centuries.

Domagoj Perkić

A legislative perspective on diving on underwater cultural heritage sites

To date nearly 400 underwater sites have been registered in the Croatian part of the Adriatic Sea. Nearly one hundred are protected as cultural heritage by legislative acts issued by the Ministry of Culture via deliberations on both their preventive protection and registration. As new sites are discovered each year and as old ones are re-evaluated, the number of protected sites increases.

There are, additionally, protected underwater archaeological zones that comprise larger areas. They mainly comprise areas of the external islands that contain the greater number of underwater archaeological sites. In such zones diving without special permission from the Ministry of Culture is not allowed. This presentation will illustrate the process of issuing such permits to diving centres. It outlines the specific ways in which underwater archaeological heritage is protected. The archaeological excavations of underwater sites are regulated through the Regulation on Archaeological Research, in which several paragraphs refer strictly to underwater work. The participation of foreign researchers is also detailed by these regulations.

Marko Petrak

Legal protection of the underwater cultural heritage in Croatia

The aim of this paper is to discuss the legal protection of underwater cultural heritage as a special part of the normative framework of cultural heritage protection in Croatia.

In the first part of presentation, Croatian Law on the Protection and Preservation of Cultural Goods (*Zakon o zaštiti i očuvanju kulturnih dobara*), we will explore the norms which regulate the legal protection and preservation of underwater cultural heritage. Then we will turn to the various regulations of the Ministry of Culture, such as the Regulation on Archaeological Research (*Pravilnik o arheološkim istraživanjima*) and the Regulation on the Procedure of Licensing Underwater Activities in Zones of Internal Waters and Territorial Sea of the Republic of Croatia Protected as Cultural Goods (*Pravilnik o postupku i načinu izdavanja dopuštenja za obavljanje podvodnih aktivnosti u unutarnjim morskim vodama i teritorijalnom moru Republike Hrvatske koji su zaštićeni kao kulturno dobro*), both of which rule in detail certain important aspects of underwater activities in the context of protecting and preserving cultural heritage.

Finally, the UNESCO Convention on the Protection of the Underwater Cultural Heritage – also ratified by the Republic of Croatia – will be briefly analysed, as will its impact on the national legal system.

Marinko Petrić

Sailing along the Eastern Adriatic coast in the fifteenth century according to pilgrim travel journals

The travel journals of European pilgrims to the Holy Land from the fifteenth century are an exceptionally valuable yet still poorly researched source for the study of the historical, political, geographical and cultural aspects of the contemporary Croatian Adriatic coast. One of those aspects is the coastal journey itself—sailing routes of Venetian passenger galleys, harbours, supplies, conditions and problems of the voyage, passengers' accommodations, and the daily routines aboard galleys. In this paper I examine the travel journals of the German pilgrims Felix Faber (1484), Konrad von Grünenberg (1486), and the Italian pilgrim Pietro Casola (1494).

Irena Radić Rossi

A discussion on the protection of post-medieval shipwrecks in Croatia

The early years of Croatian underwater archaeology, though generally vibrant and productive, may be characterized as unsystematic, a situation that has barely changed until recently. In 1949, for example, the Naval Museum of Dubrovnik began the first organized campaign to raise underwater archaeological finds. Curiously, despite the presence of many much older sites, the campaign concentrated on eighteenth-century wreck in the bay of Veliki Molunat, south of Dubrovnik.

1967 saw the discovery of another important wreck near the islet of Gnalić, south of Biograd. The sixteenth-century wreck was partially explored in the following years, and after undergoing a complex programme of conservation in Zadar and abroad the material was exhibited in the newly established Municipal Museum of Biograd. Although the Gnalić wreck has proven to be one of the most interesting examples of a post-mediaeval trading vessel with well-preserved hull remains, its research was never organized as a systematic project. The site was never fully protected on the seabed, and its long term looting continues even today.

In 1972-1974 the important sixteenth-century Ragusan shipwreck in the bay of Suđurađ on the island of Šipan near Dubrovnik (Ragusa) was partially explored. The wooden hull remains were left on the seabed covered by sand.

In 1976 a merchantman of probable Venetian origin was discovered in the channel of Koločep. The site, known as Drevine, could be roughly dated to the seventeenth century. Unfortunately, conservation was never undertaken and the material was never examined in detail. Also in this case excavations ceased with the raising of the cargo, and the wooden hull remains were left on the seabed.

