

# Submerged Heritage Potopljena baština

Number 9 / Broj 9, Zadar, December 2019 / Prosinac 2019.

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# IMPRESSUM

## SUBMERGED HERITAGE / POTOPLJENA BAŠTINA

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Diver with amphorae on newly discovered site at Jankova Bay, Ugljan island /  
Ronilac s amforom na novootkrivenom nalazištu u Jankovoj uvali na otoku Ugljanu  
(Photo: M. Kaleb)





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## The night of the Museums 2019

In February of 2019 ICUA took part in the Night of Museums event-the all-night event featured an open gallery and the screening of a documentary film on Preserving Submerged Heritage. Roko Surić and Maja Kaleb gave a lecture on the Digital Visualisation of Underwater Finds with members of the public able to try their hands at documentation methods utilised by underwater archaeologists. The interest of the public during this event was again very high and ICUA was visited by over 700 people.

## Meeting of the Croatian underwater archaeologists



A meeting of underwater archaeologists from across Croatia was held on 1st March 2019 at ICUA at the initiative of the Ministry of Culture. Participating in the meeting were Assistant to the Minister of Culture Hrvoje Manenica, PhD personnel from Directorate for the Protection of Cultural Heritage in Ministry of Culture, the representatives of the majority of institutions involved in the investigation and protection of underwater heritage in Croatia and the staff of a number of conservation departments with competence in the coastal counties that are home to the majority of protected underwater sites. The purpose of the meeting was to improve cooperation on a broad range of projects and the issue of creating working groups to determine investigation and protection priorities. The meeting resulted in a cooperation agreement that will in the future facilitate the participation of underwater archaeologists in joint projects.

## International Conference on the protection of underwater cultural heritage held in Brest and Meeting of the members of UNITWIN Network

The high-level international conference on the protection



**Workshop for making digital model of archaeological finds / Radionica izrade digitalnih modela arheoloških nalaza (Photo: F. Trcera)**



## Noć Muzeja 2019.

Tijekom veljače 2019. MCPA se pridružio manifestaciji Noć muzeja, te je tijekom cjelovečernjeg događanja uz otvorenu galeriju prikazan dokumentarni film pod nazivom „Očuvanje potopljene baštine“. Roko Surić i Maja Kaleb su održali radionicu „Digitalna vizualizacija podvodnih nalaza“ gdje je šira javnost mogla praktično isprobati metode dokumentiranja koje koriste podvodni arheolozi. Interes javnosti i ove se godine pokazao vrlo velik, te je tijekom manifestacije MCPA posjetilo više od 700 posjetitelja.

## Sastanak hrvatskih podvodnih arheologa

Na inicijativu Ministarstva kulture u MCPA je 1. ožujka 2019. održan sastanak podvodnih arheologa iz cijele Hrvatske. Na sastanku su uz pomoćnika ministrice kulture dr. sc. Hrvoja Manenicu i djelatnike Uprave



**Zoran Wiewegh from the Minister of Culture is presenting the state of Croatian underwater archaeology / Zoran Wiewegh iz Ministarstva kulture prezentira stanje u hrvatskoj podvodnoj arheologiji (Photo: M. Kaleb)**





**Discussion during international conference in Brest / Rasprava tijekom međunarodne konferencije u Brestu (Photo: D. Kurtov)**

of underwater cultural heritage was held in Brest, in the Grand Amphitheatre des Ateliers des Capucins, from 17 to 19 June 2019. It was organized by the French Government together with UNESCO. The Director-General of UNESCO Audrey Azoulay together with Jean-Yves Le Drian, Minister for Europe and Foreign Affairs, opened the international conference. The Conference was focused on issues of ratification and implementation of the 2001 Convention, protection of underwater archaeology, underwater robot technologies, marine law as well as challenges related to sustainable tourism and other topics. The purpose of the Conference was to consider the existing system of protection and conservation of underwater cultural heritage in line with UN's Sustainable Development Objectives, in particular with Goal 14 on the sustainable use of the oceans, seas and sea resources. The international conference in Brest and meetings in Paris were attended by ICUA representatives, Director Mladen Pešić and Head of International Cooperation and Funding Department Doris Kurtov. The ICUA's Director held a presentation about tourism and access to underwater cultural heritage on 18th June 2019. The annual meeting of the UNESCO UNITWIN Network for Underwater Archeology, chaired by the University of Southampton, was also held in Brest. The importance of the 2001 Convention on the Protection of Underwater Cultural Heritage was stressed, as well as the UNESCO's role in issues that fall within its core competencies.

### **The seventh session of the Meeting of States Parties to the 2001 Convention on the Protection of Underwater Cultural Heritage**

The seventh session of the Meeting of States Parties to the 2001 Convention on the Protection of Underwater Cultural Heritage took place at UNESCO Headquarters in

za zaštitu kulturne baštine Ministarstva kulture, sudjelovali predstavnici većina ustanova koje se bave istraživanjem i zaštitom podvodne baštine u Hrvatskoj, kao i djelatnici nekoliko Konzervatorskih odjela pod čijom se nadležnošću nalaze primorske županije gdje se nalazi većina zaštićenih podvodnih nalazišta. Svrha sastanka je bila poboljšanje međusobne suradnje na različitim projektima te pitanje formiranja radnih skupina za određivanje prioriteta istraživanja i zaštite, a sastanak je rezultirao formiranjem Sporazuma o suradnji koji bi u budućnosti olakšao međusobno sudjelovanje podvodnih arheologa na zajedničkim projektima.

### **Međunarodna konferencija o zaštiti podvodne kulturne baštine u Brestu i sastanak članova Unitwin mreže**

Međunarodna konferencija o zaštiti podvodne kulturne baštine održana je u Brestu od 17.-19.06.2019. godine u organizaciji vlade Francuske Republike i UNESCO-a. Konferenciju je otvorila generalna direktorica UNESCO-a Audrey Azoulay zajedno s ministrom za Europu i vanjske poslove Francuske Republike Jean-Yves Le Drianom. Konferencija je bila usredotočena na pitanja ratifikacije i provedbe 2001. Konvencije, zaštiti podvodne kulturne baštine, tehnologijama podvodne robotike, pitanjima pomorskog prava kao i izazovima vezanim uz održivi turizam te drugim temama. Svrha konferencije bila je razmotriti postojeći sustav zaštite i očuvanja podvodne kulturne baštine uzimajući u obzir cilj održivog razvoja br. 14. iz Programa UN-a za održivi razvoj do 2030., kojim se potiče zaštita i održivo iskorištavanje oceana, mora i morskih resursa u svrhu održivog razvoja.

Na međunarodnoj konferenciji u Brestu sudjelovali su predstavnici MCPA-a iz Zadra ravnatelj Mladen Pešić i rukovoditeljica Odjela za međunarodnu suradnju i fondove Doris Kurtov. Ravnatelj Centra održao je 18. lipnja 2019. predavanje na temu turizma i pristupa podvodnoj kulturnoj baštini.

U Brestu je održan i godišnji sastanak UNESCO-ove UNITWIN mreže za podvodnu arheologiju kojom predsjedava Sveučilište u Southamptonu. Naglašena je važnost 2001. Konvencije kao i uloga UNESCO-a u pitanjima koja spadaju u njezine temeljne nadležnosti.

### **Sedmi sastanak država potpisnica UNESCO-ve 2001 Konvencije o zaštiti podvodne kulturne baštine**

Sedmi sastanak država potpisnica UNESCO-ve 2001 Konvencije o zaštiti podvodne kulturne baštine održan





Paris from 20th to 21st June 2019. The participants were presented the Secretariat's and STAB (The Scientific and Technical Advisory Body to the 2001 Convention) mission reports and the 2001 Convention Internal Review Report (2019 marks the 10th anniversary of its entry into force). It was discussed a need for new ratifications, greater visibility for the Convention and its enhanced implementation. The best examples of underwater cultural heritage protection were presented and new STAB members were elected. The number of the STAB members was increased to 14 underwater archaeology recognized experts from all over the world.



### **An exhibition of research at Piruzi opened in Pula**

On Thursday, May 16th, 2019, at the C8 Gallery of the Pula's Archaeological Museum of Istria, the exhibition "Sunken Roman ship on the rocks of Piruzi near Rovinj" was opened. The exhibition was prepared by authors (L. Bekić, M. Kaleb, R. Surić, M. Pešić, M. Ćurković Madiraca, L. Blažeka, F. Trcera) from the International Center for Underwater Archeology in Zadar, after four years of field research of this site. Numerous divers and lovers of history and archaeology of Istria gathered in the exhibition and promotion. At the same time, the promotion of a new comprehensive bilingual monograph on the research at the Piruzi was held. The author of the book is Max Fiederling, one of the research participants and a member of the Bavarian Society for Underwater Archeology, which co-financed translation to German language.

### **Visit of the representatives of the Chinese National Centre of Underwater Cultural Heritage to ICUA Zadar**

Within the Year of Culture and Tourism between the Republic of Croatia and the People's Republic of China from 15th to 16th April 2019. the representatives of the National Centre of Underwater Cultural Heritage (NCUCH) visited ICUA Zadar. Deputy Director of the NCUCH Mr Wang Damin and the Deputy Director of the Institute for Conservation and Restoration Mr Zhang Zhiguo, had the opportunity to see the workshops on wood, metal and ceramics, the Gallery of underwater archaeology and the former church of St. Nicholas. Representatives of the NCUCH expressed their wish to establish direct cooperation for the purpose of exchanging experts in the field of conservation-restoration profession. Issues related to the development of joint projects in the field of



***Speech of the Director-General of UNESCO Audrey Azoulay on the opening of the Meeting of States Parties / Govor generalne direktorice UNESCO-a Audrey Azoulay na otvorenju sastanka država potpisnica (Photo: M. Pešić)***

je u sjedištu UNESCO-a u Parizu od 20.-21. lipnja 2019. godine. Između ostalog, glavne teme sastanka bile su izvješće o radu Tajništva, interna evaluacija 2001. Konvencije (u 2019. obilježava se 10. obljetnica stupanja na snagu predmetne Konvencije), nužnost novih ratifikacija, izmjene i dopune Poslovnika te Statuta STAB-a (The Scientific and Technical Advisory Body to the 2001 Convention), predstavljanje najboljih primjera zaštite podvodne kulturne baštine, izvješća s misija te izbor novih članova STAB-a. Broj članova STAB-a povećan je na 14, a čine ga priznati stručnjaci s polja podvodne arheologije iz čitavog svijeta.

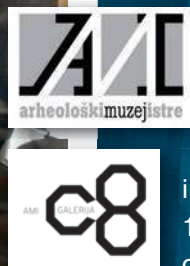
### **Izložba o istraživanjima na Piruzima otvorena u Puli**

U četvrtak 16. svibnja 2019 u Galeriji C8 pulskog Arheološkog muzeja Istre otvorena je izložba "Potopljeni rimski brod na hridi Piruzi kod Rovinja". Izložbu su pripremili autori (L. Bekić, M. Kaleb, R. Surić, M. Pešić, M. Ćurković Madiraca, L. Blažeka, F. Trcera) iz Međunarodnog centra za podvodnu arheologiju u Zadru, nakon četiri godine terenskog istraživanja ovog nalazišta. Na izložbi i promociji okupili su se brojni ronioci i zaljubljenici u povijest i arheologiju Istre. Ujedno je održana promocija nove opsežne dvojezične monografije o istraživanjima na Piruzima autora Maxa Fiederlinga,





*Children are testing replica of the ancient depth gauge / Djeca iskušavaju repliku antičkog dubinomjera (Photo: M. Kaleb)*



jednog od učesnika istraživanja i člana Bavarskog društva za podvodnu arheologiju koje je i sufinanciralo prijevod knjige na Njemački.

## Posjet predstavnika kineskog Nacionalnog centra za podvodnu kulturnu baštinu MCPA-u Zadar

U okviru programa obilježavanja Godine kulture i turizma između Republike Hrvatske i NR Kine od 15.-16. travnja 2019. godine, u posjet zadarskom centru boravili su predstavnici Nacionalnog centra za podvodnu kulturnu baštinu. Zamjenik ravnatelja Nacionalnog centra za podvodnu kulturnu baštinu Wang Daminom te zamjenik ravnatelja Instituta za konzervaciju



*Meeting with Chinese colleagues / Sastanak s kineskim kolegama (Photo: E. Muftić)*

i restauraciju Zhang Zhiguo, imali su priliku vidjeti radionice za drvo, metal i keramiku, Galeriju podvodne arheologije te bivšu crkvu sv. Nikole. Predstavnici kineskog Nacionalnog centra izrazili su želju za uspostavljanjem izravne suradnje u svrhu razmjene stručnjaka iz područja konzervatorsko restauratorske struke. Razgovaralo se o mogućnostima zajedničkih projekata na polju podvodne arheologije, razmjene izložaba te publikacija. Predloženo je potpisivanje Sporazuma o suradnji između dviju institucija kojim će se dogovoriti uvjeti buduće suradnje te detalji njene provedbe.

## Suradnja na podvodnim arheološkim istraživanjima šibenskog i zadarskog područja

U suradnji s Odjelom za podvodnu arheologiju Hrvatskog restauratorskog zavoda tokom lipnja 2019. naši su djelatnici Luke Bekić, Roko Surić i Maja Kaleb bili dio tima na istraživanju podmorja tvrđave sv. Nikola u Šibenskom kanalu. Radi se o spomeniku koji je uz obrambeni sustav grada Zadra upisan na UNESCO-v Popis svjetske

underwater archaeology, exchange of exhibitions and publications were discussed. It was proposed to sign the Agreement on Cooperation between two institutions in order to agree on terms of future cooperation and details of its implementation.

## Cooperation in underwater archaeological research in Šibenik and Zadar area

In June 2019 collaboration with the Department for underwater archaeology of the Croatian Conservation Institute saw ICUA staff Luka Bekić, Roko Surić and Maja Kaleb forming part of the team investigating the waters off the Sveti Nikola fortress in the Šibenik channel. This site, together with the defensive system of the City of Zadar, was jointly inscribed in the UNESCO list of protected world heritage along with a number of Italian and Montenegrin monuments as the Venetian defensive system of the sixteenth and seventeenth century, with this particular effort investigating the broader area around the fortress. In September ICUA staff took part in an investigation conducted by the Archaeological Museum of Zadar. This project is investigating the antiquity period sewn boats at the Kremenjača harbour in Zaton near Zadar. Roko Surić and Maja Kaleb participated in the underwater investigation, while a conservator Zdenka Vrgoč was responsible for taking samples of wood for further analysis of the species used in the construction of the boats.





**St. Nicholas fortress  
in Šibenik channel /  
Tvrđava sv. Nikola  
u Šibeniku  
Photo: M. Kaleb**

### **Exhibition “Mijoka Shipwreck - The Awakening Secret of the Murter Sea”**

From June 3rd to July 5th 2019 at St. Nicholas's Church in Zadar an exhibition called “Mijoka Shipwreck - The Awakening Secret of the Murter Sea” was opened. The exhibition was organized in cooperation with the Museum of the City of Šibenik and the Croatian Conservation Institute (HRZ). The authors of the exhibition were underwater archaeologist Vesna Zmaic Kralj and curator Marina Lambaša, and the author of the artwork and graphic equipment was Ante Filipović Grčić from 2FG studio. About 400 years ago a ship with an extremely interesting and unusual cargo was sunk on the shallows of Mijoka, which proved to be more valuable than anyone could have guessed. Thanks to the financial support of the Ministry of Culture of the Republic of Croatia, protective archaeological investigations were conducted at the site from 2006 to 2012 by the Department for Underwater Archeology of the Croatian Conservation Institute. An area of 64 m<sup>2</sup> was explored and a large collection of valuable moving finds dated to the sixteenth and seventeenth centuries was collected. The exhibition presented in a very clear and visually interesting way the results of archaeological research of the underwater shipwreck site near the shallows of Mijoka, not far from the island of Murter.

### **SENSMAT project**

ICUA Zadar staffer Anita Jelić took part in meetings as a member of the advisory body for the SENSMA (Preventive Solutions for Sensitive Materials of Cultural

baštine pod zajedničkim upisom s nekoliko talijanskih i crnogorskih spomenika pod nazivom „Venecijanski obrambeni sustav 16. i 17. stoljeća”, a ovom prilikom pregledano je šire područje uokolo same utvrde. Djelatnici MCPA su tokom rujna sudjelovali na istraživanju koje je provodio Arheološki muzej u Zadru. Radi se o projektu istraživanja šivenih antičkih brodova u luci Kremenjača u Zatonu kod Zadra. Roko Surić i Maja Kaleb su sudjelovali u podvodnim istraživanjima, a konzervatorica Zdenka Vrgoč je bila zadužena za uzimanje uzoraka drva radi daljnjih analiza vrste drva od kojih je brod rađen.

### **Izložba „Brodolom Mijoka - probuđena tajna murterskog mora“**

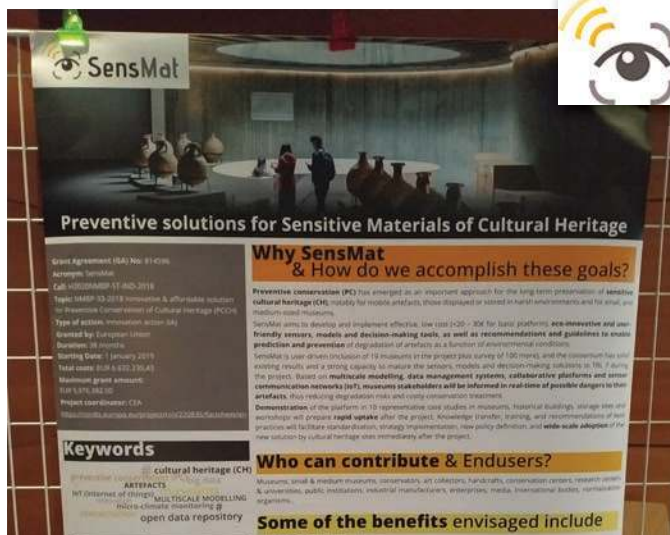
Od 3. lipnja do 5. srpnja 2019. godine u crkvi sv. Nikole u Zadru bila je otvorena izložba pod nazivom “Brodolom Mijoka - probuđena tajna murterskog mora”. Izložba



**Opening of the Murter Mijoka exhibition / Otvorenje  
izložbe Murter Mijoka (Photo: K. Ivković)**

je organizirana u suradnji s Muzejom grada Šibenika i Hrvatskim restauratorskim zavodom (HRZ). Autorice izložbe su podvodna arheologinja Vesna Zmaić Kralj i kustosica Marina Lambaša, a autor likovnog postava i grafičke opreme Ante Filipović Grčić iz 2FG studija. Prije oko 400 godina na plićini Mijoka potopljen je brod s izuzetno zanimljivim, nesvakidašnjim teretom koji se pokazao vrijednijim nego što je itko mogao pretpostaviti. Zahvaljujući financijskoj potpori Ministarstva kulture RH, zaštitna arheološka istraživanja su na lokalitetu provedena od 2006. do 2012. godine od strane Odjela za podvodnu arheologiju HRZ-a. Istraženo je područje od 64 m<sup>2</sup> te je sakupljena velika kolekcija vrijednih pokretnih nalaza datiranih u 16. i 17. stoljeće. Izložba je na iznimno jasan i vizualno zanimljiv način rezultate arheoloških istraživanja podmorskog lokaliteta brodoloma kod plićine Mijoke, nedaleko otoka Murtera.





### Lectures during SENSMAT Meeting / Predavanja tijekom SENSMAT sastanka (Photo: A. Jelić)

Heritage) project. The meetings were held in Brussels on 12th and 13th March and in Paris on 29th and 30th October 2019. The role of the advisory body is to critique or endorse the work of individual institutions and to advise in the domain of preventative conservation. The objective of the project is to design devices that will forestall artefact degradation caused by microclimatic conditions.



### WOAM Conference

For several years ICUA Zadar is a member of organization ICOMOS Croatia. During 2019, ICUA staffer Jelić took part in the 14th ICOM-CC Wet Organic Archaeological Materials (WOAM) Working Group Conference in Portsmouth (United Kingdom) from 20th to 24th May 2019. The conference included four sections with a series of lectures on the degradation and conservation of wet archaeological materials of organic origin, in-situ conservation, reburial, and site surveys, as well as post-conservation treatments of objects of organic archaeological materials.