A major decision was reached at the 1969 meeting in Šibenik regarding the *in situ* preservation of submerged archaeological sites. In effect, *in situ* preservation was to be given precedence over other

methods of protection in cases of difficult and fragile underwater archaeological sites. After thirty years, the 2001 UNESCO Convention for the Protection of Underwater Cultural Heritage has placed an emphasis on it. This paper discusses the present state of submerged cultural resource protection and research in Croatian waters, points out weaknesses in the system that during the past three decades have caused serious degradation of several important sites, and maps a way forward using systematic research and protection on an international level.

Renato Gianni Ridella

Bronze cannons of Genoese manufacture from Croatian seas: Identification and dating methods of ordnance recovered from wrecks

On the occasion of the “Ships and Guns” conference held in Venice in December of 2008, I noticed two groups of Genoese bronze cannons found in Croatian waters. The first is represented by two medium *petrieri* (muzzle loading stone-throwers) found together with a certain number of cast iron guns in a wreck site off the Grebeni islet near the eastern coast of the island of Vis. The other group is composed of a saker and some broken pieces (three heavy *petrieri* and a falconet) recovered from the sea close to the shore of Brsečine near Dubrovnik.

All of these pieces of ordnance represent the typical Genoese shape, but their peculiarities consist of the form of the muzzle-mouldings and the two squared holes visible in the base ring. These last housed the stems of iron handles, now fully corroded by salt water. In addition, one of the *petrieri* found off Grebeni bears a Genoese weight mark, CA 9 – R° 53, expressed in *cantara* and *rotoli*, which means that this piece weighed 454 kilograms just after its casting and fire-proofing.

It must be remembered that bronze ordnance almost completely disappeared from the armament of Mediterranean merchant ships at the beginning of the seventeenth century, having been replaced by less expensive cast iron guns. So the probability that a bronze piece found on a wreck may belong to the sixteenth century is very high. In our case, it is possible to define more accurately the dating of these Genoese cannons raised from Croatian waters thanks to some defining characteristics. These show that the Grebeni *petrieri* were cast by the Genoese gun founder Francesco Sommariva around the end of the sixteenth or in the first years of the seventeenth century, while at least two of the Brsečine pieces were produced by Gio. Battista Gandolfo (Genoa, 1535–ca.1601), possibly in the 1590s.

In conclusion, it appears evident that in many cases it is very difficult to provenance merchant ship bronze cannons as they often lack clarifying coats-of-arms and inscriptions. I propose a method of sourcing ordnance produced in other locales using the defining characteristics that are similar to those of Genoese ordnance.

Vladimir Skračić

The wooden boat – a vital link in the chains of scattered islands

This paper focuses on a type of boat that bears the name *betinska gajeta*, which even today, centuries after its first documented use, preserves its main characteristics as a multifunctional family boat. The concentration of such boats in the area of the island of Murter (the towns of Murter and Betina) is a consequence of the particular properties belonging to peoples from two settlements distributed among the surrounding archipelagos (Kornati, Murterski Škoji) and the nearby mainland (Modrave, Makrina). To reach those properties it was necessary to use a boat, so it represents a vital unit of the family and local estate. The existence of the numerous wooden boats (at least one per family) influenced the urbanization of the settlements—where jetties served as continuation of streets, where docks were a common site in the numerous bays of the archipelagos, and where there existed small shipyards and ancillary crafts (sail makers, blacksmiths, rope-twisters etc).

The *gajeta* performed many functions, ranging from the transportation of people and goods, to fishing, and other marine related activities. Its main propulsion consists of oars (maximum five) and a lateen sail. The first evidence for its use in the Zadar-Šibenik archipelago comes from the sixteenth century (fishermen boats from Sali on Dugi otok).

The shipbuilding of Betina was established by P. Filipi and his sons, who during the mid eighteenth century transferred their manufacture from Korčula to Betina, and after that to the other nearby settlements. Today the boat is recognized for its local identity, which is realized through the constant use of the vessel and rowing and sailing regattas (Betina, Prvić, Zlarin, Pašman). The largest regatta, the *Latinsko idro* (i.e., “Lateen Sail”), is held off the island of Murter; each year at the end of September. The homonymous association from Murter and Betina built a new authentic *gajeta* and is trying to regenerate a professional school for wooden shipbuilding.