### Conservation conference in Formentera

The 1st International Symposium of Conservation for Underwater Archaeology (ISCUA) – Preserving the Invisible was held on Formentera island in Spain from 20th to 22nd September 2019. The event was organised by IBEAM (Instituto Balear de Estudios en Arqueología Marítima) and the Consell Insular de Formentera. Antonija Jozić participated in the symposium as a member of the scientific committee and one of 23 speakers. She gave two lectures in the course of the symposium: one presented

### SENSMAT projekt

Djelatnica MCPA Zadar Anita Jelić je sudjelovala na sastancima kao član Savjetodavnog tijela u projektu SENSMAT (Preventive Solutions for Sensitive Materials of Cultural Heritage). Sastanci su se održavali u Briselu 12. i 13. ožujka 2019. i u Parizu 29. i 30. listopada 2019. Uloga Savjetodavnog tijela u ovom projektu je da kritizira i odobrava djelovanje pojedine institucije te da savjetuje u području preventivne konzervacije. Cilj projekta je dizajniranje urađaja koji će spriječiti degradaciju artefakata koja je uzrokovana mikroklimatskim uvjetima.

### WOAM konferencija

MCPA je već nekoliko godina uključen u organizaciju ICOM Hrvatska. Tijekom 2019. naša je djelatnica Anita Jelić sudjelovala na konferenciji 14th ICOM-CC Wet Organic Archaeological Materials (WOAM) Working Group Conference koja se održavala u Portsmouth-u, UK, od 20. do 24. svibnja 2019. Konferenciju su organizirali



### Visit to the Historic England lab facility as part of WOAM 2019 / Posjet laboratorijima Historic England u sklopu WOAM 2019. (Photo: A. Jelić)

Mary Rose Trust i Historic England. Na konferenciji su održane 4 sekcije s nizom predavanja o degradaciji i konzervaciji mokrog arheološkog materijala organskog podrijetla, a teme su bile vezane i uz in situ konzervaciju, ponovno zakapanje mokrih nalaza, pregled podvodnih terena te brigu za organski materijal nakon provedenih postupaka konzervacije.

### Konferencija o konzervaciji na Formenteri

Na otoku Formenteri u Španjolskoj u periodu od 20. do 22.



the conservation and restoration work performed by ICUA staff on the iron anchors from the Gnalić site, and the second and closing lecture of the symposium informed event participants of the structure, work organisation and activity of ICUA.



**Group photo of the Formentera conference participants / Grupna fotografija sudionika konferencije na Formenteri (Photo: IBEAM)**

## The International Project VirtualArch – Visualize to Valorize

The Sense and Sustainability international conference on archaeology and tourism was staged in Zagreb from 6th to 10th May. The event was organised by the Archaeological Museum of Zagreb and the European Association of Archaeologists. Participating on behalf of the City of Zadar and representing ICUA Zadar was archaeologist Maja Kaleb, joined by Czech colleague Jiri Unger of the Institute of Archaeology of the Czech Academy of Sciences in staging a presentation on Making the Invisible Visible – The International Project VirtualArch – Visualize to Valorize. The lecture showcased the results of underwater archaeological investigation under the INTERREG programme at the Barbir site in Sukošan. Following the same project activities, a VirtualArch Summer School was held in Toruń, Poland from 24th to 30th June. The objective of this school was to acquaint participants with new methods of 3D visualisation in archaeology. Participants worked with laser imaging devices and learned the basics of photogrammetry. ICUA staff member Roko Surić took part in the training session.



## European Landscape Convention

At the invitation of Maguelonne Déjeant-Pons, Secretary of the Steering Committee for Culture, Heritage and Landscape of the Council of Europe, Doris Kurtov took part in a meeting (workshop) on the implementation of the European Landscape Convention focusing on

rujna 2019 održan je međunarodni simpozij službenog naziva "1st International Symposium of Conservation for Underwater Archaeology (ISCUA)- Preserving the invisible". Glavni organizatori simpozija bili su IBEAM (Instituto Balear de Estudios en Arqueología Marítima) i Consell Insular de Formentera. Antonija Jozić je sudjelovala je na simpoziju kao član znanstvenog odbora i kao jedna od ukupno 23 govornika. Tijekom simpozija održala je 2 predavanja gdje je prezentirala konzervatorsko restauratorske radove koje su djelatnici MCPA proveli na željeznim sidrima sa lokaliteta Gnalić, a drugim predavanjem koje je ujedno bilo i završno predavanje simpozija predstavila je sudionicima ustroj, organizaciju rada i aktivnosti MCPA.

## Međunarodni projekt VirtualArch – Visualize to Valorize

Međunarodna konferencija o arheologiji i turizmu „Sense and Sustainability“ održala se u Zagrebu od 6. do 10. svibnja u organizaciji Arheološkog muzeja u Zagrebu i Europske asocijacije arheologa. U ime Grada Zadra, predstavnik MCPA Zadar bila je arheologinja Maja Kaleb koja je zajedno s češkom kolegom Jiri Unger (Institut za arheologiju Češke akademije znanosti,



**Student workshop  
in Toruń /  
Studentska  
radionica u Torunu  
(Photo: R. Surić)**

Prag) održala prezentaciju „Making the invisible visible - The international project VirtualArch - visualize to valorize“. Predavanjem su predstavljeni rezultati podvodnih arheoloških istraživanja vezanih uz INTERREG program koji se odvijao na nalazištu Barbir u Sukošanu. Nastavno na isti projekt od 24. do 30. lipnja u Torunu u Poljskoj održala se ljetna škola - VirtualArch Summer School. Cilj škole bilo je upoznavanje polaznika s novim metodama 3D vizualizacije u arheologiji. Polaznici su radili na uređajima za lasersko snimanje te su naučili osnove fotogrametrije, a djelatnik MCPA Roko Surić je sudjelovao na toj edukaciji.





**Interesting lectures in European landscape convention / Zanimljiva predavanja na Europskoj konvenciji o krajolicima (Photo: D. Kurtov)**

water, landscape and citizenship in the face of global change in Seville, Andalusia on 14th and 15th March organised by the Spanish ministry of culture and sports and the Council of Europe. Some 200 representatives of government and non-governmental organisations, local and regional governments, specialists, researchers, members of the Steering Committee for Culture, Heritage and Landscape (CDCPP) and others working in the area of landscape protection and sustainable development took part in the two-day event. ICUA activities and international cooperation were presented at the meeting as was legislation covering the protection of underwater archaeological heritage.

### Scientific Approaches to Ceramics and Glass Conservation in China

From 11th to 22nd November ICUA staff member Martina Ćurković Madiraca participated in a workshop on Scientific Approaches to Ceramics and Glass Conservation at the Palace Museum in Beijing, China, organised by the International Institute for Conservation of Historic and Artistic Works (IIC) and the International Training Centre for Conservation (ITCC). This workshop had its core topic issues related to the conservation of glass and ceramics and pooled twenty-four conservators from around the world that discussed numerous topics related to ethical measures, conservation strategies, preventive measures, scientific analysis and other topics related to the challenges faced by conservator specialists.

**Participants of the China workshop / Sudionici radionice u Kini (Photo: R.Kam)**

## Europska Konvencija o krajolicima

Na poziv članice Tajništva Odbora za kulturu, baštinu i krajolik Vijeća Europe gđe. Maguelonne Dejeant-Pons, Doris Kurtov je sudjelovala na sastanku (radionici) o provedbi Europske Konvencije o krajolicima pod nazivom „Voda, krajolik i građanstvo suočeni s globalnim promjenama” koji je održan u Sevilli, Andaluziji od 14.-15. ožujka u organizaciji španjolskog Ministarstva kulture i sporta te Vijeća Europe. Na dvodnevnom sastanku sudjelovalo je oko 200 predstavnika vladinih i nevladinih organizacija, lokalnih i regionalnih vlasti, stručnjaka, znanstvenika, članova Upravnog odbora Vijeća Europe za kulturu, baštinu i krajolik (CDCPP) te ostalih koji rade u resoru zaštite krajolika i održivog razvoja. Na sastanku su predstavljene aktivnosti Centra, međunarodna suradnja kao i zakonska regulativa vezano uz zaštitu podvodne arheološke baštine.

## Znanstveni pristup konzervaciji keramike i stakla u Kini

U periodu od 11. do 22. studenog naša djelatnica Martina Ćurković Madiraca je sudjelovala na radionici ‘Scientific Approaches to Ceramics and Glass Conservation’ u The Palace Museum, Beijing, Kina koju organiziraju International Institute for Conservation of Historic and Artistic Works (IIC) i The International Training Centre for Conservation (ITCC). Ovo je radionica je kao osnovnu temu imala pitanja vezana uz konzervaciju stakla i keramike, na njoj je sudjelovalo 24 konzervatora iz cijelog svijeta te su se bavili brojnim temama vezanim uz etičke mjere, strategije konzervacije, preventivne mjere, znanstvene analize i druge teme vezane uz izazove s kojima se susreću stručnjaci restauratori.



INTERNATIONAL INSTITUTE  
FOR CONSERVATION OF  
HISTORIC AND ARTISTIC WORKS





## Archaeological excavations of the St. Nicholas complex

During 2019 ICUA staff continued archaeological excavations within the complex of St. Nicholas church with archaeology students from the University of Zadar. The excavations resulted in the discovery of numerous archaeological finds dating from the Iron Age to the most recent periods. Certainly the most interesting discovery includes parts of floors and foundations of structures from Roman times which testifies the continuity of settlement of this region. Notable are also the findings of 14 graves dating from the late medieval period and they are related to activities in the area of the monastery complex. The excavations conducted in 2019 also mark the completion of many years of archaeological researches that were necessary before the final adaptation of the underwater archaeology presentation center, and we look forward for the next steps on its construction to begin in the near future.

## Public Lectures on Underwater Cultural Heritage

In order to promote the underwater heritage protection and research, ICUA staff gave several public lectures. On February 26th 2019 Roko Surić presented a lecture with the topic "Preservation and protection of Croatian underwater cultural treasure". The lecture was held at the Zadar City Library as part of the "Marine Tuesday" cycle, which this institution has traditionally organizing for many years.

On the occasion of the Day of the City of Zadar, Antonija Jozić and Mladen Pešić held lectures at ICUA's premises and the topics were "Conservation and Restoration of Underwater Archeological Findings at ICUA" and "Archeological Investigations of the Ancient Port of Barbir in Sukošan".

**Roko Surić at the Zadar City Library / Roko Surić u Gradskoj knjižnici Zadar**  
(Photo: M. Kaleb)



## Arheološka iskopavanja kompleksa sv. Nikola

Tijekom 2019. godine su djelatnici MCPA sa studentima arheologije Sveučilišta u Zadru nastavili sa arheološkim iskopavanjima unutar kompleksa crkve sv. Nikole. Iskopavanja su rezultirala otkrićem brojnih arheoloških nalaza koji se datiraju od željeznog doba do najnovijih razdoblja. Svakako među najzanimljivije otkriće spadaju dijelovi podnica i temelja zidova iz rimskog vremena koji svjedoče o kontinuitetu naseljavanja ovog područja. Ističe se i nalaz 14 grobova koji se datiraju u kasnosrednjovjekovno razdoblje i povezuju se uz aktivnosti na prostoru samostanskog sklopa. Iskopavanja koja su se provela 2019. godine označavaju i završetak višegodišnjih arheoloških radova koji su bili neophodni prije uređenja prezentacijskog centra podvodne arheologije, te se nadamo da će u skoroj budućnosti započeti i daljnji koraci na njegovoj izgradnji.



**Students are excavating late medieval graves / Studenti iskopavaju kasnosrednjovjekovne grobove**  
(Photo: M. Kaleb)

## Javna predavanja o podvodnoj kulturnoj baštini

U svrhu promocije zaštite i istraživanja podvodne baštine, djelatnici MCPA su održali nekoliko javnih predavanja. Jedno od njih je 26. veljače na temu „Očuvanja i zaštite hrvatskog podvodnog kulturnog blaga“ održao Roko Surić u Gradskoj knjižnici Zadar u sklopu ciklusa „Morski utorak“ koji ova ustanova tradicionalno održava već dugi niz godina.

Povodom dana grada Zadra u prostorima MCPA su predavanja održali Antonija Jozić i Mladen Pešić, a teme su bile Konzerviranje i restauriranje podvodnih arheoloških nalaza u MCPA, te arheološka istraživanja antičke luke Barbir u Sukošanu.



# SECOND INVESTIGATION CAMPAIGN AT SESTRICA ISLAND NEAR ROVINJ

## DRUGA KAMPANJA ISTRAŽIVANJA KOD OTOKA SESTRICE BLIZU ROVINJA

Luka Bekić lbekic@icua.hr / Maja Kaleb mkaleb@icua.hr

In mid-May of 2019, the International Centre for Underwater Archaeology in Zadar (ICUA) joined forces with the Bavarian Society for Underwater Archaeology (BGfU, Germany) to continue our work on the archaeological investigation of the Rovinj area. The work is now focused on the remains of an antiquity period wreck with a cargo of amphorae and, possibly, stone intermediate goods in the waters off Velika Sestrica island. This is the second excavation campaign at the site, where investigation kicked off in October of 2013 with an underwater reconnaissance survey. Funding for the investigative work was provided through the Croatian culture ministry and the tourism board in Rovinj. As in the previous campaign Luka Bekić served as field director. The other members of the field crew were Mladen Pešić, Maja Kaleb, Franka Trcera and Roko Surić of ICUA Zadar; Marko Runjajić, Georg Hartmann, Annika Skolik and Eric Kressner of the BGfU; Peta Knott of the Nautical Archaeological Society; and outside and technical staff Jelena Čelebić and Marko Srećec. Logistical support (scuba tank filling, equipment storage and boat transport) was provided by The Old Diver club at the Mon Perin tourism camp near the town of Bale.

It was back in 2013 that a new potential wreck position was discovered off Velika Sestrica island near Rovinj (Bekić 2013, 47). Last year saw the first excavation campaign in which a number of large cavities were excavated yielding finds. It also saw the first drawn and photogrammetric documentation of the site (Bekić 2018). 190 special finds were isolated from among the 152 kilograms of documented artefacts. It was evident that this was the wreck of a ship carrying a cargo of Forlimpopoli type amphorae and various glass and ceramic ware from the ship's inventory. Also observed were numerous cuboid stone blocks that may have been part of the cargo. A preliminary date puts the ship in the second or third century.



Međunarodni centar za podvodnu arheologiju u Zadru (MCPA) je u suradnji s Bavarskim društvom za podvodnu arheologiju (Bayerischen Gesellschaft für Unterwasserarchäologie - BGfU) iz

Njemačke sredinom svibnja 2019. g. proveo arheološko istraživanje na području grada Rovinja. Istraživanje je provedeno na ostacima antičkog brodoloma s teretom amfora i kamenih poluproizvoda u podmorju otočića Velika Sestrica. Radi se o drugoj kampanji iskopavanja nalazišta čije je istraživanje započelo podmorskim rekognosciranjem u listopadu 2013. g. Istraživanje su financijski potpomogli Ministarstvo kulture RH i Turistička zajednica Grada Rovinja. Kao i dosada, voditelj istraživanja bio je Luka Bekić, a u njemu su sudjelovali Mladen Pešić,



Maja Kaleb, Franka Trcera i Roko Surić iz MCPA Zadar te Marko Runjajić, Georg Hartmann, Annika Skolik i Eric Kressner iz BGfU, Peta Knott iz Nautical Archaeological Society te vanjski i tehnički suradnici Jelena Čelebić i

**1. Excavation of deep cavities and crevices in the bedrock / Iskopavanje dubokih jama i procjepa u živoj stijeni (Photo: L. Bekić)**







## **2. Excavation in underwater cave J13 / Iskopavanje u podvodnoj pećini J 13 (Photo: L. Bekić)**

This year the field crew was tasked with continuing the excavation of cavities, mapping all the stone blocks and taking samples for petrographic analysis. Also on the plan was the completion of the drawn and photogrammetric documentation. The crew was about the same size as last year's team and we hoped to wrap up the lion's share of the investigation effort. The weather was, however, uncooperative, with strong southerlies and rain handicapping our efforts. Particularly unfavourable was the fact that the site is exposed to southerly gusts in a very shallow area that acts like a cape shutting off the entrance to the channel between the two islands. This causes the waves to break right over the site and toss the divers around the bottom, hampering work and making it impossible on some days. In spite of these difficulties the team of archaeologists continued the investigation and succeeded in achieving most of the objectives, although investigation will have to be continued in the coming year.

Excavation continued of the cavities opened but not completed in 2018. Cavities J7 and J3 were first fully investigated. Both did not yield much by way of finds. A new cavity, J8, was opened: it covers three large connected depressions located at the centre of the site. Cavity J15 was excavated nearby. At the north end of the site a number of cavities were excavated along with the already completed Cavity J3. These are Cavities J16 and J17, while Cavity J18 was not excavated, but ought to be in light of the rich finds in Cavity J3. We also began work on the excavation of Cavity J9, near recess/cave J1. Near it are Cavities J10 and J14, also investigated in the course of this year's efforts. They lie at the south end of the site. Also excavated here was cave J13, including the excavation of its continuation, accessible only through a broken ceiling, J13b. This stratigraphic unit yielded the recovery of numerous sherds of amphorae and other pottery—most, however, were so firmly fused with the rock that they could not be extracted. Work in Cavity J13b will have to be completed in the coming year.

Marko Srečec. Logističku podršku punjenja ronilačkih boca, skladištenja opreme i prijevoza brodom pružio je Ronilački centar The Old Diver u turističkom kampu "Mon Perin" nedaleko od Bala.

Još 2013. g. otkrivena je nova pozicija potencijalnog brodoloma kod otočića Velika Sestrica blizu Rovinja (Bekić 2013, 47). Prošle godine provedena je prva istraživačka kampanja u kojoj je istraženo nekoliko većih jama s nalazima i započeta nacrtana i fotogrametrijska dokumentacija nalazišta (Bekić 2018). Tada je između 152 kilograma dokumentiranih arheoloških nalaza izdvojeno 190 posebnih nalaza. Očito je bilo kako se radi o brodolomu s teretom amfora tipa Forlimpopoli te različitim staklom i keramikom koja je bila dio brodskog inventara. Uz to uočeni su brojni pravilni kameni blokovi za koje se sumnja da su također dio tereta. Preliminarno se brodolom može datirati u 2. ili 3. stoljeće.

Ove godine zadatak arheološke ekipe bio je nastavak iskopavanja jama, kartiranje svih kamenih blokova te uzimanje uzoraka za petrografsku analizu. Također je plan bio dovršiti nacrtanu i fotogrametrijsku dokumentaciju. Broj članova ekipe bio je sličan prošlogodišnjem i očekivalo se da bi se ove godine moglo dovršiti gotovo cijelo istraživanje. Na žalost, vrijeme nije poslužilo arheološku ekipu te su jako jugo i kiša ometali rad. Posebno je nepovoljna okolnost bila u tome što je nalazište smješteno na udaru juga i to na vrlo plitkom području koje poput rta zatvara ulaz u prolaz između dva otoka. Iz tog razloga valovi su se lomili upravo na nalazištu te bacali ronioce po dnu, zbog čega je rad bio otežan, a neke dane i nemoguć. Neovisno od tih problema, arheološka ekipa uspjela je nastaviti istraživanja i velikoj mjeri obaviti ciljeve, mada će se istraživanja morati nastaviti i naredne godine.

Nastavljeno je iskopavanje jama koje su započete 2018. g. a nisu dovršene. Tako su prvo jame J 7 i J 3 istražene

## **3. One of the stone blocks, typical of those found on the seabed / Tipičan kameni blok na dnu mora (Photo: M. Kaleb)**







**4. Taking samples from one of the blocks for petrographic analysis / Uzimanje uzorka s jednog od blokova za petrografsku analizu (Photo: M. Kaleb)**

This year also saw a survey of the broader wreck area, i.e. of the entire south and west side of the island. This was aimed at ascertaining the area of distribution of potsherds and of the stone blocks. It again established that the overlap in the distribution of potsherds and stone blocks is almost complete: they are concentrated over a distance of fifty metres and appear sporadically over a distance of 100 metres. All of the finds are distributed at a depth of from one to three metres.

Last year's documentation of the Sestrica site saw a preliminary 3D model developed of a large area around the island, used in creating a digital image over which a graphic plan of the site has been produced. Besides the digital documentation, 2018 also saw the setting of a baseline and a series of fixed reference points for analogue documentation. It is only with the combination of these two methods, i.e. their overlap, that we can be confident that the site has been properly and accurately documented.

In the course of this year's investigative work the existing 3D model was supplemented with a further 2,500 new photographs loaded in the Agisoft Metashape computer software application. The existing fixed reference points were emphasised with yellow tape in order to render them visible in the model, and so that the new model could be merged with last year's model. We have thus to date documented an area of about two thousand square metres. Since part of the site lies at depths of less than two metres taking the necessary photographs was significantly hampered by the rough weather and high waves. All of the investigated cavities are visible in the model, as are those yet to be investigated. Likewise, all finds discovered in the process of the surface survey were positioned by triangulation from the nearest fixed reference points, with these measurements transferred

do kraja. U obje jame nije pronađeno mnogo nalaza. Započet je iskop nove jame, J 8, koja je zapravo jama koju čine tri veće povezane udubine i nalazi se na središnjem dijelu nalazišta. U njejoj blizini iskopana je i jama J 15. Na sjevernom dijelu nalazišta je osim dovršene jame J 3 iskopano još nekoliko njih. To su jame J 16 i J 17 dok J 18 nije iskopana ali bi ju trebalo istražiti zbog bogatih nalaza u J 3. Također je započeto s iskopom jame J 9, koja se nalazi poblježe pećini J 1. U njejoj blizini su i naredne jame J 10 i J 14 koje su također istražene ove godine. One se nalaze na južnom dijelu nalazišta. Tu je iskopana i pećina J 13 i započet iskop njenog nastavka koji je pristupačan samo kroz razbijenu tavanicu, J 13b. U ovoj stratigrafskoj jedinici pronađeno je mnoštvo ulomaka amfora i posuđa, međutim većina je bila tako čvrsto srasla sa stijenama da nisu mogli biti izvučeni. Jamu J 13b će trebati dovršiti naredne godine.

Ove godine pregledano je i šire područje brodoloma, odnosno cijela južna i zapadna strana otoka. Na ovaj način htjelo se provjeriti područje rasprostiranja keramičkih ulomaka te područje rasprostiranja kamenih blokova. Opet se pokazalo kako se keramički ulomci i kameni blokovi gotovo u potpunosti preklapaju, odnosno pojavljuju se u prostoru dužine 50 metara u gušće i najviše 100 metara sa pojedinačnim primjerima. Svi nalazi su raspoređeni na dubinama od 1 do 3 metra.

Prošlogodišnjim dokumentiranjem nalazišta Sestrice, napravljen je preliminarni 3D model velikog područja podmorja otočića za potrebe digitalnog snimka preko kojeg je izrađen grafički plan nalazišta. Osim digitalne dokumentacije, 2018. godine postavljena je i osnovna linija te serija fiksnih točaka za analognu dokumentiranje. Tek kombinacijom ove dvije metode, odnosno njihovim preklapanjem, možemo biti sigurni da je nalazište dokumentirano na ispravan i točan način.

**5. One of the large Forlimpopoli amphorae sherds / Pronađu se i veći ulomci amfora tipa Forlimpopoli (Photo: M. Kaleb)**







**6. A lead billet in situ / In situ olovni valjak**  
(Photo: L. Bekić)

to the digital plan. The digital documentation (positioning and overlap, find entry, cavity and stone drawing) was processing in the Autodesk AutoCAD computer-aided design and drafting software application.

It was also decided in the course of the documentation process that samples would be taken of the stone blocks. A large hammer was used to successfully break off four samples of a minimum size of five by five centimetres. Of that two samples were broken off the bedrock, one

Tijekom ovogodišnjeg istraživanja, postojeći 3D model je upotpunjen sa novih 2500 fotografija u računalnom programu Agisoft Metashape. Postojeće fiksne točke su naglašene žutom trakom kako bi bile vidljive na modelu, te kako bi se novonastali model mogao povezati s prošlogodišnjim. Na ovaj način je do sada dokumentirano područje oko 2 000 m<sup>2</sup>. Snimanje fotografija znatno je otežalo loše vrijeme i visoki valovi zbog činjenice da se dio nalazišta nalazi na dubini manjoj od 2 m. Na modelu su vidljive sve jame koje su istražene, kao i one koje će se tek istraživati. Također, svi nalazi koji su pronađeni površinskim pregledom su pozicionirani triangulacijom od najbližih fiksnih točaka, te su te mjere prenesene na digitalni plan. Digitalna dokumentacija (pozicioniranje i preklapanje, unošenje nalaza, crtanje jama te kamenja) obrađena je u računalnom programu Autodesk AutoCAD.

Također je tijekom procesa dokumentacije kamenih blokova odlučeno koji će se blokovi uzorkovati. Velikim čekićem je uspješno odlomljeno 4 uzoraka u minimalnoj dimenziji 5 x 5 cm. Od toga su dva uzorka odlomljeni od žive stijene - jedan pod morem, jedan na kopnu, te od jednog većeg i od jednog manjeg bloka u moru. Peti uzorak je oblutak iz jame SJ 14, potencijalni balastni kamen. Svi uzorci poslani su na petrografsku analizu na Geološki zavod na Prirodoslovnomatematickom fakultetu



**7.**  
**Peta Knott with a recovered bronze nail / Peta Knott s pronađenim brončanim čavlom**  
(Photo: L. Bekić)





**9. All artefacts are weighed, measured and counted / Svi nalazi se važu, mjere i prebrojavaju**  
(Photo: M. Runjajić)

underwater, the other on land, and from one of the large and one of the small cuboid blocks in the sea. A fifth sample is a cobble from Cavity SU14, a possible ballast stone. All samples were sent for petrographic analysis to the geology department of the University of Zagreb's Faculty of Science to determine whether these blocks were transported by ship from some other position or if they are natural deposits broken from this island.

The analysis results came in a few months later. The sample broken off on land on the shores of the island was determined to be shallow water marine limestone, while the cobble that was posited to have perhaps been a ballast stone was microsparite limestone. Unlike these, the two samples from what were posited to be dressed blocks (the cuboids) were attributed to late-diagenetic dolomites. However, the sample broken off the platform bedrock on the seabed was also identified as late-diagenetic dolomite. According to the geologists, these rocks may be found interlayered in the northern Adriatic. It is, then, evident that what we have here is a dolomite interbed between limestone, now found at a depth of about two metres. We can thus conclude that this constitutes an implausible case of a wreck site coinciding with a geological phenomenon. It is possible that this dolomite layer was exploited and processed at this site in the Roman period, but we cannot associate this activity with our wreck.

Seventy special finds were isolated this year in the course of the excavation of the cavities. As in the previous year these are predominantly sherds of Forlimpopoli type amphorae, but this year did see some other artefact type recoveries. We found a number of rim and base sherds of various pots and bowls, with some sherds attributable to Aegean coarse ware.

Among the non-ceramic finds were two small fragments of glass. There were also metal finds. Prominent among

Sveučilišta u Zagrebu, kako bi se ustanovilo da li su blokovi prevezeni brodom s neke druge pozicije ili su prirodne naslage odlomljene od ovog otoka.

Nekoliko mjeseci kasnije stigli su i rezultati analize. Uzorak koji je odlomljen na kopnu, na obali otoka određen je kao plitkovodni vapnenac, a obli kamen za koji se pretpostavljalo da bi mogao biti balast je vapnenac mikrosparit. Za razliku od njih, dva uzorka iz pretpostavljenih obrađenih blokova pripisani su kasnodijagenetskim dolomitima. No i uzorak koji odbijen od pločaste žive stijene na dnu također je kasnodijagenetski dolomit. Po mišljenju geologa, ove stijene mogu se naći međusobno uslojene na području sjevernog Jadrana. Stoga je očito kako se radi o jednom geološkom prosloju dolomita između vapnenaca, a koji se sada nalazi na dubini od oko 2 metra. S time se može zaključiti kako je riječ nevjerojatnoj podudarnosti mjesta brodoloma s jednim geološkim fenomenom. Ipak, moguće je da se taj sloj dolomita u rimsko doba uistinu na ovom mjestu iskorištavao i obrađivao, s time da se ta aktivnost ne može više povezati s ovim brodolomom.

Prilikom iskopavanja jama, ove godine pronađeno je 70 posebnih nalaza. Kao i prošle godine, većinom su to ulomci amfora tipa Forlimpopoli, ali ove godine pronađeno je i nešto drugačijih nalaza. Nađeno je nekoliko oboda i dna različitih lonaca i zdjela, a neki se ulomci mogu pripisati i egejskog gruboj keramici (ECW).

Od nekeramičkih nalaza pronađena su dva manja ulomka stakla. Pronađeni su i metalni nalazi. U prvom redu to su dva brončana čavla koji vjerojatno potječu od brodske konstrukcije. Nakon toga valja spomenuti i jedan željezni klin, također od brodske konstrukcije. Ovi nalazi potvrđuju kako je ovdje riječ o brodolomu, a za očekivati je da će se naredne godine naći još čavala iz nekadašnje drvene brodske konstrukcije. Vrijedan nalaz je i brončana igla s glavicom, najvjerojatnije ukosnica, kakve su česte u rimskim ženskim grobovima. Pronađen je i jedan olovni valjak s dvije rupe na nasuprotnim stranama, nepoznate namjene.

Ovogodišnje istraživanje potvrdilo je naša dosadašnja saznanja o nalazištu te dalo dodatne dokaze o postojanju brodoloma na ovom mjestu, a to su tri metalna brodska čavla. Nadamo se da će naredne godine biti još nalaza ovog tipa. Uz već poznate amfore tipa Forlimpopoli, pronađeni su i malobrojni ulomci nekih drugih tipova, ali sve u svemu, jasno je kako se teret gotovo u potpunosti sastojao od amfora tipa Forlimpopoli, u raznim varijantama i dimenzijama. Uz to, na brodu je, vjerojatno u vlasništvu posade, bilo grubih lonaca za kuhanje i spremanje hrane, vrčeva, zdjela i zdjelica, boca, uljanica i drugih predmeta koji su bili neophodni za život na brodu.



these are two bronze nails likely originating from the ship's structure. Also noteworthy is an iron spike, also from the ship's structure. These finds confirm a wreck and we can expect in coming years to recover more nails from the former ship's structure. A notable find is that of a bronze pin with head, likely a hairpin of the kind frequently found in the graves of Roman women. Another find is that of a lead billet with two holes on opposite sides, of unknown purpose.

This year's investigation has confirmed our existing knowledge of the site and provided additional evidence that it is the site of a wreck in the form of three metal ship's nails. We hope that the coming years will see more recoveries of this kind. Along with the already confirmed Forlimpopoli type amphorae we did find a small number of sherds of other pottery forms, but, all in all, it is clear that the cargo consisted almost entirely of various variants and sizes of Forlimpopoli amphorae. Also on this ship were - likely the property of the crew - coarse cooking and food storage pots, jugs, bowls (small and large), bottles, oil lamps and other items essential to life on board a seagoing ship.

The petrographic analysis has shown the stone blocks to be of local origin and it is unlikely that the wrecked vessel was associated with them. There is, of course, the possibility that they were extracted at the seashore in the Roman period, dressed and transported for use elsewhere. The coming year will see us complete the investigation of the cavities of greatest interest, and perhaps some new significant finds will help us better understand this shipwreck.

Parallel to this archaeological investigation ICUA Zadar and NAS Portsmouth staff joined forces at the Mon Perin tourism camp to stage an annual underwater archaeology course following the NAS system for a number of interested divers from various countries. This year the course involved the work of domestic NAS instructors and Peta Knott, a NAS education officer from the United Kingdom. Young archaeologist Maja Kaleb passed her NAS instructor's course and she will in the future teach new applicants.

**10. The Sestrica 2019 field crew and the NAS course participants. Standing, left to right: / Istraživačka ekipa Sestrice 2019 i polaznici tečaja NAS. Stoje s lijeva: Marko Runjajić, Ana Čurić, Emil Fabjanac, Jelena Čelebić, Annika Skolik, Konstantin Merkouris, Franka Trcera, Mladen Pešić, Eric Kressner, Mircea Topa, Mrs. Topa; sitting, left to right: / sjede s lijeva: Luka Bekić, Peta Knott, Maja Kaleb, Heba Hasmi (Photo: L. Bekić)**

Petrografska analiza je pokazala kako su kameni blokovi ovdje autohtoni te nije vjerojatno da je nastradali brod s njima imao neke veze. Ipak, postoji mogućnost da su oni u rimsko doba ovdje, na obali mora odlamani iz svog ležišta, obrađivani te prevoženi negdje prema potrebi. Slijedeće godine dovršiti će se istraživanje najzanimljivijih jama i možda će neki novi važni nalazi pomoći u boljem determiniranju ovog brodoloma.

Paralelno s provođenjem ovih arheoloških istraživanja u turističkom kampu Mon Perin su djelatnici MCPA Zadar i NAS Portsmouth održali redovni godišnji tečaj podvodne arheologije po sustavu NAS za nekoliko zainteresiranih ronionica iz raznih zemalja. Ove godine je u provođenju tečajeva s domaćim NAS nastavnicima sudjelovao i nadzornik iz britanskog NAS-a, arheolog Peta Knott. Tom prilikom je i mlada arheologica Maja Kaleb položila instruktorski tečaj NAS te će nadalje i ona podučavati nove pristupnike.

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# NEW INSIGHT INTO THE ANTIQUITY PERIOD HARBOUR AT BARBIR IN SUKOŠAN

## NOVA SAZNANJA SA ISTRAŽIVANJA ANTIČKE LUKE BARBIR U SUKOŠANU

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Our investigation of the antiquity period harbour at Barbir in Sukošan is now in its third year. This notable underwater site has already produced significant data on a diversity of activity that took place in the area of this harbour complex in the period from the first to fifth century, which saw its intensive utilisation on the part of the local population. Many of the archaeological finds uncovered in the course of the underwater investigation also point to the harbour at Sukošan having traded with various other Mediterranean hubs on the maritime routes running along the eastern shores of the Adriatic. Joining ICUA staffers Mladen Pešić, Luka Bekić, Roko Surić, Maja Kaleb and Franka Trcera at this year's investigative work were outside archaeologists Elisabeth Briggs (UK), Roman Scholz and Andreas Grundmann (Germany), archaeology student Vinka Milišić and outside associate Marko Lete. Maja Grgurić of the University of Zadar led the drone assisted aerial imaging, with logistical support provided by the Zadar Sub and Meridijan Yacht Servis companies.

The primary objective of the 2019 underwater archaeological investigation was to continue the excavation of Trenches 1 and 2 from the previous campaigns. The objective of the work was to determine the total cross section of the structure and the stratification at Mole 1. Upon completion of the excavation of Trenches 1 and 2, we opened excavation of Trenches D and E at the entrance to the antiquity period harbour that aimed to determine the stratification in the broader harbour area used by watercraft in the antiquity period.

Trenches 1 and 2 were set such that their total length was fifteen metres, and they continue one from the other. The excavation of these trenches was begun in previous campaigns from both sides and the objective this year was to join the two excavations to form a single trench, which was achieved. The excavation was done to a depth

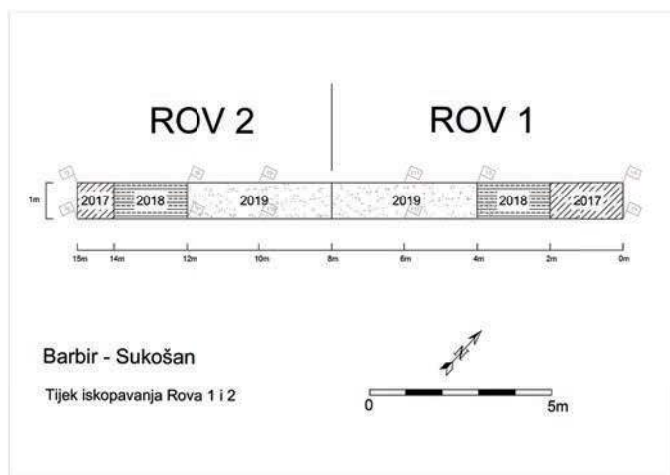


Istraživanja antičke luke Barbir u Sukošanu nastavljena su i treću godinu za redom. Ovo vrijedno podvodno nalazište dalo nam je do sada niz podataka o različitim aktivnostima koja su se odvijale na prostoru lučkog kompleksa tijekom razdoblja između 1. i 5. st., kada je on intenzivno korišten od strane lokalnog stanovništva. No, brojni arheološki nalazi otkriveni tijekom podvodnih istraživanja idu u prilog činjenici da je luka u Sukošanu bila povezana i s različitim mediteranskim centrima u sklopu pomorskih veza koje su se kretale istočnom obalom Jadrana. Uz djelatnike MCPA Mladena Pešića, doc.dr.sc. Luku Bekića, Roka Surića, Maju Kaleb, Franku Trcera, na istraživanju su ove godine sudjelovali i vanjski suradnici arheolozi Elisabeth Briggs (UK), Roman Scholz i Andreas Grundmann (Njemačka), studentica arheologije Vinka Milišić i vanjski suradnik Marko Lete. Zračno snimanje dronom izvršila je Maja Grgurić sa Sveučilišta u Zadru, dok smo za logističku podršku koristili usluge tvrtki Zadar Sub i Meridijan Yacht Servis d.o.o.

**1. Aerial image of the antiquity period structures at Barbir / Zračni snimak antičkih struktura na Barbiru s rasporedom sondi**  
(Photo: M. Grgurić, edit by: M. Kaleb)







## 2. Plan of the excavated sections in Trenches 1 and 2 by year of excavation / *Nacrt iskopanih dijelova Rova 1 i 2 po godinama (by: M. Kaleb)*

of 160 centimetres below the current seabed level, with the breadth of the trenches being up to 150 centimetres. Six stratigraphic units formed during the harbour's active period were identified in the course of the dig. Two layers stand out in significance in terms of the finds they yielded.

One of these contained numerous

finds that are attributable to the period of the late first and second century. This layer lies below the now visible structures of the antiquity period harbour and it is older than the structures that were the chief objective of the investigation. In the late first and second century the mole structure had not yet been built in this area; if mole structures had existed, they were not of the same scale as those from the later period. This can be concluded from the fact that most of the finds from this layer are covered by calcification, characteristic of ceramic artefacts that spend a long time on the seabed, with marine activity creating a layer of calcification upon them, unlike artefacts that are relatively quickly covered by sand and are free of calcification on the wall surface of the pottery. All of these finds are also situated below the level of the stone structure that constitutes Mole 1.

Prominent among the artefacts recovered from this layer are the base of a Forlimpopoli amphora, the upper section of a Porto Recanati amphora (mid first – second century, BAR 157), coarse ware bowl rim sherds, rim sherds from African Hayes 8 form small bowls (late 1st – mid 2nd century, BAR 162)<sup>1</sup>, and a fragment of decorated glass



## 3. The launch of excavation in Trench 1 / *Početak iskopavanja unutar Rova 1 (Photo: M. Letic)*

Osnovni cilj podvodnih arheoloških istraživanja tijekom 2019. g. je bio nastavak iskopavanja Rova 1 i 2 koja su se obavljala prethodnih arheoloških kampanja, a svrha istraživanja je bila definiranja ukupnog presjeka strukture i uslojenosti Mola 1. Nakon završetka iskopa Rova 1 i 2, započet je iskop sondi D i E koje su locirane na samom ulazu u antičku luku, a čija je svrha bila utvrđivanje uslojenosti na širem prostoru luke koji su brodovi koristili u antičkom periodu.

Položaj Rova 1 i 2 postavljen je na način da njihova ukupna dužina iznosi 15 m, a oni se međusobno nastavljaju jedan na drugi. Iskop Rovova je prethodnih godina započet s obje krajnje strane, a cilj je bio ove godine spojiti oba iskopa u jednu jedinstvenu sondu, u čemu se i uspjelo. Sam iskop sondi vršio se do dubine od 160 cm ispod razine današnjeg morskog dna, širina sondi bila je do 150

cm, a prilikom istraživanja definirano je 6 stratigrafskih jedinica koje su nastale tijekom perioda korištenja luke. Dva sloja su se prema nalazima koji su u njim prepoznati izdvojila kao najvažnija.