Tatiana Villegas

Coastal military defensive fortifications and their relation to underwater cultural heritage

During the colonial period in Latin America and the Caribbean, the Spanish Crown built several military fortifications in the major ports and coastal cities as part of a defence system to protect the transatlantic trade. These military architectural complexes included anchorage sites and shipyards. They embody some of the richest aspects of the maritime history of South America and the Caribbean and were often the scene of naval battles between the Spanish, English, French and Portuguese, all eager to obtain the hegemony of trade in the New World. Numerous shipwrecks lie in waters surrounding these fortifications, and many of these architectural sites are already within international

protection schemes, such as the UNESCO World Heritage List. Searching for a more direct link between forts and shipwrecks through already existing notions of cultural roads or cultural landscapes will increase the possibilities of protection and research and allow for programmes to protect land and underwater sites within the same scope.

Željko Peković

A medieval casting house in the historic core (Old Town) of Dubrovnik

The beginning of exploration of *Gornji ugao* and playground *Peline* site started in year 2005 with excavation of the tower dike and archaeological trenches in front of the tower, in order to trace the original tower entry. Besides the located original tower entry and underneath the playground level, spreading across an area of 450 square metres, the medieval industrial zone - casting house with melting furnaces and all following volumes has been discovered.

The site is located in the north-west corner of the Dubrovnik Old Town, in the area of former “*tenaille*” of the city walls. The site is flanked by the tower *Minčeta* on the north side, to the west by the city wall, which connects the two towers, *Minčeta* and *Gornji ugao*, and on the south and east side with the city walls. The tower *Gornji ugao* is first mentioned in the year 1332, and the casting house was at that time “open” and outside the city walls. It was integrated in the city area when the city wall, connecting the tower *Minčeta* with the tower *Gornji ugao* has been built in the year 1457. The casting house was most probably not existent prior to that date, since it has not been sheltered. According to the examined remnants it has been in function during a long period of time.

In course of archaeological excavations on the site the fragments of Romanic bulwark were found. With the deepest foundations, built on the rock, these are the oldest structures on the site. After they ceased functioning, they were demolished, and the area was levelled with sterile earth layer. In the sixteenth century, the casting house has been built, functioning, with breaks, until the big earthquake in 1667, when it has been buried by the rubble from the surrounding buildings and was used as a dumping ground.

During the research 5 zones have been defined: A – melting furnace zone, B – covered storage of sand with residue deposit and the cistern, C – mould casting shop, D and D1 – water basins, channels and residue deposits.

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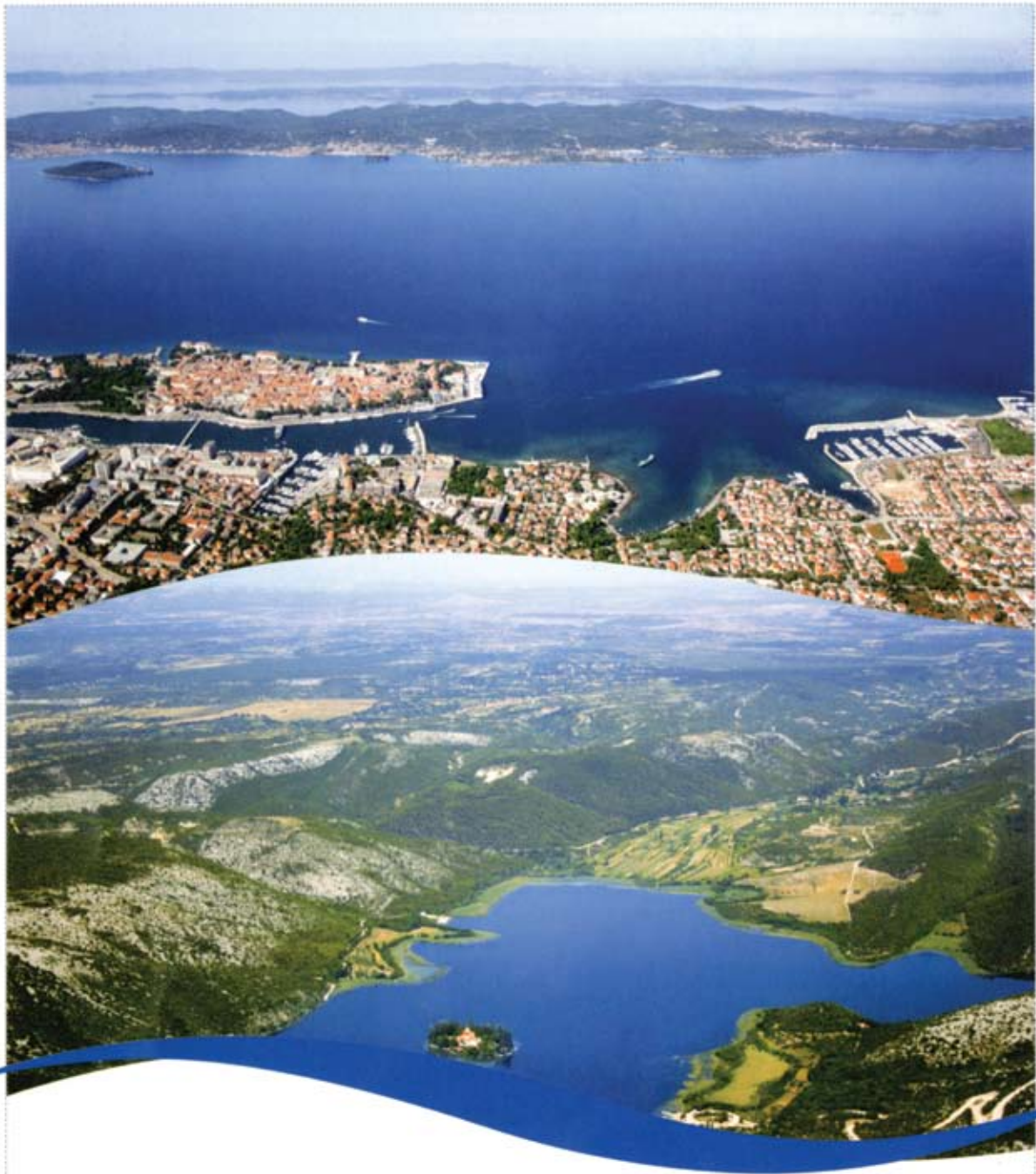
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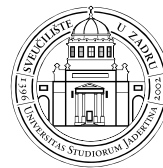
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Zadar has a long university tradition with ties to the church as early as the tenth century. On 14 June 1396 the university *Studium generale*, later the *Universitas Jadertina*, was established in the Dominican convent. It remained active until 1807 when it was closed during the time of French rule. From 1553 onward it was a privileged European university, a *universitas privilegiata*, with the right to assign the highest academic titles.