Jedan od njih sadržavao je brojne nalaze koji se mogu pripisati razdoblju kraja 1. i 2. st. Taj se sloj nalazi ispod danas vidljivih struktura antičke luke i on je vremenski stariji od samih struktura koje su i bile glavni cilj istraživanja. U razdoblju kraja 1. i 2. st. još nisu bile izgrađene strukture antičkog mola na ovom području, a ako su i postojale nisu bile tolikog opsega kao i one iz kasnijeg razdoblja. To se može zaključiti iz činjenice da je većina nalaza iz ovog sloja pokrivena kalcifikatom koji je karakterističan za keramičke nalaze koji se duže

## 4. Sherd of a small African bowl of the Hayes 8 form / *Ulomak afričke zdjelice forme Hayes 8 (Photo: M. Kaleb)*





(BAR 174). The decoration is ground into the glass on this fragment, and we can make out three horizontal lines under which there are a series of rhombi, some of which enclose a ground decoration. From the preserved section we deduce that it is probably from a drinking cup. Also found in this layer were a number of sherds from different oil lamp types. One of the interesting finds is that of a fragmentarily preserved oil lamp with a figural erotic scene that can be attributed to some time in or around the second century (BAR 140). One coin was found (BAR 152) that we can tentatively identify on the basis of its size as a copper As - only a restoration will allow for a more precise imperial attribution. Among the frequent finds of organic materials, usually the pits of olives, grapes and peaches, walnut shells and pine nuts, this layer also contained numerous animal bones finds. Notable among the organic finds in this layer is the partially preserved fragment of a wooden pulley - on the outer side of its flange is a groove with traces of woodworking (BAR 130).

The other particularly interesting layer contained fourth century finds. This layer lies from 70 to 110 centimetres below the current seabed, which is from 300 to 340 centimetres below current sea level. Characteristic finds are rim sherds

**6. A fragmented oil lamp with erotic imagery / Fragmentirana uljanica s erotskim prikazom (Photo: M. Kaleb)**



**5. Part of a Porto Recanati amphora / Dio amfore tipa Porto Recanati (Photo: M. Kaleb)**

vremena nalaze na morskom dnu, te se pod utjecajem mora na njima stvara kalcificirani sloj, za razliku od nalaza koji u kraćem vremenskom razdoblju budu zatpani pijeskom i ostaju bez kalcifikata na površinskoj stijenci. Također su svi ovi nalazi smješteni ispod razine kamenih gradnji koje su tvorile Mol 1.

Od nalaza iz ovog sloja se mogu istaknuti dno Forlimpopoli amfore, gornji dio amfore forme Porto Recanati (sredina 1. - 2. st., BAR 157), obodi grubih zdjela, obod afričke zdjelice forme Hayes 8 (kraj 1.- sredina 2. st., BAR 162)<sup>1</sup> te ulomak dekoriranog stakla (BAR 174). Ulomak stakla nosi ukrase nastale brušenjem, te se prepoznaju tri horizontane linije ispod kojih se nalazi uzastopni niz rombova od kojih neki u unutrašnjosti imaju brušene dekoracije. Prema obliku koji je sačuvan se najvjerojatnije radi o formi čaše. U ovom je sloju pronađeno i nekoliko ulomaka različitih uljanica, a svakako je jedan od zanimljivijih nalaza fragmentirano sačuvana uljanica s figurativnim prikazom erotske scene koja bi se okvirno mogla smjestiti u 2. st. (BAR 140). Nađen je i jedan novčić (BAR 152), a preliminarno se prema njegovoj veličini može zaključiti

da se radi o bakrenom asu, no tek će nakon restauracije biti moguće pobliže definirati kojem se caru može pripisati. Uz učestale nalaze organskog materijala, najčešće koštica maslina, grožđa, breskvi, te ljuski oraha i pinjola, u ovom se sloju nalaze i brojni ostatci životinjskih kostiju. Od organskih nalaza iz ovog sloja može se istaknuti djelomično očuvani ulomak drvenog koloturnika kojem se s vanjske strane oboda vidi utor s tragovima obrade (BAR 130).

Drugi posebno zanimljivi sloj je onaj koji je sadržavao nalaze iz razdoblja 4. st. To je sloj koji se nalazio između 70 i 110 cm ispod razine današnjeg morskog dna, što je od 300 do 340 cm ispod današnje morske razine. Karakteristični su nalazi oboda afričkog tanjura forme Hayes 50<sup>2</sup> (BAR 177) te oboda afričke plitke zdjele Hayes 61 (BAR 131) koji se datiraju u 4. st.,<sup>3</sup> a proizvodili su se na području današnjeg Tunisa. Nađeno je i dno amfore Late Roman 3 koja se datira nakon 4. st., a proizvodila se na području Male Azije (BAR 147),<sup>4</sup> pojedini ulomci grubog kuhinjskog i sigilatnog posuđa,





**7. Wooden piles in Trench 1 / Drveni piloni u Rovu 1**  
(Photo: M. Lete)

from African Hayes 50 form plates<sup>2</sup> (BAR 177) and rim sherds from African Hayes 61 form shallow bowls (BAR 131), dated to the fourth century and manufactured in present day Tunisia. Also found was the base of a Late Roman 3 amphora dated to after the fourth century<sup>3</sup> and manufactured in Anatolia (BAR 147),<sup>4</sup> individual sherds of coarse cooking ware and sigillata ware, an amphora stopper made from the body of another amphora, amphora base and rim sherds, and a number of sherds from a jug of Aegean production (BAR 187).

Noteworthy among the finds in this layer are two coins struck under either emperor Constantius II or Constans, which, together with the finds from last year put the collection at thirty coins. Upon completion of the excavation in Trenches 1 and 2, they were covered with geotextile, backfilled with the stone removed from them, and the site was restored as much as possible to its original state. During the backfilling process we discovered a small stone capital on which we identified an acanthus leaf decoration (BAR 194), which was, in this context, part of the stone fill used when building up the port structure. This is a frequent decoration on capitals of the Corinthian order, frequently used in Roman period architecture for its decorative quality.

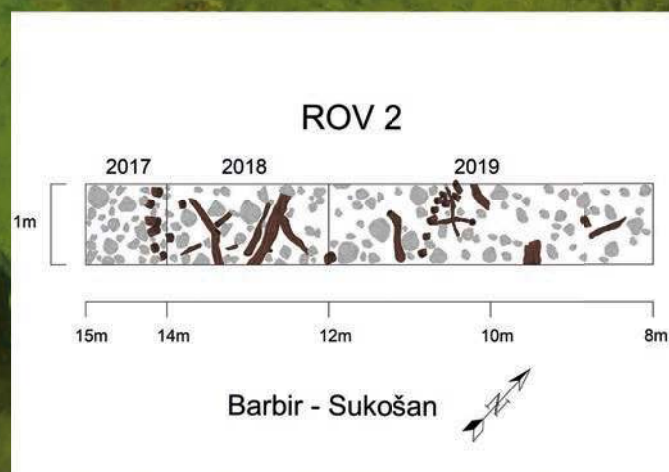
During the 2017 investigation it was determined that different kinds of timber were used in the construction of Mole 1, differentiated by species and form and by the purpose served by individual elements. Vertical piles were identified as part of the structure of the mole that served to hold the stone fill in place as it was dumped here. It is evident that the building of the mole saw wooden piles first rammed into the silt at the outer perimeter at intervals of 20 to 30 centimetres, with stones of various sizes dumped into the resulting structure along with laid logs. The continuation of the investigation in 2019 revealed new details concerning the construction method. It was

čep amfore proizveden od tijela druge amfore, ulomci dna i oboda amfora te vrč egejske proizvodnje u većem broju ulomaka (BAR 187).

Od ostalih nalaza unutar ovog sloja valja spomenuti dva novčića iz razdoblja careva Konstancija II ili Konstansa, što zajedno s prošlogodišnjim nalazima čini kolekciju od 30 novčića. Po završetku iskopa Rova 1 i 2 njihova je površina prekrivena geotekstilom, zatrpani su kamenjem koje je iz njih izvađeno, te je nalazište dovedeno koliko je to bilo moguće u prvobitno stanje. Prilikom zatrpavanja je pronađen i jedan manji dio kamenog kapitela na kojem se prepoznaje ukras u vidu akantusovog lišća (BAR 194), koji se u ovom kontekstu nalazio kao dio kamena korištenog prilikom nasipanja lučkih kontrukcija. Takav se ukras često javlja na kapitelima poznatim kao korintski tip, učestalo upotrebljavan u rimskoj arhitekturi radi svoje dekorativnosti.

Već prilikom istraživanja 2017. utvrđeno je da se za gradnju strukture Mola 1 koristila različita drvena građa koja se razlikuje na osnovu vrste drva i njihove forme, te svrhe kojoj su služili pojedini element. Tada su pronađeni vertikalni piloni za koje je zaključeno da su bili dio pristanišne strukture koji su služili za zadržavanje kamenja prilikom njegovog nasipanja tijekom gradnje. Očigledno je da su prilikom gradnje strukture mola na krajnjem vanjskom rubu prvo zabijani drveni piloni u mulj na nepravilnom razmaku od oko 20-30 cm, a unutar te strukture je zatim nabacivan kamen različitih dimenzija zajedno s položenim drvenim trupcima. Nastavak istraživanja 2019. godine otkrio nam je i nove podatke o načinu njegove gradnje. Tako je ustanovljeno da je uz niz pilona koji su postavljeni uz vanjski rub strukture, pojavljuju još dva niza vertikalno zabijenih pilona koji se nalaze na području Rova 2 na dijelu bliže obali. To nam svjedoči da se konstrukcija možda gradila u etapama, a svakako je osnovni razlog takve gradnje bio pojačavanje

**8. Plan view of the wooden structure in Trench 2 / Tlocrt drvene konstrukcije unutar Rova 2**  
(By: M. Kaleb)







9.  
*Excavation of  
Trench D in the  
sandy seabed /  
Iskop sonde D na  
pjeskovitom dnu  
(Photo: M. Pešić)*

thus established that, along with the series of piles set at the outer perimeter of the structure, there are a further two series of vertically rammed piles in Trench 2 in the section nearer the shoreline. This tells us that the structure may have been built in stages, and certainly the main reason for this manner of construction would be to increase the integrity of the landing stage. The analysis of the wood tells us that all of the piles were of stone pine, while evergreen oak (*Quercus ilex*) was used for the logs that formed the fill of Mole 1.

The excavation of Trenches D and E at the entrance to the Roman harbour has just begun, but already the first layers have offered interesting data that testify to the extent of the space useful to antiquity period seafarers. This campaign also saw a survey of the wider harbour area aimed at determining the spread of surface finds. We observed some areas of greater find concentration in the harbour area, and discovered an interesting part of the harbour's wooden elements. This is a series of several logs of irregular form set in parallel and concentrated at one spot, and about three metres away a few smaller wooden elements and intact preserved pine cones. Around these wooden elements is a greater concentration of ceramic material. For now, the structure has only been imaged as a surface feature, including a high resolution orthophoto image, and we hope that a more detailed examination in the next campaign will tell us more about these structures.

As has been the practice in previous years the two-week investigation of the antiquity period harbour at Barbir in Sukošan saw an introductory underwater archaeology course at the site organised by ICUA in collaboration with the Global History of Capitalism Project of the

čvrstoće pristanišnih struktura. Analiza drva je pokazala da su svi piloni izrađeni od bora pinije, dok se za trupce koji su tvorili ispunu Mola 1 koristio hrast crnika (*Quercus ilex*).

Iskop sonde D i E koje su smještene uz sam ulaz u rimsku luku je tek započet, no već su prvi slojevi dali zanimljive podatke koji svjedoče o rasprostiranju korisnog prostora kojeg su antički moreplovci koristili. Prilikom istraživanja je pregledano i šire područje unutar luke radi utvrđivanja rasprostiranja površinskih nalaza. Tom su prilikom zamijećene određene veće koncentracije nalaza na pojedinim dijelovima luke, a otkriven je i zanimljiv segment drvenih dijelova koji se nalazi unutar luke. Radi se o nizu od nekoliko paralelno postavljenih drvenih trupaca nepravilnih oblika koncentriranim na jednom mjestu, te oko 3 metra dalje od njih još nekoliko manjih drvenih dijelova i cjelovito očuvanih šiški bora. Uokolo ovih drvenih dijelova nalazi se i veća količina keramičkog materijala. Za sada je konstrukcija samo površinski snimljena, te je napravljen orfo-foto snimak visoke razlučivosti, a nadamo se da ćemo u sljedećim arheološkim kampanjama uslijed detaljnijih pregleda moći reći nešto više o tim strukturama.

Kao što je bila praksa i prethodnih godina, tijekom dva tjedna istraživanja antičke luke Barbir u Sukošanu, na samom je nalazištu proveden Osnovni tečaj podvodne arheologije koji je MCPA Zadar ove godine organizirao u suradnji s Global History of Capitalism Project (Oxford Centre for Global History, Sveučilište Oxford) te Römisch-Germanische Kommission iz Frankfurta i Arheološkim muzejem u Zadru. Tečaj je održan za osam studenata koji su imali mogućnost pod stalnim nadzorom instruktora provesti niz vježbi neophodnih za usavršavanje u



Oxford Centre for Global History (University of Oxford), the Romano-German Commission from Frankfurt, and the Archaeological Museum in Zadar. The course was staged for eight student participants who were provided the opportunity under constant instructor guidance to perform a number of exercises essential to training for non-destructive underwater site documentation methods (2D, 3D, photogrammetry), find documentation and archaeological excavation. Taking part in the investigative work at the site in the frame of this introductory course were students Yomna Osman (Egypt), Ying Ying Yan (China), Đorđe Cvetković (Malta), Urszula Ostaszewska (Poland), Ioan Huw Espley (UK), Tiberiu Potarniche (Romania), Jamie Lee Swift (UK), and Napat Piromrak (Thailand).

We plan to continue our investigative work at the antiquity period harbour at Barbir in Sukošan next year and are confident that it will produce new insight into everyday life in the area and into the status of the harbour within the overall scheme of Adriatic maritime navigation.



**10. Ortophoto model of the part of surface finds in Roman harbour / Ortofoto model dijela površinskih nalaza unutar luke (By: R. Surić)**

nedestruktivnim metodama dokumentacije podvodnog nalazišta (2D i 3D, fotogrametrija), dokumentaciji nalaza te arheološkim iskopavanjima. U sklopu Osnovnog tečaja podvodne arheologije na nalazištu su tijekom istraživanja u radu sudjelovali i studeni Yomna Osman (Egipat), Ying Ying Yan (Kina), Đorđe Cvetković (Malta), Urszula Ostaszewska (Poljska), Ioan Huw Espley (UK), Tiberiu Potarniche (Rumunjska), Jamie Lee Swift (UK), Napat Piromrak (Tajland).

Nastavak istraživanja antičke luke Barbir u Sukošanu planira se i sljedeće godine, te će zasigurno rezultirati novim spoznajama o svakodnevnom životu koji se odvijao na ovom području kao i o važnosti same luke unutar režima jadranske plovidbe.

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<sup>1</sup> Hayes 1972, 33-37.

<sup>2</sup> Hayes 1972, 69-73.

<sup>3</sup> Hayes 1972, 107.

<sup>4</sup> Keay 1984, 286-289.

**11.**  
**Sailing to the**  
**archaeological**  
**site / Plovidba**  
**na arheološko**  
**istraživanje**  
**(Photo: R. Surić)**





# THE FIRST UNDERWATER ARCHAEOLOGY FIELD SCHOOL IN SLOVAKIA

## PRVÁ TERÉNNÁ ŠKOLA ARCHEOLÓGIE POD VODOU NA SLOVENSKU

Klaudia Daňová kladia.danova@gmail.com / Mirka Daňová mirka.danova@gmail.com



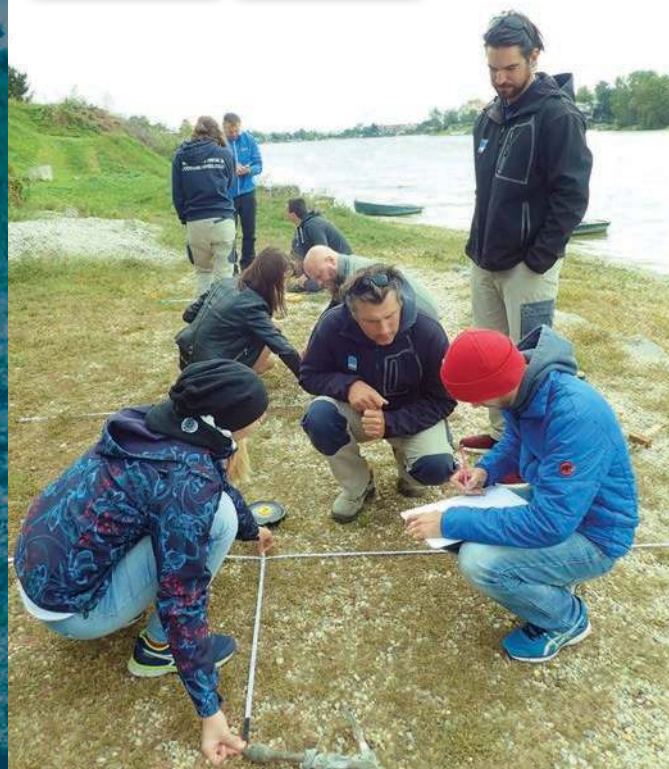
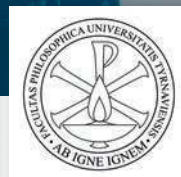
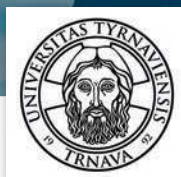
**1. Dry simulation of documentation. Maja Kaleb (ICUA) is explaining details / Tréning dokumentácie na súši. Maja Kaleb (ICUA) vysvetľuje detaily (Photo: M. Daňová)**

Slovakia is a country that, despite the density of its river network, did not have a tradition of exploring its underwater archaeological heritage until recently. The Department of Classical Archaeology in cooperation with the Institute of Archaeology of the Slovak Academy of Sciences did not systematically address this issue until 2017 (as part of the VEGA grant project "Fords, bridges, waterways and settlement patterns in Považie and Ponitrie, a pilot project for the utilization of the archaeological underwater methods in Slovakia"). Gradually there has been more and more cooperation with Croatian institutions (the University of Zadar and ICUA), which has been extremely beneficial.

In the autumn of 2019, thanks to cooperation with the International Centre for Underwater Archaeology (ICUA), the first field school focused on underwater archaeology was organized in Senec (SW Slovakia). The event lasted from the 22nd to the 28th of September 2019, and was attended by three diving archaeologists from Slovakia, the Czech Republic and Germany as well as three Slovak divers.

Slovensko je krajina, ktorá nemala napriek hustote riečnej siete až donedávna tradíciu v skúmaní archeologického dedičstva pod vodou. Katedra klasickej archeológie v spolupráci s Archeologickým ústavom SAV sa touto problematikou začali systematicky zaoberať až v roku 2017 (v rámci grantového projektu VEGA „Brody, mosty, diaľkové cesty. Dávnové komunikácie a sídla na Považí a Ponitří s využitím archeológie pod vodou. Pilotný projekt“). Postupne budovaná spolupráca s chorvátskymi

inštitúciami  
(Univerzita v



**2. Dry simulation of documentation. Luka Bekić (ICUA) is explaining details / Tréning dokumentácie na súši. Luka Bekić (ICUA) vysvetľuje detaily (Photo: M. Daňová)**





**3. Details of the documentation are crucial. Diana (diver-fireman) is improving her documenting skill on land / Správna dokumentácia je kľúčová. Diana (potápač-hasič) si osvojuje detaily dokumentácie na súši (Photo: M. Daňová)**

The first two days of the program were focused on introducing the methods of underwater surveys and research, documentation and measurement methods in this environment. The program was complemented by numerous practical exercises in a lake near Senec. The whole week was unforgettable thanks to exceptionally favorable autumn weather. Wednesday was devoted to exploring Northwest Slovakia. The participants visited Devín Castle at the confluence of the Danube and the Morava, a Bratislava Castle exposition focused on the Celtic settlement in the area and the decompression chamber at the HBO Centre. They spent the evening at the University of Trnava in Trnava (TrUni) and in the city of Trnava.

After a day without diving, the summer school participants got back into it and continued for two days with a theoretical introduction and practical exercises focusing on the geodetic aspect of research, data processing in GIS software, underwater photogrammetry basics, research organization and the possibility of publishing their own outputs. Maja Kaleb, Roko Surić and Franka Trcera (all from ICUA) led the theoretical training as well as the exercises and consultations and supplemented them with examples from their rich experience. Following this, more of these exercises took place again under the



**4. Theory lessons and lectures took part in the hotel / Teoretická príprava a prednášky prebiehali v hoteli (Photo: M. Daňová)**

Zadare, ICUA) bola mimoriadne prínosná.

Na jeseň v roku 2019 sa podarilo vďaka spolupráci s Inštitútom na ochranu kultúrneho dedičstva pod vodou (ICUA) zorganizovať v Senci (JZ Slovensko) historicky prvú terénnu školu zameranú na archeológiu pod vodou. Akcia trvala od 22. do 28. septembra 2019 a zúčastnili sa jej traja potápajúci archeológovia zo Slovenska, Čiech a Nemecka a traja slovenskí potápači.