The development of higher education in Zadar began in 1955 with the establishment of the Faculty of Arts of the University of Zagreb, and in 1998 the High Teachers' school was established. The two institutions represented the base for the re-establishment of the University of Zadar in 2003. Today it is an entirely integrated university, consisting of twenty-three departments, mainly of humanistic and social studies, as well as several new departments in the technical and natural sciences. Postgraduate studies at the University include Archaeology of the Eastern Adriatic, The Geographical Littoral, Cultural Tourism, History of Croatian Maritime Affairs, Linguistics, Literature, Culture and Society, and European Studies: Languages and Cultures in Contact.

Although the University lacks a specific programme in maritime archaeology, the teaching of maritime archaeology is incorporated within the study of archaeology. Intense international collaboration projects in maritime and nautical archaeology presents great potential for its future development, while the abundance of easily accessible archaeological sites provides rich training opportunities for students. A recently launched project entitled Archipelagos aims to spread the University outward to neighbouring archipelagos and Zadar's hinterland, to people depopulated areas, and to provide opportunities to prosper while preserving historical and traditional values.



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Università
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The University Ca' Foscari of Venice began as the *Scuola Superiore di Commercio di Venezia* (High School of Commerce), founded in 1868. In 1935 the institution entered the group of state universities.

Besides the Faculty of Economics, the University Ca' Foscari is composed of the Letters and Philosophy, Foreign Languages and Literature and Mathematical, Physical and Natural Sciences. The historical building of the University, the Directorate today, is the prestigious palace on Canal Grande, which gives the name to the institution. The other seats of the University are situated in the historical centre of Venice, as well as in Mestre and farther inland.

Ca' Foscari together with IUAV and other international institutions founded the Venice International University, situated on the island of San Servolo. In 1999 the Faculty of Letters and Philosophy introduced the Programme of Underwater Archaeology, and in 2001 the first Italian Maritime Archaeology programme was initiated. In 2000 the Department of Antiquity and Near East Studies organized the IX International Symposium on Boat and Ship Archaeology (ISBSA). In 2002 and 2003 two summer schools on maritime archaeology were convened, the first Italian masters programme in maritime archaeology began in 2009. Aside from its many terrestrial archaeological missions in Italy and abroad, the Department of Antiquity and Near East Studies is very active in underwater archaeological research.