Program prvých dvoch dní bol zameraný na predstavenie metód prieskumu a výskumu pod vodou, spôsobu dokumentácie a meraní v tomto prostredí. Doplnili ho početné praktické cvičenia v jazere pri Senci. Celý týždeň sa stal nezabudnuteľným aj vďaka mimoriadne priaznivému jesennému počasiu. Streda bola venovaná spoznávaní severozápadného Slovenska. Účastníci navštívili hrad Devín na sútoku Dunaja a Moravy,



**5. Ready for dive – Martin (diver-archaeologist, Prague) left and Anton (diver-PhD student, Bratislava) right / Pripravení na ponor - vľavo Martin (potápajúci archeológ, Praha), vpravo Anton (potápač-PhD študent, Bratislava) (Photo: M. Daňová)**





water of Sunny lakes (Slnečné jazerá, Senec, Slovakia).

**6.**  
**Martin Kvietok**  
**(archaeologist)**  
**is getting ready**  
**for the dive /**  
**Archeológ Martin**  
**Kvietok sa**  
**chystá na ponor**  
**(Photo: M. Daňová)**

The whole week's evening program was complemented by lectures dealing with various issues. Mirka Daňová (the Department of Classical Archaeology, TrUni) / Klaudia Daňová (the Institute of Archaeology of SAV) presented the Research Project of Slovak Rivers on Monday; Bára Machová (the Institute of Archaeology of the CAS, Prague) presented the case studies of river archaeology in the Czech Republic on Tuesday and Luka Bekić (ICUA) presented the examples of Roman ports and piers of Istria and Dalmatia on



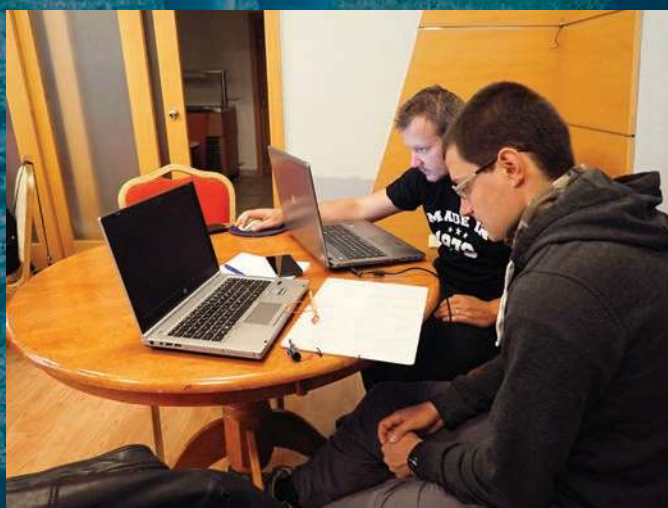
**7. Klaudia and Diana are checking the underwater measurements / Klaudia a Diana kontrolujú hodnoty namerané pod vodou (Photo: M. Daňová)**



**8. Exhibition in Bratislava castle / Expozícia Bratislavského hradu (Photo: M. Daňová)**

expozičiu Bratislavského hradu zameranú na keltské osídlenie oblasti a dekompresnú komoru Centra HBO. Podvečer strávili na pôde Trnavskej univerzity v Trnave (TrUni) a v meste Trnava. Po dni programu bez potápania sa účastníci letnej školy opäť vrátili do tempa a pokračovali dva dni teoretickým zoznámením aj praktickými cvičeniami zameranými na geodetický aspekt výskumu, spracovanie dát v GIS, základy fotogrametrie pod vodou, organizovanie výskumov a zoznámili sa s možnosťami publikovania vlastných výstupov. Teoretickú prípravu, cvičenia aj konzultácie viedli Maja Kaleb, Roko Surić a Franka Trcera (všetci ICUA), ktorí výklad doplnili o príklady svojich bohatých skúseností. Časť týchto cvičení sa opäť odohrala pod vodou Slnečných jazier.

Večerný program celého týždňa bol doplnený prednáškami



**9. Data processing by Martin and Anton / Martin a Anton spracovávajú dáta po ponore (Photo: M. Daňová)**



Thursday. Mladen Pešić (ICUA) presented the main lecture on Wednesday on research projects focused on the cultural richness of Croatian waters, not only to field school participants, but also to students of the Department of Classical Archaeology in Trnava, divers and the general public at the University of Trnava in Trnava. The program for the last evening of the field school was held by the nearby wine-growing town of Modra, which organized a wine festival that included presentations of traditional crafts.

Thanks to the field school under the professional auspices of ICUA, we managed to provide a fulfilling course for individuals and to create a space for meeting and discussion for active divers in Slovakia, the Czech Republic and Germany. The group will continue to cooperate and participate in the search, protection and exploration of cultural heritage in Central European waters.

**10. Taking  
photos for the  
photogrammetry  
model / Tréning  
fotenia pre  
fotogrametrický  
model  
(Photo: M. Daňová)**

zaoberajúcimi sa rôznorodou problematikou. Mirka Daňová (Katedra klasickej archeológie, TrUni)/Klaudia Daňová (Archeologický ústav SAV) predstavili v pondelok Projekt výskumu slovenských riek; Bára Machová (Archeologický ústav ČAV Praha) v utorok Vybrané štúdie z riečnej archeológie v Českej republike a Luka Bekić (ICUA) vo štvrtok o príklady rímskych prístavov na Istrii a v Dalmácii. Hlavná prednáška Mladena Pešića (ICUA) o výskumných projektoch zameraných na kultúrne bohatstvo chorvátskych vôd, bola prezentovaná v stredu nielen účastníkom terénnej školy, ale aj študentom Katedry klasickej archeológie v Trnave, potápačom a širokej verejnosti na pôde Trnavskej univerzity v Trnave. Program záverečného večera terénnej školy zabezpečilo neďaleké vinárske a vinohradnícke mesto Modra, ktoré usporiadalo Vinobranie spojené s prezentáciou tradičných remesiel.

Vďaka zorganizovanej terénnej škole sa podarilo pod odbornou záštitou ICUA zabezpečiť plnohodnotný kurz pre jednotlivcov a vytvoriť priestor pre stretnutie a diskusiu potápačov pôsobiacich na Slovensku, v Čechách a Nemecku. Skupina bude ďalej pokračovať v spolupráci a podieľať sa na hľadaní, ochrane a skúmaní kultúrneho dedičstva vo vodách Strednej Európy.

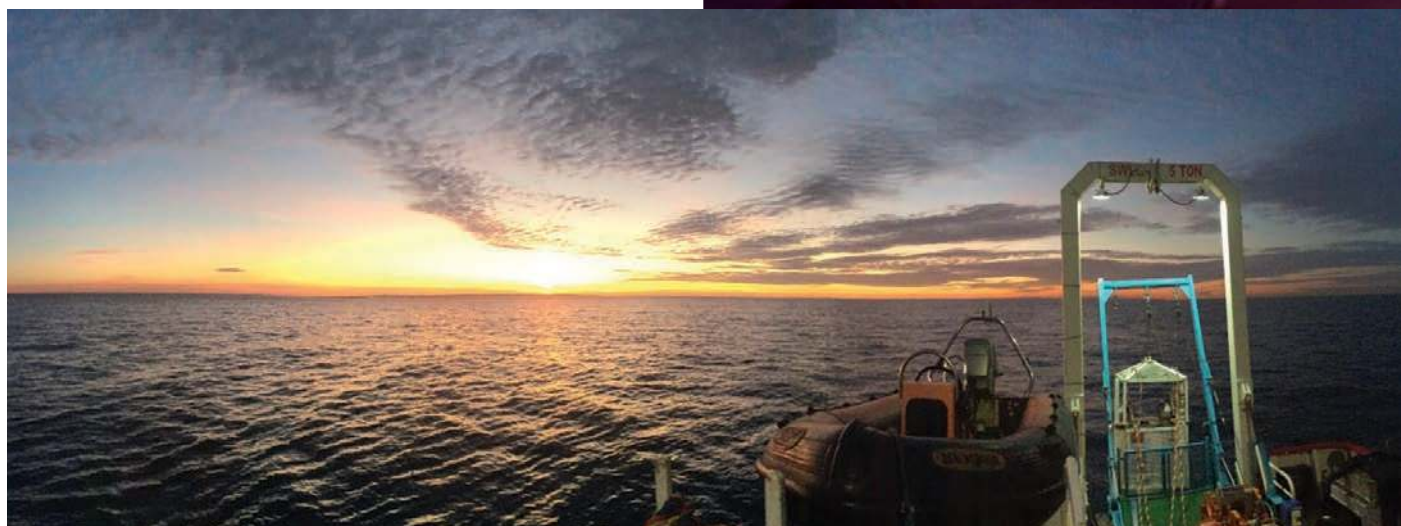




# EXCAVATION OF THE ROOSWIJK (1740)

## OPGRAVING VAN DE ROOSWIJK (1740)

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The Rooswijk was on its second voyage to Batavia in the East Indies (nowadays, Jakarta, Indonesia) when during the first night of the voyage on 9th January 1740, the ship got caught in a heavy easterly storm and ran aground on the Goodwin Sands. In the town of Deal, gun shots were heard from the ship in distress. A chest full of letters washed up on the shore of Deal, revealing the fate of the Rooswijk. None of the 237 crew members and possibly an unknown number of passengers survived the disaster. The ship was not found and the cargo was never recovered.

The wrecking of the Rooswijk meant a huge financial loss for the VOC. Archival research revealed that the Rooswijk was carrying a large cargo of silver coins and bars. It is likely that many crew members also took coinage with them on the journey. An 8 reales coin was worth 1.5 times as much in Asia as in Europe. Not only the VOC benefited from this; the crew of the ships also smuggled their own or borrowed money to Asia. This was a lucrative addition to the moderate wage they received. It is suspected that up to half of the money on board the ship was smuggled money.

VOC ships would often carry various supplies, half-products and materials. For instance, planks, masts, ropes, sails and other materials for the ships, ammunition and weapons for the weapon chambers, and bricks and roof tiles for forts,

### **1. The Rooswijk site at the Goodwin Sands / De Rooswijk site bij de Goodwin Sands ©: Cultural Heritage Agency of the Netherlands (Rijksdienst voor het Cultureel Erfgoed / Historic England.**

De Rooswijk was bezig aan haar tweede reis naar Batavia in Oost-Indië (Jakarta, Indonesië), maar al tijdens de eerste nacht van de reis op 9 januari 1740 werd het schip getroffen door een zware storm en kwam vast te zitten bij de Goodwin Sands. In Deal zijn kanonschoten gehoord van een schip in moeilijkheden. Een kist vol met brieven spoelde later aan bij de kust van Deal, wat het lot van de Rooswijk liet zien.

### **2. Thimble chest / Kist met vingerhoedjes ©: Cultural Heritage Agency of the Netherlands / Historic England.**







**3. Diver using an acoustic tracking beacon during the excavation of the wreck site / Duiker bezig met het opgraven van de Rooswijk ©: Cultural Heritage Agency of the Netherlands / Historic England.**

houses and other buildings. The ships also carried food such as butter, salt and wine, as well as clothing, paper, writing materials and even bibles. Furthermore, they had ballast on board. Archival records have not survived, so it is unknown how many supplies the Rooswijk took on its second journey to the East. From archaeological discoveries we know that thimbles, sabre blades and knives were on board, as well as copper sheets and stones that may have served as ballast.

Around the year 2000 the remains of the Rooswijk were found on the seabed by diver Ken Welling. Although the Rooswijk lies in British territorial waters, the Dutch state is considered to be the owner of the ship as they claim ownership of all VOC wrecks. In 2005, over 10,000 objects were salvaged. Rex Cowan, who had obtained a salvage permit from the Dutch state, led the salvage operation. Archaeologists from both countries expressed regret that the shipwreck was salvaged and that the archaeological value of the site was not realised. This led to a stop on issuing salvage permits in the Netherlands in 2007. In 2007, the wreck was also designated under the Protection of Wrecks Act 1973 and gained protected status. In 2016 the wreck was placed on the Heritage at Risk Register. Although the salvage permit was maintained until 2017, the designation meant that work on the Rooswijk was only possible with an appropriate license, administered by Historic England on behalf of the Department for Digital, Culture, Media and Sport.

In 2016, a survey of the wreck by the Cultural Heritage Agency of the Netherlands (RCE), in cooperation with Historic England (HE), revealed that the remains of

Niemand van de 237 bemanningsleden of mogelijke passagiers heeft de ramp overleefd. Het schip werd niet gevonden en de lading is nooit naar boven gehaald.

De schipbreuk betekende een groot financieel verlies voor de VOC. Archiefonderzoek toont aan dat er een grote lading zilveren munten en baren aan boord was. Het is aannemelijk dat de 237 bemanningsleden geld aan boord hadden. Een munt van 8 real was 1,5 keer zoveel waard in Azië dan in Europa. Dit was niet alleen aantrekkelijk voor de VOC, ook de bemanningsleden van verschillende klassen smokkelden hun eigen geleende geld mee naar Azië. Dit was een winstgevende toevoeging aan het magere salaris dat ze ontvingen. Verondersteld wordt dat tenminste de helft van het geld aan boord smokkelgeld is geweest.

VOC Schepen vervoerden veelal verschillende goederen, half-producten en materialen. Er werden onder andere vaak planken, masten, touwen en zeilen voor het schip, munitie en wapens voor de wapenkamers, stenen en

**4. Diver carefully removing sand from the wreck with a dredge / Duiker verwijdert voorzichtig zand van het wrak met een dredge ©: Cultural Heritage Agency of the Netherlands / Historic England.**





the Rooswijk were exposed and threatened by erosion as well as in danger due to the threat of illicit recovery of materials. The survey revealed that the wooden remains, cargo and ship's equipment were highly dispersed. It showed that the suspected stern of the ship was most threatened by erosion. Because of the threat to the Rooswijk, the RCE decided to develop a joint project: the first extensive archaeological investigation of a VOC vessel in collaboration with Historic England. It was decided to focus on the stern of the ship as this was the part that was suspected to provide most information about the people on board the ship. Two seasons of excavations took place in 2017 (three months) and 2018 (two months). The RCE and HE jointly undertook this project with MSDS Marine as the UK Project Managers and Diving Contractor and with the help and support of many partners from both countries including recreational divers, former salvage divers, archaeologists, historians, material specialists, heritage managers, students and the public.

**6. A collection of the different coins that were found in the wreck of the Rooswijk / Een collectie van de verschillende munten die werden aangetroffen in het wrak van de Rooswijk ©: Cultural Heritage Agency of the Netherlands / Historic England.**



**5. Lead container for storing food / Loden container voor het bewaren van eten ©: Cultural Heritage Agency of the Netherlands / Historic England.**

dakpannen voor forten, huizen en andere gebouwen meegenomen. De schepen vervoerden daarnaast ook goederen zoals boter, zout, wijn, papier, schrijfmateriaal en bijbels.

En de schepen hadden ballast aan boord.

Archiefmateriaal die de lading van het schip beschrijft is er niet meer, waardoor niet bekend is wat de Rooswijk vervoerde.

Uit archeologische bron weten we dat er vingerhoedjes, sabels en messen aan boord waren, evenals metalen platen en stenen, die waarschijnlijk als ballast hebben gediend.

Rond 2000 zijn de overblijfselen van de Rooswijk teruggevonden door duiker Ken Welling. Ondanks dat het wrak zich in Britse territoriale wateren bevindt, wordt Nederland als eigenaar beschouwd aangezien zij staatseigendom claimt van alle VOC-wrakken. In 2005 zijn meer dan 10.000 objecten gelicht. Rex Cowan, die een bergingsvergunning had verkregen van de Nederlandse staat, leidde de berging. Archeologen uit beide landen betreuren dat het wrak deels is geborgen en dat daarbij de unieke informatiewaarde van de site niet leidend was. Dit leidde ertoe dat in 2007 in Nederland werd gestopt met het verlenen van bergingsvergunningen. In hetzelfde jaar werd de Rooswijk ook aangewezen als beschermd wrak





7.  
*Selection of the glass  
 bottles / Selectie van  
 glazen flessen*  
 ©: Cultural Heritage  
 Agency  
 of the Netherlands /  
 Historic England.

The International Institute of Social History was commissioned by the RCE to examine Dutch and English archives. So far, the names of 19 crewmembers have been identified, including the skipper Daniel Ronsieres. These names were mentioned in old notarial and VOC archives and in genealogical sources.

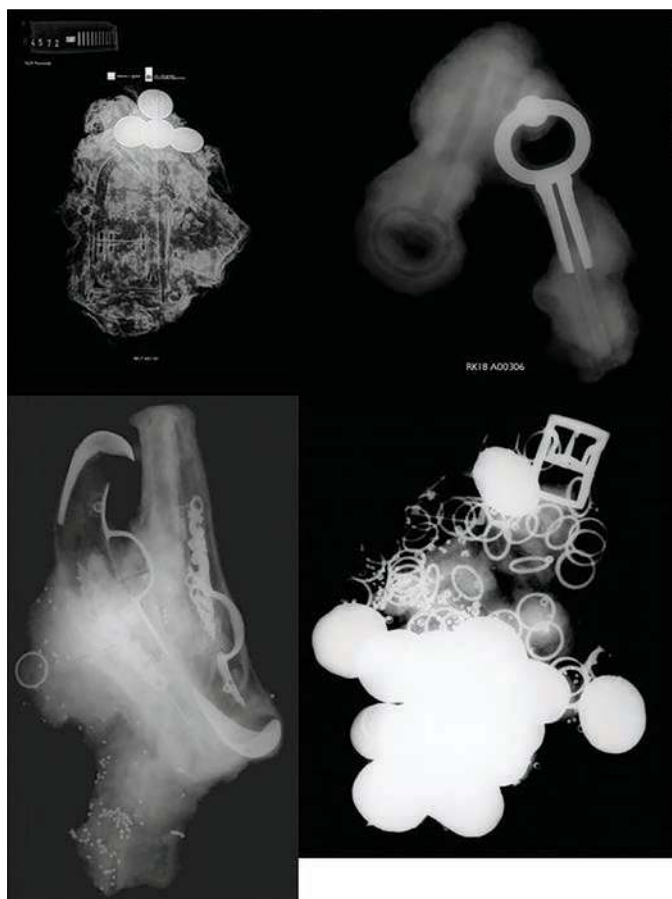
Most names of crew members of the Rooswijk can be found in the archives because of the practise of smuggling money. The money often came from other private individuals or banks who put the loans on paper at the notary. Some passengers, often senior officers, had

onder de Protection of Wrecks Act 1973. In 2016 werd het wrak op de lijst van Heritage at Risk Register gezet. De aanwijzing van de Rooswijk als beschermd wrak maakte het onmogelijk om zonder door Historic England goedgekeurde licentie op de Rooswijk te duiken ondanks het feit dat de bergingsvergunning nog geldig was tot en met 2017.

In 2016 bleek tijdens een inspecterend onderzoek van de Rijksdienst voor het Cultureel Erfgoed (RCE) en Historic England (HE), dat grote delen van het wrak van de Rooswijk uit het zand staken. Hierdoor werden de wrakdelen blootgesteld aan erosie en illegale bergingen. Het onderzoek toonde verder aan dat de houtresten, lading en de scheepsuitrusting wijdverspreid lagen. Multibeam sonar toonde aan dat de vermoedelijke achterstevan het meest aan erosie werd blootgesteld. Door deze bedreiging besloot de RCE om een gezamenlijk project op te zetten met HE en MSDS Marine als aannemer, om het VOC- schip te onderzoeken. Op basis van de multibeambeelden werd besloten om de focus op het achterstevan te leggen. Verwacht werd dat daar de meeste informatie over de mensen aan boord te vinden zou zijn. De opgravingen vonden plaats in 2017 (3 maanden) en in 2018 (2 maanden). Uit beide landen hebben diverse partners bijgedragen aan de opgraving van de Rooswijk, waaronder sportduikers, voormalige bergingsduikers, archeologen, historici, materiaalspecialisten, erfgoedmanagers, studenten en het publiek.

Het Internationaal Instituut voor Sociale Geschiedenis heeft de Nederlandse en Engelse archieven doorzocht. Daarbij zijn tot dusver de namen van 19 bemanningsleden

8. Lock (top left), key void (top right) pistols (bottom left), rings, belt buckle and coins (bottom right) / Te zien op de röntgenfoto's is een slot (linksboven), de afdruk van een sleutel (rechtsboven) en de pistolen (linksonder). Rechtsonder is een concretie met ringen, een riemgesp en meerdere munten zichtbaar ©: Cultural Heritage Agency of the Netherlands / Historic England.





a lot of money with them. They borrowed large amounts before departure, up to 17,000 guilders. The lowest amount found so far was 30 guilders, borrowed by a sailor. Not all of this money was for smuggling. The lower ranks also used the borrowed money to pay off debts or to buy goods for private trade in India before leaving.