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The growth of numerous academic programmes related to the Mediterranean area inspired the University of Zagreb to establish the CMS, the Center for Mediterranean Studies, in 1996. Situated in Dubrovnik, CMS is hosted by CAAS, the Center for Advanced Academic Studies, an institution founded by the University of Zagreb, which owns and maintains the century-old building.



CMS promotes specific collaborative initiatives, exchanges and dialogue, bringing together various universities, heritage-management institutions and cultural entities. It has a long tradition organizing conferences, summer schools, courses and training seminars, all of which follow the concept of a Mediterranean region, regardless of limits and divisions.

As part of that mission, CMS also cooperates with local and regional authorities, as well as with numerous NGO's, thus enabling the diffusion of Mediterranean culture and its preservation the whole Mediterranean community.

CMS projects focus mainly on:

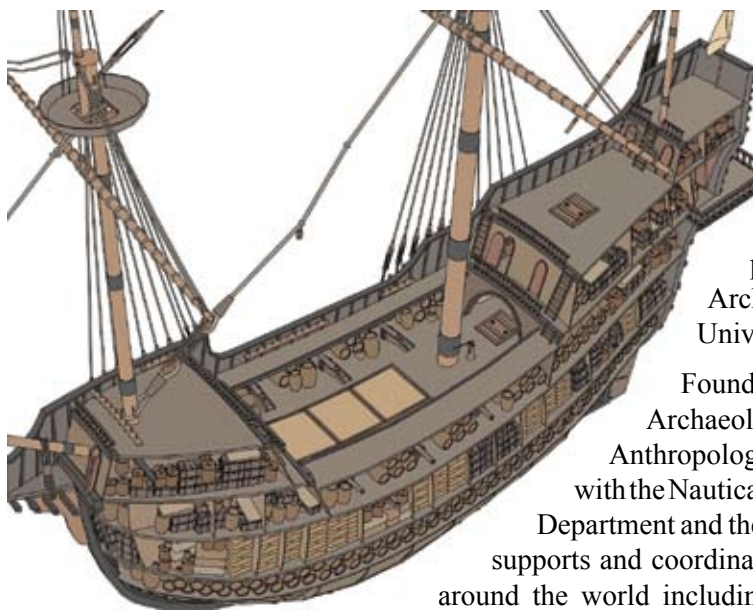
- Mediterranean heritage
- Sephardic culture
- Maritime history and underwater archeology
- History of Mediterranean medicine
- Language

and cooperates with academies of science, universities, UNESCO, UNICEF, museums, cultural organizations and institutions.



Center for Maritime Archaeology and Conservation

Anthropology Building 107
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<http://nautarch.tamu.edu/cmac>



The mission of the Center for Maritime Archaeology and Conservation (CMAC) is to support the research of the Nautical Archaeology Programme (NAP) by studying ships and shipwrecks in the context of the seafaring cultures that created them. A variety of projects are conducted in partnership with the Institute of Nautical Archaeology (INA), also based at Texas A&M University (TAMU).

Founded in 2005, the Center for Maritime Archaeology and Conservation is headquartered in the Anthropology building at Texas A&M University, along with the Nautical Archaeology Programme of the Anthropology Department and the Institute of Nautical Archaeology. The center supports and coordinates faculty and student field research projects around the world including many in Mediterranean countries, Africa, eastern Asia, northern Europe and the Americas. CMAC maintains eight laboratories at the university that further its goal of researching, analyzing, and publishing archaeological finds. Five of the laboratories focus on discoveries from shipwreck sites, including the Steffy Ship Reconstruction Laboratory, the Ship Model Laboratory, the New World Laboratory, the Old World Laboratory, and the Wilder Imaging Laboratory. In these laboratories excavated ships are reconstructed on paper or computers, and comprehensive analyses are carried out on artifacts, as well as on faunal and botanical remains.

CMAC has three laboratories devoted to the conservation of archaeological materials from marine environments. These include the Conservation Research Laboratory (CRL) with an on-campus teaching facility and a large-projects facility at TAMU's Riverside Campus; the Archaeological Preservation Research Laboratory; and the Archaeo-Genomics Laboratory. Through the CRL, CMAC maintains an active contract programme that conserves finds from terrestrial and underwater archaeological sites, and provides stabilization treatment of artifacts held in museum and historic site collections. The contract programme provides outside institutions with reasonably-priced, high-quality conservation services.