Maritime archaeologists dived to 26 meters depth to expose parts of the wreck, to record and photograph objects and traces of the ship and its crew. They excavated over 2000 artefacts which are now being conserved. During the conservation the team are making new discoveries every day: shoes with special wooden insoles to provide protection from the cold, lead packaging material to store food, the use of buckwheat for the packing of materials, makers marks on knife blades and tiny glass beads encased in dense concretions.

In the stern of the ship clear concentrations of coins were found. Several of these coins are perforated. It is suspected that these holes were made to sew the coins into clothes, probably to hide them from their fellow sailors. In the different currency groups, smuggled money, official money and private money seem clearly recognisable.

A large amount of glass onion bottles were also found. Two bottles have survived with the cork still intact, meaning that its contents can potentially be sampled and analysed. The presence of substantial stone blocks could indicate that the Rooswijk carried prefabricated architecture. The presence of musket balls and even musket plates bearing the VOC emblem show the presence of soldiers travelling alongside the passengers and crew. The soldiers were below decks, and they would have been trapped when the Rooswijk wrecked. Human remains were also found on the seabed.

**9. Kim Roche and Nicole Schoute working on the conservation assessment / Kim Roche en Nicole Schoute bezig met de conservering ©: Cultural Heritage Agency of the Netherlands / Historic England.**



gevonden, waaronder die van de kapitein Daniël Ronsieres. Deze namen zijn teruggevonden in oude notariële stukken, VOC-archieven en genealogische bronnen.

De meeste namen van de bemanning van de Rooswijk werden gevonden vanwege een speciale reden: gesmokkeld geld. Het geld werd vaak geleend van privé investeerders en banken die de leningen op papier lieten zetten door notarissen. Sommige passagiers, met name senior officieren, hadden veel geld bij zich. Zij leenden grote bedragen, tot wel 17.000 gulden voor vertrek. Het laagste bedrag dat tot dusver is gevonden was 30 gulden, van een matroos. Niet al dit geld was smokkelgeld. De lagere klassen gebruikten het geleende geld ook om schulden af te lossen of om goederen te kopen voor privéhandel in India.

Maritiem archeologen doken naar 26 meter diepte om onderdelen van het wrak bloot te leggen en om objecten en sporen te documenteren. De artefacten werden naar het oppervlak gebracht en tot de conservering in water bewaard. Meer dan 2000 artefacten zijn gelicht en worden nu geconserveerd. Tijdens de conservering worden vele nieuwe ontdekkingen gedaan: schoenen hebben een speciale houten inleg tegen de kou, er waren loden containers aan boord die dienden om eten in te bewaren voor een lange tijd, het gebruik van boekweit als verpakkingsmateriaal, merken op lemmetten van messen en kleine glazen kralen binnenin de concreties.

In het achtersteven zijn verschillende concentraties munten gevonden. Enkele van deze munten zijn geperforeerd. Aangenomen wordt dat deze gaatjes zijn gemaakt om de munten in de kleding te kunnen naaien om ze zo voor mede-bemanningsleden te verbergen. In de verschillende valutagroepen is een duidelijk verschil te zien tussen officieel, smokkel- en privégeld.

Er is een grote hoeveelheid glazen uienflessen aangetroffen. Bij twee flessen is de kurk nog aanwezig, wat betekent dat de inhoud mogelijk kan worden bemonsterd en geanalyseerd. De stenen blokken kunnen een indicatie zijn van bouwmaterialen. Muskietkogels en musketplaten met het VOC-logo bevestigen de aanwezigheid van soldaten. De soldaten verbleven benedendeks en zullen daar waarschijnlijk hebben vastgezeten toen het wrak zonk. Er zijn menselijke botten teruggevonden op de zeebodem. Verder zijn ook metalen platen, koperen potten en pannen aangetroffen.

Na twee seizoenen van opgravingen zijn alle objecten vervoerd naar het conserveringslab in Fort Cumberland in Portsmouth waar ze worden geanalyseerd en geconserveerd. Alle artefacten worden ontzout voordat met het conserveringsproces wordt gestart. Voorafgaand





Following both seasons of excavations, all of the objects were transported to the Historic England conservation facilities at Fort Cumberland in Portsmouth to be assessed and conserved. During this phase, all the artefacts will be desalinated prior to their individual conservation treatment. Before the treatment of the concretions starts, x-rays are taken to determine the contents. Cannonballs, musket balls, coins, glass beads, pewter jugs, spoons, buckles, a lock, a key and two pistols have been found inside different concretions. A great variety of specialists are now assessing the material in order to answer the original and new research questions.

The conservation treatment of the coins is almost complete. After desalination, the coins were air dried. Some of them were mechanically cleaned as well, as they had some concretion and corrosion products obscuring the surface. Ceramics and glass have finished conservation as well. All other artefacts are still in the desalination process, but will be actively conserved in the near future. This will include de-concreting and removing of corrosion layers, as well as stabilising artefacts.

MSDS Marine developed a virtual dive trail for the Rooswijk, which is available in both Dutch and English. This dive trail offers a unique glimpse into the wreck. Everyone, divers and non-divers can see the wreck in high detail and can get background information, specialist interviews, artefact information and pictures, films and 3d models. It can be found at: [Cloudtour.tv/rooswijk](http://Cloudtour.tv/rooswijk).

#### **10. Part of the Virtual Dive Trail / Deel van de Virtual Dive Trail ©: Cultural Heritage Agency of the Netherlands / Historic England.**

aan de conservering van de concreties worden eerst röntgenfoto's gemaakt om te achterhalen wat er binnenin zit. Er zijn kanonskogels, musketkogels, munten, glazen en koperen kralen, tinnen kannen en lepels, gespen, een slot, een sleutel en twee pistolen aangetroffen. Verschillende materiaalspecialisten onderzoeken de artefacten om antwoorden op de originele onderzoeksvragen te vinden of om nieuwe vragen te stellen.

De conserveringsbehandeling van de munten is bijna klaar. Na het ontzouten zijn de munten gedroogd. Keramiek en glas zijn ook geconserveerd. Alle andere vondsten bevinden zich nog in het ontzoutingsproces, maar worden nu actief geconserveerd. Dit houdt in dat ze worden ontdaan van de concrementie, dat de corrosielagen worden verwijderd en dat ze worden gestabiliseerd.

MSDS Marine heeft een virtual dive trail geproduceerd voor de Rooswijk, die beschikbaar is in zowel Nederlands als Engels. Deze dive trail geeft een uniek kijkje van de binnenkant van het wrak. Iedereen kan het wrak in hoge kwaliteit bekijken. Daarnaast wordt er achtergrondinformatie verstrekt, evenals interviews met specialisten, informatie, foto's, films en 3d modellen over artefacten en nog veel meer. De dive trail kan worden gevonden op: [Cloudtour.tv/rooswijk](http://Cloudtour.tv/rooswijk)

De voortgang van het #rooswijk1740 project kan worden gevolgd op Twitter, Facebook en op [Maritime-Heritage.com](http://Maritime-Heritage.com).

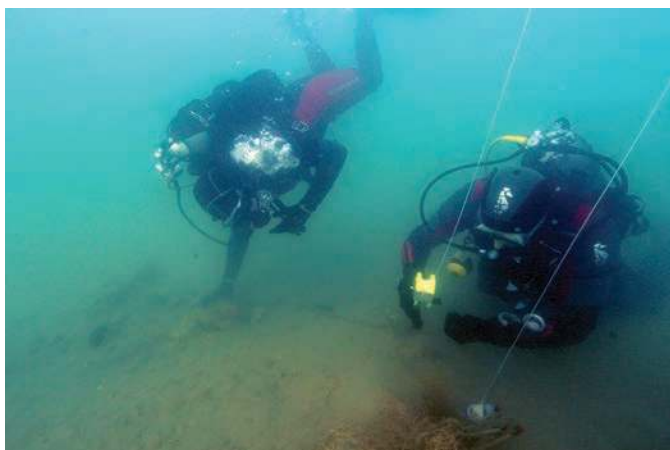
The progress of the #rooswijk1740 project can be followed on Twitter, Facebook and on [mass.cultureelerfgoed.nl](http://mass.cultureelerfgoed.nl)



# UNDERWATER ARCHAEOLOGICAL INVESTIGATION AT NIN

## POD Vodna ARHEOLOŠKA ISTRAŽIVANJA U NINU

Roko Surić rsuric@icua.hr



**1. Survey of the seabed in the bay facing Nin / Pregled morskog dna u Ninskom zaljevu (Photo: R. Surić)**

The history of Nin tells one of the more fascinating Croatian stories. Of particular interest is the early Croatian period, when Nin assumes the role of one of the seats of power in the early Croatian state. Back in the 1960s the waters off Nin at the mouth of the lagoon were the site of the remarkable discovery of the remains of two *condura* type boats, the famed *Condura Croatica*, dated to the twelfth century. To this day this is, without parallel, the most significant discovery related to maritime navigation in the early Croatian period. It

Povijest grada Nina među zanimljivijima je na prostoru Hrvatske. Posebno je značajan starohrvatski period, kada Nin postaje jedno od najznačajnijih središta starohrvatske države. U podmorju Nina, na ulazu u ninsku lagunu još 60-ih godina 20. st otkriveni su ostaci dviju brodica kondura (*Condura Croatia*), koje se datiraju u 12. st. Pokazalo se da su do današnjeg dana ti nalazi, bez premca, najznačajnija otkrića vezana uz plovidbu u starohrvatskom razdoblju. Vodeći se tom spoznajom, odlučeno je ponovno aktualizirati istraživanja na ninskom prostoru.



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### 2.

***The seabed to the northeast side of the Ždrijac peninsula near Nin with indicated archaeological site positions / Podmorje sjeveroistočne strane poluotoka Ždrijaca u Ninu s označenom pozicijom arheološkog lokaliteta (By: P. Stencel)***

Međunarodni centar za podvodnu arheologiju u Zadru proveo je u razdoblju od 14. listopada do 18. listopada 2019. godine podmorsko arheološko istraživanje na području Ninskog zaljeva i ulaza u ninsku lagunu. Uz djelatnike MCPA na istraživanju su sudjelovali i kolege iz poljskog Centra za podvodnu arheologiju, Sveučilišta Nikola Kopernik iz Toruna.







3.  
*Ždrijac site archaeological finds / Pregled  
arheoloških nalaza na  
lokalitetu Ždrijac  
(Photo: R. Surić)*

was with this in mind that we have revived the investigation of the area around Nin.

In the period from 14th to 18th October the International Centre for Underwater Archaeology in Zadar undertook an underwater archaeological investigation in the bay facing Nin and at the entrance to the lagoon around Nin. Joining ICUA staff in this investigation were colleagues from the Centre for Underwater Archaeology of the Nicolaus Copernicus University's Institute of Archaeology in Toruń, Poland.

The archaeological investigation in this area was divided into two parts: the bay facing Nin along the Ždrijac peninsula, and the entrance to the Nin lagoon. Based on the data provided by previous archaeological investigation and reports we could expect cultural remains in both areas<sup>1</sup>.

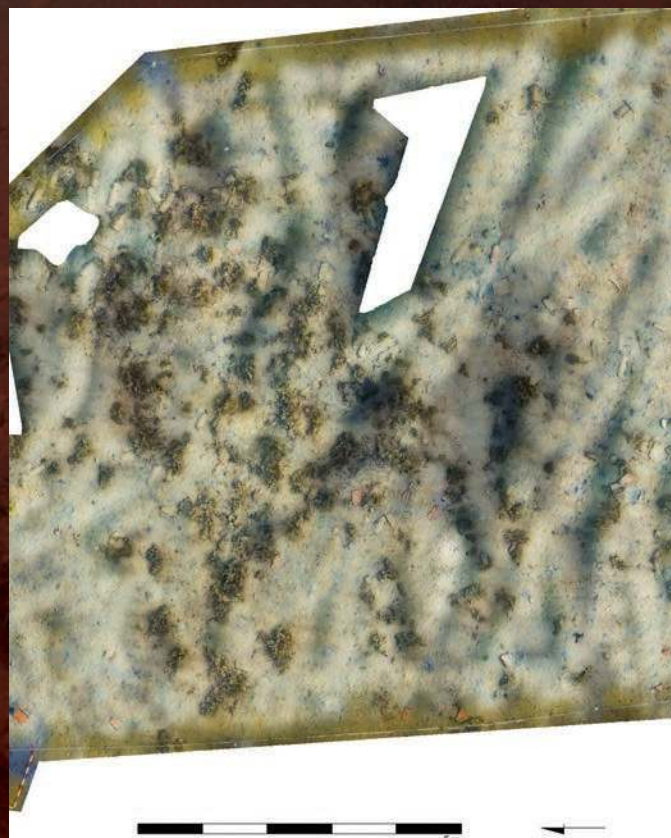
The first area is encompassed by Nin Bay where, near the Ždrijac peninsula, the late professor Z. Brusić discovered in the 1960s an archaeological site characterised by a large quantity of roof tiles including both tegulae<sup>2</sup> and imbrices<sup>3</sup>. While examining the site he also discovered a conglomerate of metal artefacts and amphorae sherds.<sup>4</sup> A survey of the terrain was planned on the basis of the site data provided by Brusić. The survey was handicapped by the surprisingly poor visibility caused by murky water flowing into the sea from the nearby mouth of the Jaruga

Arheološko istraživanje na predmetnom području podijeljeno je na dvije cjeline: ninski zaljev uz poluotok Ždrijac i ulaz u ninsku lagunu. Na osnovu prijašnjih arheoloških istraživanja i izvješća moglo se pretpostaviti da se na oba prostora nalaze tragovi arheoloških lokaliteta<sup>1</sup>.

Prva cjelina je prostor Ninskog zaljeva na kojem je u blizini poluotoka Ždrijac još 60-ih godina prošlog stoljeća pokojni prof. Z. Brusić otkrio arheološki lokalitet koji karakterizira velika količina ulomaka krovnog crijeva tegula<sup>2</sup> i imbreksa<sup>3</sup>, a prilikom pregleda otkrio je konglomerat metalnih predmeta te ulomke amfora.<sup>4</sup>

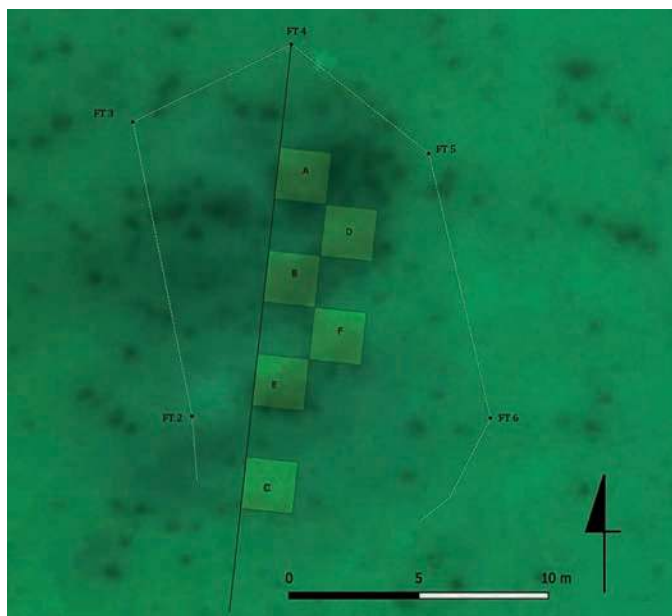
Vodeći se podacima o lokaciji koje donosi profesor Brusić isplaniran je pregled terena. Pregled je otežavala iznenađujuće loša vidljivost, koju uzrokuje mutna voda koja se u more ulijeva iz obližnjeg ušća potoka Jaruge. Arheološki ostaci ulomaka krovnog crijeva pronađeni su na morskom dnu na prostoru površine oko 150 m<sup>2</sup>.

Prije početka iskopavanja na prostoru lokaliteta napravljeno je fotogrametrijsko snimanje, a na šest pozicija uz rub lokaliteta postavljene su fiksne točke. Arheološke sonde dimenzija 2 x 2 m postavljene su na prostor hrpe s ulomcima crijeva. Svi nalazi izvađeni su na brod, a potom su dokumentirani, izvagani i definirani te su se dobiveni podaci unosili u specijalne tablice kako bi se po završetku istraživanja dobila šira slika o samom lokalitetu te karakteru i količini nalaza. Dio nalaza koji nije



4. *Orthophoto model of the central site area / Ortofoto model centralnog dijela nalazišta (By: P. Stencel)*





**5. Orthophoto model of the site with indicated trenches and datum points / Ortofoto model nalazišta s označenim sondama i fiksnim točkama (By: P. Stencil)**

Creek. Roof tile fragments were found on the seabed over an area of about 150 square metres.

Excavation work was preceded by photogrammetry imaging of the area, with datum points set at six positions along the perimeter of the site. Two by two metre trenches were dug in the area at which roof tile fragments were concentrated in a heap. All recovered artefacts were brought up to our boat and then documented, weighed and identified, with the obtained data entered into tables. Upon completion of the investigation this provides us with a broader picture of the site and of the types and quantities of recovered artefacts. Once documentation on board our boat was done all artefacts that were not critical to further analysis were first bagged and then emptied/deposited at the site with the objective of re-creating, post-investigation, the visual appearance of the seabed site.

The effort saw six trenches excavated (A, B, C, D, E and F), with excavation assisted by dredges. The investigation documented a total of 244 artefact finds, most of which are fragments of imbrices, and a smaller number of tegulae fragments. Most of the other recovered artefacts are corroded iron nails.

The recovered tegulae differ from the classic tegula of the Roman period and most likely are of early medieval provenance, when the tegulae and imbrices in use were of smaller dimensions.<sup>5</sup> Corrosion process had caused iron nails to fuse with many of the tegula and imbrex fragments. Numerous recoveries of individual corroded iron nails were also made in the trenches. Finds of this kind may indicate the cargo of a sunken vessel. If that

ključan za daljnju analizu je nakon dokumentiranja na brodu spreman u vreće i potom deponiran pored lokaliteta, kako bi se po završetku istraživanja na morskom dnu ponovno stvorio vizualno atraktivan lokalitet.

Istraženo je 6 arheoloških sondi (A, B, C, D, E i F), a iskopavanja su vršena pomoću mamut sisaljki. Istraživanjem su ukupno dokumentirana 244 nalaza, od kojih većina pripada ulomcima imbreksa, a manji dio pripada ulomcima tegula. Od ostalih nalaza većina se može okarakterizirati kao korodirani željezni čavli.

Pronađene tegule razlikuju se od klasičnih tegula iz rimskog perioda i najvjerojatnije pripadaju ranosrednjovjekovnom razdoblju kad se koriste tegule i imbreksi manjih dimenzija.<sup>5</sup> Na velikom broju ulomaka tegula i imbreksa ostale su uslijed procesa korodiranja „slijepljeni“ željezni čavli. Isto tako su u sondama pronađeni i brojni pojedinačni nalazi korodiranih željeznih čavala. Ovakav tip nalaza može indicirati da se radi o teretu potonulog broda. U tom slučaju čavli su mogli zajedno s ostalim teretom pripadati teretu broda, no ostaje mogućnost da su služili kao dio brodske konstrukcije koja je s vremenom mogla nestati s ovakvog lokaliteta zbog osjetljivosti organskog materijala na propadanje u moru. Ovogodišnjim istraživanjem na prostoru 6 sondi nisu pronađeni arheološki nalazi koji bi se pomoću tipološke analize mogli datirati u uži vremenski okvir. Ostaje nada da će se budućim istraživanjem pronaći takav nalaz koji bi pomogao u dataciji lokaliteta.