Throughout much of human history, boats and ships have carried people, ideas, technology, and trade around the world. Through its study of shipwrecks CMAC is uniquely qualified to interpret important social, technological, and economic transitions that have occurred within or between cultures, and over a vast expanse of time. The research mission of CMAC is inherently interdisciplinary, involving anthropology, oceanography, geography, engineering, all the natural sciences, history, languages, and architecture. And because oceans connect the world's land masses and cultures, the work of CMAC is necessarily international in scope, involving scholars and research institutions from North and South America, Europe, Africa, Asia, and Australia. CMAC faculty have studied sites as ancient as the 13th-century B.C. Ulu Burun wreck in Turkey and as recent as the 1830s-era Mississippi River steamboat Heroine in Oklahoma, USA.

Dubrovački muzeji / Dubrovnik Museums

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DU'm | DUBROVAČKI MUZEJI
DUBROVNIK MUSEUMS

The Dubrovnik Museums began on 5 February, 1872 with the foundation of the Dubrovnik Regional Museum, the fourth museum of its kind to be established in Croatia. Housed on the first floor of the Town Hall building, this museum was inaugurated in April of 1873. A valuable natural history collection represented the nucleus of the museum, to which cultural, historical, and archaeological collections were soon added.

Today, the Dubrovnik Museums represent a regional institution comprised of five museums:

- The Archaeological Museum
- The Ethnographic Museum
- The Cultural-Historical Museum
- The Maritime Museum
- The Modern History Museum

All of these museums are under a single institutional management. The rich museum holdings are displayed at three locations—the Rectors Palace, the Rupe Granary and St. John's Castle. The Archaeological Museum and the Modern History Museum await a permanent premises in which to display their collections.



The Dubrovnik Maritime Museum was established in 1941 when the Society of Dubrovnik organized an exhibition entitled “The navigation routes and Dubrovnik through the centuries”. It is located in St. John's Castle, which was rebuilt after the earthquake of 1979. The permanent display was opened in 1986. It consists of 4,000 exhibits owned by the Museum and illustrates the naval history of Dubrovnik and the surrounding region. The Museum includes a valuable library containing many rare books and important archival materials.

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The University of Dubrovnik is the youngest university in Croatia. It was established in 2003 on the foundations of a very long tradition stretching back to the seventeenth century, but also on decades of modern higher education. The main characteristics of the University of Dubrovnik are:

- An organized system that does not copy existing universities in the Republic of Croatia, and a financing that grants complete integration of the University.
- In the academic year 2004/2005 the University of Dubrovnik had twelve university and six professional courses in the following fields: navigation science, marine engineering, marine electrical engineering and communication technologies, business and applied information technology, aquaculture and mariculture, economy and business studies, tourism and mass communication.



The objects of the University are...

- to encourage teaching and research activities of its staff.
- to implement and maintain Quality Control/Quality Assurance
- to encourage and support the mobility of students, teaching and non-teaching staff, including full recognition of ECTS for students participating in exchange programmes with partner institutions.
- to adjust all of the programmes according to the Bologna declaration and EU praxis.
- to support the LLP (Lifelong Learning Programme).
- to develop international cooperation with partner institutions within the EU and worldwide



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Association of friends of Dubrovnik Antiquity**

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The Association of Friends of Dubrovnik Antiquities was established in 1952 by a group of citizens to heighten the sensitivity of the general public to the cultural heritage of Dubrovnik. As a reaction to the numerous devastations that began in the nineteenth century they have managed to raise interest and awake the consciousness, pride and love for the city's inherited architectural treasure and works of art.

The cofounder, first president and life-long honorary president of the Association was Lukša Beritić (1889-1969), a naval engineer, enthusiast, and protector of the monuments of his homeland. Thanks to his efforts and devotion the Association won the reputation and confidence of the community and was tasked with the maintenance and management of the most impressive monument in the city, the city walls. The Association applied its same devotion and effort to the unique fortification complex of the city walls of Ston, as well as of many other monuments of Dubrovnik, such as Fort Sokol, the gate of Ploče, the forts of Revelin and Lovjenac, the edifice of the guild of Rozario, the Kaše breakwater, the church of St. Peter The Elder, the big and small fountains of Onofrio, among others.

Beritić's vision was rightly founded on trusting the affection of people for their own cultural heritage. The Association has proven by example that monuments can be preserved by the volunteers, assisted and supervised by competent institutions, incorporating in their protection the consciousness of Dubrovnik's people.





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Grad Dubrovnik
City of Dubrovnik



Grad Biograd na moru
City of Biograd na moru