Drugi dio ovogodišnjih istraživanja bazirao se na prostor ulaza u ninsku lagunu. Na ovoj lokaciji 60-ih i 70-ih godina 20. st. istraživani su ostaci drvenih konstrukcija starohrvatskih brodica kondura (*Condura Croatica*). Ovogodišnje istraživanje je započeto na način da je pregledano morsko dno na prostoru prolaza iz Ninskog zaljeva u ninsku lagunu, a na taj način uočeno je nekoliko lokacija s arheološkim nalazima. Prva zanimljiva pozicija otkrivena je uz današnji istočni profil kanala koji vodi u ninsku lagunu. Na tom prostoru uočeni su vrhovi 15 drvenih pilona, odnosno oblihi trupaca zabijenih u pješčano

**6. Documenting finds on board the boat / Dokumentiranje nalaza na brodu (Photo: R. Surić)**







**7. Some of the roof tiles recovered from Trench C. A corroded nail has fused with the tegula fragment in the upper right corner / Dio nalaza krovnog crijepa iz sonde C. Na ulomku tegule u gornjem desnom uglu ostao je slijepljeni korodirani čavao (Photo: J. Jarosz)**

is the case the nails and other finds would be from the cargo of a ship, but there is also the possibility that the nails were from a ship's structure that decayed away over time as the organic material was impacted by marine activity at the site. This year's investigation, covering the excavation of six trenches, did not yield the recovery of cultural remains that could provide a narrower dating frame through typological analysis. We can only hope that future investigation will yield finds that could assist in dating the site.

The second part of this year's campaign centred around the entrance to the Nin lagoon. It was here that investigation in the 1960s and 1970s saw the discovery of remains of the early Croatian *condura* type boats

morsko dno. Na poziciji na kojoj se nalazi njihova najveća koncentracija postavljena je arheološka sonda A. Osim drvenih pilona iskopavanjem nisu uočeni drugi arheološki nalazi. Pet drvenih pilona je dokumentirano a potom i izvađeno, kako bi se mogli detaljnije dokumentirati i kako bi se na njima provele analize. Na osnovu rezultata analiza moći će se donijeti zaključak da li su piloni bili u funkciji blokade ulaza u ninsku lagunu.

Druga pozicija otkrivena je 20-ak m južno od prve. Na vrhu profila, otkrivena je drvena daska koja viri iz današnjeg morskog dna. Pošto je otkrivena na prostoru na kojem se zbog otkrića prije spomenutih brodskih konstrukcija svaki takav nalaz mora tretirati kao potencijalno arheološki vrijedan nalaz. Iz tog je razloga na prostoru otkrića postavljena sonda B, dimenzija 2x2 m.

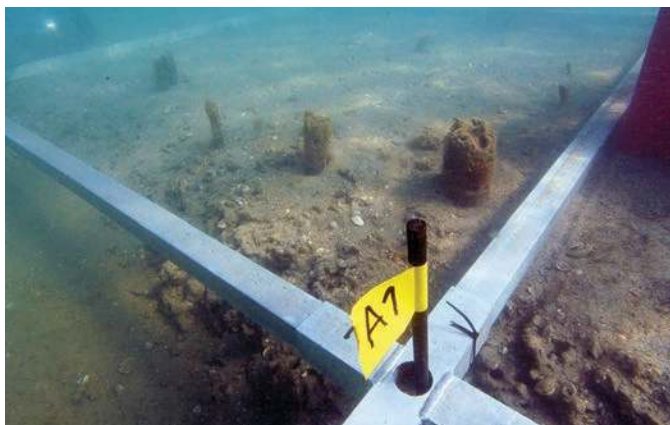
Jedan kraj daske je ravan i po svemu sudeći odlomljen u recentnije vrijeme, dok je kraj koji je bio zabijen u sediment pravilno zaobljen. Zbog takvog izgleda nametnuo se zaključak kako se možda radi o vrhu drvenog vesla koji je ostao zabijen u morsko dno. Ninsko područje poznato je po tradicionalnim brodicama tzv. „batele“ koje karakterizira ravno dno što im omogućuje da se lako mogu prevući preko plitkog pješčanog spruda. S obzirom da su kondure također dizajnirane za savladavanje plitkih mora moguće je da su se u prošlosti koristile slične metode prevlačenja preko plitkog pješčanog spruda, pa se veslaču prilikom odgurivanja brodice od morskog dna vrh vesla odlomio i ostao zaglavljen u sedimentu.

Treća pozicija nalazi se nešto južnije u odnosu na prve dvije pozicije. Pregledom ovog prostora otkrivena je četvrtasta drvena greda koja izvire iz morskog dna. Ove godine se na toj poziciji nije iskopavalo, već je uzet dio



**8.**  
**An aerial image of the investigation area at the entrance to the Nin lagoon / Zračni snimak istraživanja na prostoru ulaza u ninsku lagunu (Photo: ICUA archives)**





**9. The tops of wooden piles in Trench A / Vrhovi drvenih pilona u sondi A (Photo: R. Surić)**

(*Condura Croatica*). This year's investigation began with a survey of the seabed in the area where the bay facing Nin transitions into the lagoon, in the course of which we observed a number of archaeological find locations. The first position of interest was identified adjacent to the present-day eastern profile of the canal that leads into the lagoon. Here we observed the tops of fifteen wooden piles, round logs rammed into the sandy seabed. Trench A was opened at the position of their greatest concentration. The excavation identified no finds other than the wooden piles. Five wooden piles were documented and extracted for more detailed documentation and analysis. The analysis, when completed, will tell us whether these piles served to block access to the lagoon around Nin.

A second site was identified some twenty metres to the south of the first position. A wooden board was discovered protruding from the present-day seabed at the top of a profile. Given that it was identified in the area of the *condura* discoveries, any such find must be treated as potentially archaeologically significant. Trench B, measuring two by two metres, was thus excavated here.

One end of the board terminates perpendicular to its length and appears to have been broken off in a recent period, while the end stuck in the sediment is uniformly rounded. This appearance could indicate the end of a wooden oar that was lost, stuck in the seabed. The area around Nin is known for the traditional *batela* type boat, characterised by a flat bottom that allows it to be easily drawn over shallow sandbanks. Given that the *condura* type boats were also designed with the ability to overcome shallow waters in mind, it is possible that similar methods were used in the past to cross sandbanks, where the tip of a rower's oar may have broken off and remained jammed in the sediment when pushing the boat off the shallow seabed.

The third position is further south from the first two positions. The survey of this area revealed a squared wooden post protruding from the seabed. No excavation



**10. An orthophoto model of Trench A with piles indicated / Ortofoto model Sonde A s označenim pilonima (By: P. Stencel)**

grede kao uzorak za analizu radioaktivnog ugljika.

Značajno je da su se istraživanju priključili podvodni arheolozi iz poljskog Centra za podvodnu arheologiju, Sveučilišta Nikola Kopernik iz Toruna. Svojim dolaskom pomogli su prilikom pregleda u mutnom moru, a upravo su poljski kolege prvi uočili ostatke lokaliteta s krovim crijepom na lokalitetu Ždrijac. Koristilo je i njihovo iskustvo u iskopavanju i dokumentiranju lokaliteta s drvenim pilonima. Nastavak suradnje s kolegama iz poljskog Centra za podvodnu arheologiju planiran je već za iduću kampanju.

Ovogodišnja istraživanja ponovno su aktualizirala podvodna arheološka istraživanja na prostoru uz grad Nin. Istraživanja se planiraju provesti i iduće godine, kako bi se upotpunila priča o bogatoj povijesti ninskog prostora.

**11. The wooden board in Trench B / Drvena daska u sondi B (Photo: R. Surić)**







12. The Nin investigation field crew; left to right: / Ekipa istraživača ninskih lokaliteta; s lijeva: Filip Nal-aksowski, Michal Gliszczyński, Andrzej Pydyn, Alicja Bieniek, Roko Surić, Kamila Kociszewska, Pawel Stencel, Mciej Rząd, Jan Jarosz and Luka Bekić.

was performed here this year, with only a sample of the wood taken for radiocarbon dating analysis.

Significant to this investigation effort was the participation of underwater archaeologists from the underwater archaeology centre of Poland's Nicolaus Copernicus University in Toruń. They assisted in the survey performed in the less than ideal conditions of murky water, and it was our Polish colleagues that first identified the roof tile site off Ždrijac. The team availed itself of their experience in the excavation and documentation of wooden pile sites. Continued collaboration with our colleagues from the Polish Centre for Underwater Archaeology is planned for the following campaign.

This year's efforts have revived underwater archaeological investigation in the Nin area. We plan to continue these efforts in the coming years with the aim of broadening our knowledge of the rich history of Nin and its neighbourhood.

<sup>1</sup> Brusić 1972; Brusić 1978; Brusić 2010.

<sup>2</sup> A flat fired clay roof tile with raised edges on both lengthwise sides. / Keramički crijep ravne površine s uzdignutim rubom na dvije paralelne uzdužne strane.

<sup>3</sup> A convex fired clay roof tile usually used in combination with tegulae to cover the joints formed between adjacent tegulae. / Konveksni keramički crijep koji se najčešće koristio u kombinaciji s tegulama, a služio je za poklapanje spoja dvije tegule.

<sup>4</sup> Brusić 2010.

<sup>5</sup> Koskinas 2011.

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# FINALLY SOLVED: THE MYSTERIOUS SINKING OF THE GERMAN U-BOAT S.M. UC 71 OF HELIGOLAND IN 1919

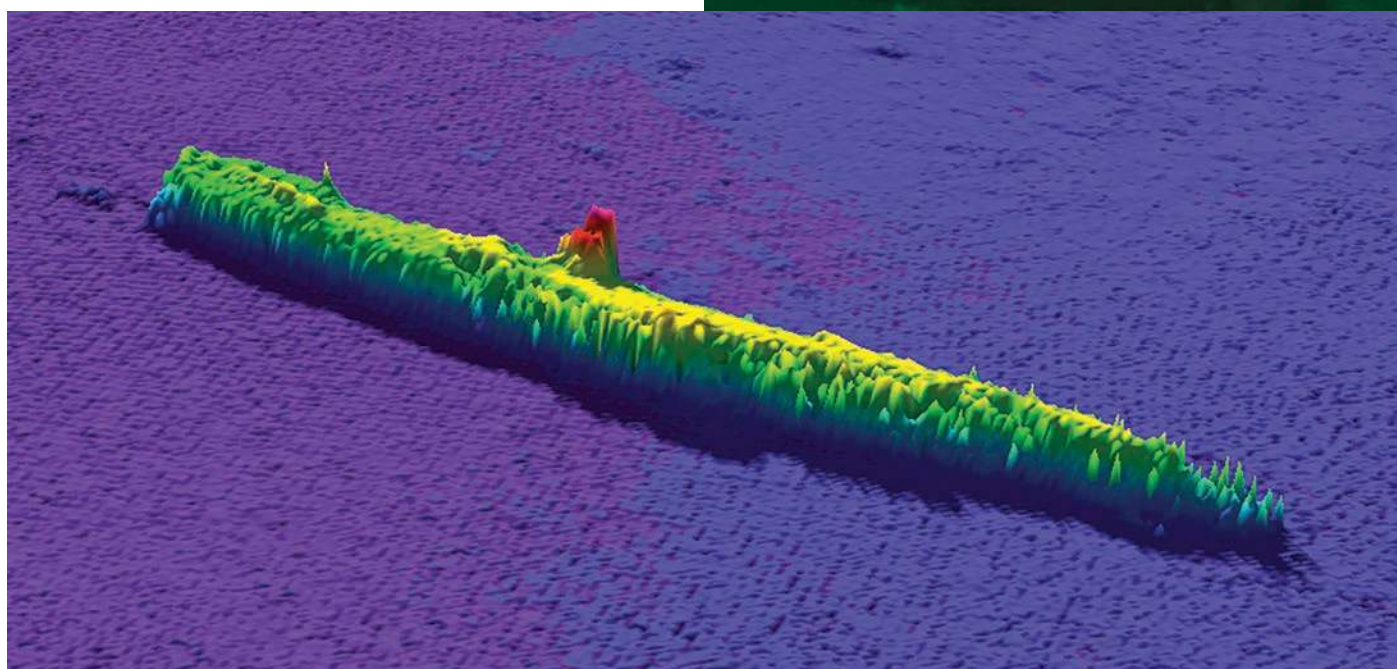
## ENDLICH GEKLÄRT: DER MYSTERIÖSE UNTERGANG DES DEUTSCHEN U-BOOTS UC 71 VOR HELGOLAND 1919

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Up to the end of the war, UC 71 carried out a total of 19 enemy patrols under five commanders, while sinking 61 civilian ships, including the well-known English U-boat trap HMS Dunraven. After the German capitulation, the ship was to be delivered to the Allies. During transit to England it sank on 20th February, 1919, immediately adjacent to the southern entrance to the North Sea island of Heligoland. In a telegram sent by the captain dated 26th February, the bad weather and high waves were the cause of the sinking. Due to its extraordinary fate and its special construction, the U-boat is of particular importance for military, naval, scientific and technical reasons. At the request of the author, it was declared a protected monument by the Schleswig-Holstein Archaeological Office in 2012.

UC 71 wurde während des Ersten Weltkrieges von der Kaiserlichen Marine unter anderem in der Nordsee, im Englischen Kanal und im Golf von Biskaya eingesetzt. Bis Kriegsende führte das U-Boot unter fünf Kommandanten insgesamt 19 Feindfahrten durch und versenkte währenddessen 61 zivile Schiffe. Nach der deutschen Kapitulation sollte das U-Boot an die Alliierten ausgeliefert werden. Bei der Überführungsfahrt nach England sank es 1919 unmittelbar neben der südlichen Einfahrt vor der Nordseeinsel Helgoland. In einem Brieftelegramm des Kommandanten vom 26. Februar gibt dieser schlechtem

**1. Multibeam picture showing the intact UC 71 in 20 meters depth / Multibeamaufnahme zeigt die intakte UC 71 in etwa 20 Meter Tiefe**  
(Photo: Jacobs University Bremen)







**2. Historical postcards of UC 71: the 53m long U-boat had a crew of 26 and could dive to 50 metres / Historische Postkarte von UC 71: das 53 Meter lange U-Boot hatte 26 Mann Besatzung und konnte bis 50 Meter Tiefe tauchen (Photo: Foto D. Wilhelmshaven)**

The identification of the wreck of UC 71 was successful in 2001 due to a private initiative, in collaboration with the Alfred Wegener Institute (AWI). An initial inventory of the wreck was also performed at the time. In July 2014, an extensive photo and video documentation was carried out by Submaris, a research diving company, to record the state of conservation. The remaining thickness of the outer and pressure hull was determined using an ultrasonic thickness gauge. The residual strength in the bow area was, for example, only 4.3 millimetres at some points. Originally, this was 11 millimetres thick. Overall, however, the wreck is still extremely well preserved. One reason for this is its location within a nature reserve in which diving and fishing are prohibited.

The underwater archaeological investigations also revealed that the submarine was obviously scuttled. During the first dives in 2001, it was possible to establish that only the tower hatch was tightly locked, the remaining two hatches on the upper deck were open. In 2014, all the doors and bulkheads were found open during documentation of the ship's interior. The telegram of 26th February, on the other hand, says that all the hatches and bulkheads had been closed. This clearly shows that this was a deliberate scuttling, which was to be hushed up on the pretext of bad weather. The diary of Georg Trinks, which appeared just recently, confirms the scuttling. Trinks was the 4th engineer on board the ship and reports impressive and very personal about daily life on board of UC 71. His diary end with the important sentence: "Kein Engländer sollte das Boot betreten, so war der Wille der Mannschaft, und sie hat es erreicht" ("No Englishman should step on the boat, that was the will of the crew and they achieved it).

Wetter und hohen Wellen die Schuld am Untergang. Nachdem „Brecher schon über den Turm schlugen“ ließ er die „Leute auf den Schlepper übersteigen“ und alle Luken schließen. Trotzdem konnte ein Sinken nicht mehr aufgehalten werden und UC 71 ging wenig später nach den beschriebenen Maßnahmen unter: „Innerhalb einer Stunde sank Boot ganz weg.“ Bei dieser Schilderung und der Position des Wracks stellte sich jedoch die Frage, warum kein Versuch unternommen wurde, den nur 1000 Meter entfernten Hafen zu erreichen.

Die Identifizierung des Wracks als U-Boot UC 71 gelang 2001 durch Privatinitiative in Zusammenarbeit mit dem Alfred-Wegener-Institut (AWI). Damals gab es auch eine erste Bestandsaufnahme. Im Juli 2014 erfolgte eine umfangreiche Foto- und Videodokumentation, um den aktuellen Erhaltungszustand zu erfassen und mögliche Ursachen für den genauen Untergang zu finden. Dabei wurde die noch vorhandene Reststärke von Außen- und Druckhülle mit einem Ultraschall-Dickenmessgerät bestimmt. Die Reststärke im Bugbereich betrug beispielsweise an einigen Stellen nur noch 4,3 mm. Ursprünglich war diese Stelle 11 mm dick. Insgesamt ist das Wrack jedoch noch außerordentlich gut erhalten. Die unterwasserarchäologischen Untersuchungen haben außerdem ergeben, dass sich das U-Boot offensichtlich selbst versenkt hat. Schon während der ersten Tauchgänge 2001 konnte festgestellt werden, dass nur das Turmluk fest verschlossen war, die übrigen beiden Luken am Oberdeck jedoch offen standen. 2014 wurden bei der Dokumentation des Schiffsinneren sämtliche Luken und Schotten offenstehend vorgefunden. Das Brieftelegramm spricht hingegen davon, dass alle Luken und Schotts geschlossen worden waren. Das lässt vermuten, dass es sich um eine gezielte Selbstversenkung handelte, die unter dem Vorwand, das Wetter sei schlecht gewesen, vertuscht werden sollte. Das bestätigten auch zwei kürzlich aufgetauchte Tagebücher des vierten Maschinisten Georg Trinks. Der Maschinenmaat war auf

**3. The net cutter lay in about five metres from the bow area / Die Netzsäge lag etwa 5 Meter vom Bug entfernt (Photo: U. Kunz)**





The scuttling of UC71 recalls the events of Scapa Flow. Here, too, on 21st July 1919, German warships was also sunk by their own crews to prevent them being handed over to the Allies as reparations.

A net cutter was supposed to cut submarine nets, which hung like curtains in the Strait of Dover, as well as in all the English river mouths and port entrances.

The nets, often including mines, were supposed to be directed or driven away from the sub by means of two steel cables attached to the end of

the saw running in parallel from the bow over the tower to the end of the stern. Sometimes the net cutter would be supported by a second, directly welded saw tooth below the bow. The 4.10 metre long and almost 200 kilogram heavy net cutter of the UC 71 was recovered in the summer of 2016 using lifting bags and an electric winch and then brought to the State Museum at Schloss Gottorf in Schleswig, Germany. At the central archaeological workshop there, the net cutter was laid in a basin with demineralized water, in which it is to be desalinated and preserved for the next two years. It will then be shown in Heligoland in the newly designed museum. The fate of UC 71 and the naval war of 1914-1918 will be shown in a virtual exhibition including the net cutter, the recently rediscovered diary of the fourth machinist of the UC 71, Georg Trinks, as well as footage and further explanations.

According to UNESCO, there are around 10,000 First World War shipwrecks. These wrecks - as well as those of the Second World War - are very complex archaeological sites. Some of these wrecks are well preserved, but the majority have been severely damaged or destroyed by commercial salvaging, plundering, scrapping or ground trawling. And although the wrecks are witnesses to one of the greatest conflicts of recent history, they have not been sufficiently investigated. Wrecks of the First World War are a significant historical source; many of them represent the state-of-the-art of the twentieth century. The protection of these underground sites is also essential to



4.  
*Scientific divers from Submaris with raised net cutter, which is astonishingly well preserved / Forschungstaucher mit der geborgenen Netzsäge, die sehr gut erhalten ist (Photo: U. Kunz)*

18 Fahrten der UC 71 dabei und beschrieb in Tinte, mit Bleistift und manchmal auch nur mit einem Buntstift seine Eindrücke, Ängste und Erfahrungen. Die Tagebücher enden mit einer wichtigen Information und bringen bezüglich des Untergangs eindeutige Gewissheit: „Kein Fuß eines Engländers sollte das Boot betreten so war der Wille der Mannschaft und sie haben es erreicht. Die Mannschaft ließ sich von dem Fischdampfer retten, den man für alle Fälle als Begleitung mit genommen hatte.“ Dank der unterwasserarchäologischen Untersuchungen sowie den aufgetauchten Tagebüchern ist nun das Rätsel um den Untergang eindeutig geklärt. Die Selbstversenkung erinnert an die Geschehnisse am britischen Flottenstützpunkt Scapa Flow.

Netzsägen an U-Booten sollten U-Boot-Spernetze zerschneiden, die wie Vorhänge in der Straße von Dover sowie sämtlichen englischen Flussmündungen und Hafeneinfahrten hingen. Die Netze - darin oft auch Minen eingeflochten - sollten dann über zwei am Ende der Netzsäge angebrachte, parallel laufende Stahlseile vom Bug über den Turm bis zum Ende des Hecks abgeführt beziehungsweise abgewiesen werden. Gelegentlich wurde die Säge durch ein zweites, direkt angeschweißtes Sägezahnenteil an der Unterseite des Bugs unterstützt.

#### 5. Open Hatch / Offene Luke (Photo: U. Kunz)





recall the horrors of the war and its history. Since 2014, the cultural heritage of the First World War has been under UNESCO's "Convention on the Protection of the Underwater Cultural Heritage".

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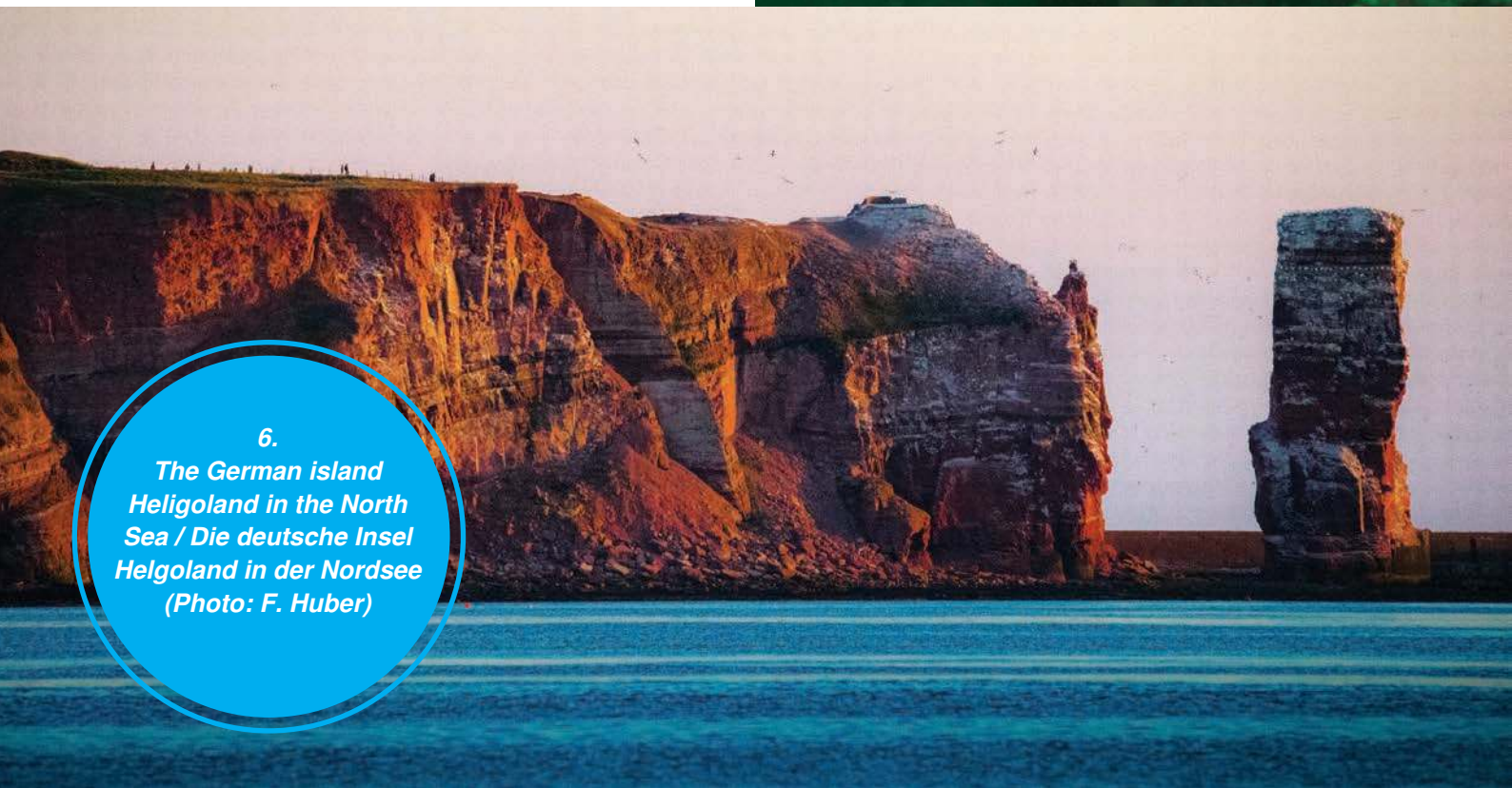
Photos and articles on the U-boat and two TV documentaries (in German) can be found at: / Fotos und Artikel zum U-Boot sowie die beiden TV-Dokumentationen (auf deutsch) finden sie unter: [www.florian-huber.info](http://www.florian-huber.info) and [www.submaris.com](http://www.submaris.com)

Die 4,10 m lange und knapp 200 kg schwere Netzsäge der UC 71 wurde im Sommer 2016 mit Hebesäcken und einer Elektrowinde geborgen und anschließend in die Stiftung Schleswig-Holsteinische Landesmuseen Schloss Gottorf in Schleswig überführt. In der dortigen Archäologischen Zentralwerkstatt hat die Netzsäge ein eigenes Becken mit demineralisiertem Wasser bekommen, in dem sie in den nächsten Jahren entsalzt und konserviert wird. Anschließend soll sie auf Helgoland im neu gestalteten Museum gezeigt werden. Eine virtuelle Ausstellung, in der neben der Netzsäge auch die erst kürzlich wiederentdeckten Tagebücher des vierten Maschinisten der UC 71, Georg Trinks, sowie Filmmaterial und weitere Erklärungen zu finden sein werden, zeigt dann das Schicksal der UC 71 sowie die Geschehnisse des Seekriegs von 1914 bis 1918.

Laut UNESCO gibt es weltweit an die 10.000 Schiffwracks des 1. Weltkrieges. Diese Wracks - wie auch die des 2. Weltkrieges - sind sehr komplexe archäologische Fundstellen. Einige dieser Wracks - wie UC 71 - sind gut erhalten aber die Mehrheit wurde durch kommerzielle Bergung, Plünderung, Verschrottung oder Grundschleppnetzfisherei schwer beschädigt oder zerstört. Und obwohl diese Wracks Zeugen eines der größten Konflikte der jüngeren Geschichte sind, wurden sie bislang nicht ausreichend untersucht. Wracks des 1. Weltkrieges sind eine bedeutende historische Quelle; viele von ihnen repräsentieren den hohen Stand der Technik des 20. Jahrhunderts. Der Schutz dieser Fundplätze unter Wasser ist darüber hinaus wichtig, um an die Schrecken des Krieges und seine Geschichte zu erinnern. Seit 2014 fällt das kulturelle Erbe des 1. Weltkrieges unter die UNESCO „Convention on the Protection of the Underwater Cultural Heritage“.

6.

*The German island  
Heligoland in the North  
Sea / Die deutsche Insel  
Helgoland in der Nordsee  
(Photo: F. Huber)*





# RETURN TO VERUDA

## POVRATAK NA VERUDU

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### 1. Daily anchoring above the wreck site / Svakodnevno sidrenje iznad nalazišta (Photo: R. Surić)

A post-medieval shipwreck was discovered in the waters off Veruda islet in 2013, leading to systematic investigation, launched in 2016 and continued in 2017 and 2019. In mid-April of 2019, following a one-year hiatus, ICUA Zadar archaeologists returned to the site near Pula, more precisely nearby Banjole, to conduct monitoring of the site condition, and to additionally explore the broader area of the Veruda wreck site. As in previous campaigns the team worked in the frame of research collaboration between the International Centre for Underwater Archaeology in Zadar and the Frankfurt-based Romano-German Commission (Römisch-Germanische Kommission, RGK) in Germany. Logistical support was provided by the Diving Indie club at the Indije tourism campsite in Banjole. Luka Bekić served as the principal investigator, working with his deputy Roko Surić. The other members of the field crew were Maja Kaleb and Franka Trcera (both ICUA Zadar), and Roman Scholz (RGK). Funding for this year's campaign was contracted by ICUA Zadar with the Ministry of culture of the Republic Croatia.



The remains of a sixteenth century wooden ship's structure, lying at a depth of six metres, were investigated in 2016 and protected with an in situ system. This involved a series of procedures to cover the site with various materials to prevent contact of the wood with

Novovjekovni brodolom u podmorju otočica Veruda otkriven je 2013. godine, sustavna istraživanja započela su 2016., te nastavljena 2017. i 2019. g. Sredinom travnja 2019. g., nakon jednogodišnje pauze, arheolozi MCPA Zadar su se ponovno zaputili u Pulu, točnije u obližnje Banjole kako bi izvršili nadzor stanja očuvanosti (tzv. monitoring) i dodatno pretražili šire područje brodoloma Veruda. Kao i do sada, stručna ekipa okupila se u sklopu znanstvene suradnje Međunarodnog centra za podvodnu arheologiju u Zadru i Römisch-Germanische Kommission iz Frankfurta u Njemačkoj. Logističku podršku pružao je ronilački centar "Diving Indie" u turističkom kampu Indije u Banjolama. Stručni voditelj arheološkog istraživanja bio je Luka Bekić, njegov zamjenik Roko Surić, dok su ostatak stručne ekipe činili Maja Kaleb i Franka Trcera (MCPA Zadar), te Roman Scholz (RGK). Novčana sredstva za ovogodišnju kampanju istraživanja osigurana su ugovorom između Ministarstva Kulture RH i MCPA Zadar.

Na samo 6 metara dubine, ostaci drvene brodske konstrukcije iz 16. stoljeća istraženi su 2016. godine i zaštićeni sustavom in situ zaštite.

Riječ je o nizu postupaka prekrivanja nalazišta različitim materijalima kako bi se spriječio doticaj samog drva s morem i organizmima koji u njemu žive. To

### 2.

**Site monitoring with the aid of a new 3D model / Nadzor nalazišta izradom novog 3D modela (Photo: F. Trcera)**







**3. Archaeologists prepare for a survey / Arheolozi se pripremaju za pregled (Photo: M. Kaleb)**

the open sea and the organisms that live in it. This was achieved by first covering the ship's structure with a large quantity of sand collected from deeper parts of the Seline channel between Cape Seline and Veruda islet. The area of the wooden remains were then covered with geotextile, a fabric made of polymer fibres that prevents the movement of the sand particles it covers. This created a stable environment that does not offer favourable conditions for shipworm activity. To further reinforce the geotextile, the entire area was again covered with a large quantity of sand. The final stage saw the ballast stones removed during the investigation returned to their original location over the remains of the wreck. Besides these protective measures, the removal of a large quantity of metal artefacts discovered in the course of systematic excavation of the site also contributed to preventing the development of chemical reactions in the interaction of wood with metal, thus retarding processes occurring in the marine environment.

The first *in situ* protection monitoring campaign was performed one year following the initial installation, in 2017, when it was established that the system works and that ideal protective conditions had been realised. The objective was achieved: the remains of the wreck were protected at a level greater than had existing prior to the archaeological excavation work. With the exception of a single dislocated documentation rail that fell out of its base as the result of the raising of a boat anchor, that year saw no observed traces of devastation. Upon arrival at the site in 2019 the first order of business was to perform a visual survey, in the course of which it was observed that one rail, installed in 2016 as the axis of the documentation bridge, was found out of its base. Frequent anchoring in the wreck site area means that when anchors are raised it often happens that the anchor will catch on to one of the rails, which can then cause significant damage to the vessel's structure. To avoid this situation in the future it was decided that the rails would all be unmounted and deposited under a ledge in the deeper part of the Seline channel.

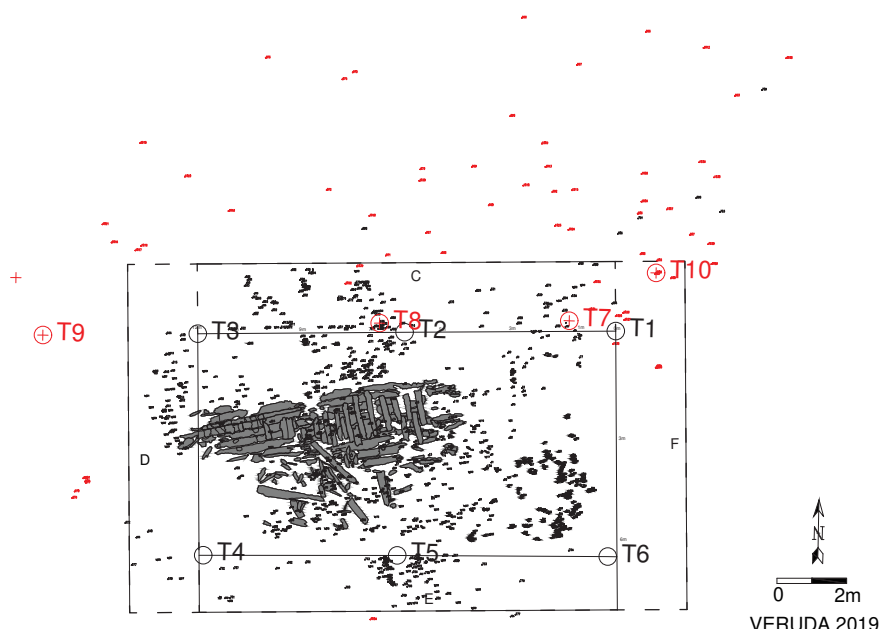
je izvedeno na način da je brodska konstrukcija prvo prekrivena velikom količinom pijeska koji je prikupljen iz dubljih dijelova prolaza Selina između istoimenog rta i otoka Veruda. Potom je područje na kojem se nalaze ostaci drva prekriveno geotekstilom, odnosno podložnim filcom – tkaninom izrađenom od polimerskih vlakana koja sprječava pomicanje čestica sedimenta koje prekriva. Na taj način je stvoren stabilan ambijent koji ne pruža povoljne uvjete za djelovanje broskog crva. Da bi se dodatno učvrstio geotekstil, cijela površina je ponovno zasuta velikom količinom pijeska. Na kraju je balastno kamenje, uklonjeno radi istraživanja, vraćeno na svoj prvobitni položaj, na ostatke broda. Uz navedenu zaštitu, samo uklanjanje velike količine metalnih arheoloških nalaza pronađenih sustavnim iskopavanjem, pridonijelo je sprječavanju razvoja kemijskih reakcija između metala i drva, te tako usporilo procese koji se odvijaju u morskom ambijentu.

Prva kampanja nadzora *in situ* zaštite provedena je godinu dana nakon njezinog postavljanja, 2017. g. kada je utvrđeno da sustav funkcionira te da su stvoreni idealni uvjeti za zaštitu. Postignut je cilj – ostaci brodoloma su zaštićeni bolje nego prije početka iskopavanja. Osim jedne dislocirane dokumentacijske šipke koja je ispala iz ležišta uslijed podizanja sidra nekog moreplovca, navedene godine nisu primijećeni tragovi devastacije. Dolaskom na nalazište 2019. g., prvo je izvršen vizualni pregled te je ustanovljeno da je opet jedna šipka, postavljena još 2016. g. kao osovina dokumentacijskog mosta, pronađena izvan ležišta. Uslijed učestalog sidrenja na području lokacije brodoloma, prilikom podizanja sidra, često se dogodi da sidro zahvati šipke koje onda znatno mogu oštetiti brodsku konstrukciju. Kako bi se navedena situacija u budućnosti izbjegla, odlučeno je da se šipke u potpunosti razmontiraju i deponiraju ispod grebena u dubljem dijelu prolaza Selina.



**4. Exploration assisted by metal detectors / Pretraživanje pomoću metal detektora (Photo: R. Surić)**





**5. Drawing of the Veruda site. Grey indicates remnants of the wooden structure, black indicates special finds from previous years, red indicates finds recovered this year / Nacrt nalazišta Veruda. Sivom bojom označeni su ostaci drvene konstrukcije, crnom posebni nalazi iz prošlih godina, a crvenom nalazi iz ove godine (By: M. Kaleb, R. Scholz)**

Along with the monitoring of the in situ protection, this year saw a widening of the exploration area with the aim of gaining more insight into the nature of the wreck and the diverse metal artefacts recovered from the cargo and ship's equipment. In this campaign the survey was again assisted by the use of metal detectors in four-by-four metres sectors for better orientation on the seabed. In relation to the central area of the site, investigated in 2016 and 2017, the sector-by-sector survey first explored the area to the north (deeper) and then the area to the west, south and east (shallower). An area of about 160 square metres was explored to the north of the site centre, yielding 33 special finds, with a further 36 finds recovered in the shallow area. The last stage saw an exploration of the deeper section of the Seline channel. At a depth of ten metres surveying was slower on account of poor visibility caused by weak sea current activity, but also by significant amounts of recent metal waste.

The survey and documentation system saw one diver examining a given sector with a metal detector, assigning a number and signalling to a diving partner that documentation could commence when a find was made. Given that the spikes marking the datum (fixed reference) points in previous years were removed at the start of the 2019 investigation campaign, four new georeferenced datum points were installed (T7–T10). All finds were positioned from these points using the triangulation method with two measuring tapes, and by the circular documentation method using a measuring tape and a compass. All artefacts were photographed

Osim tzv. monitoringa *in situ* zaštite, i ove godine je prošireno područje pretrage kako bi se upotpunila priča o brodolomu i raznovrsnosti metalnih nalaza koji su činili dio tereta ili brodske opreme. Pregled se i ove kampanje vršio pomoću metal detektora unutar sektora dimenzija 4x4 metra radi lakše orijentacije na morskom dnu. U odnosu na središnji dio nalazišta koji je istražen 2016. i 2017. g., po sektorima je prvo pretraženo područje koje se nalazi sjeverno (dublje), a zatim je pretražen i prostor zapadno, južno i istočno (pliće). Sjeverno od centra, pretraženo je područje od oko 160 m<sup>2</sup> i pronađena su 33 posebna nalaza, dok su u plićini pronađena još dodatna 36 nalaza. Za kraj je odlučeno da se pregleda i dublji dio prolaza Seline.

Na dubini do 10 metara, pregledavanje je usporavala loša vidljivost zbog slabog djelovanja morskih struja, ali i velika količina recentnog metalnog otpada.

Sustav pregleda i dokumentiranja nalaza je funkcionirao na način da jedan ronilac pregledava zadani sektor metal detektorom, a u trenutku kada pronađe nalaz, dodijeli mu broj i signalizira svom ronilačkom paru da može započeti s dokumentiranjem. Kako su šipke na kojima su tijekom proteklih godina bile smještene i fiksne točke odmah na početku istraživačke kampanje 2019. g. uklonjene, postavile su se nove 4 georeferencirane,

**6. Daily find documentation / Svakodnevno dokumentiranje nalaza (Photo: M. Kaleb)**





and each was assigned a number and individually packed. In all the 82 special finds, prominent effort yielded among which are parts of copper cauldrons, fragments of melted tin and tin ware, lead rings, iron nails and massive bronze nuts. Although most of these types of artefacts are known to us from earlier investigation of the site, we did observe some artefacts that will certainly broaden our picture of the Veruda wreck.



7.  
**A lead tool /  
Olovni alat  
(Photo: M. Kaleb)**

This year's campaign at the Veruda site also saw a number of surveys conducted in nearby areas. Accounts of a cannon stuck in a vertical position in one of the depressions to the southwest side of Veruda islet remain unresolved as this year's examination of the area failed to locate it. Along with the examined seabed area just off the shore of the islet, we performed another survey of the Seline channel where there is a significant amount of archaeological material dating from the antiquity period to the eighteenth century. A diversity of objects of a very broad dating range have made their way to the seabed in the channel between Veruda and the mainland as a result of the very long time it has served as an anchorage.

In coming years we plan to continue our systematic monitoring of the protective measures installed at the Veruda islet wreck near Pula, and we are also in the preparatory phase for the publication of a monograph that will crown the investigation of this post-medieval gem, the secrets of which we have worked to shed light on over the past six years.

**8. The 2019 investigation team at the Veruda site. From the left: / Istraživački tim 2019. godine na nalazištu Veruda. S lijeva: Roman Scholz, Jerome Garcia, Franka Trcera, Roko Surić, Luka Bekić, Maja Kaleb (Photo: M. Kaleb)**



fiksne točke (T7-T10). Od tih su točaka svi pronađeni nalazi pozicionirani metodom triangulacije pomoću dva metra i metodom kružnog dokumentiranja pomoću metra i kompasa. Svi arheološki nalazi su fotografirani, te svaki zasebno s dodijeljenim brojem i zapakirani. Ukupno su pronađena 82 posebna nalaza, među kojima se ističu dijelovi bakrenih kotlova, ulomci rastaljenog kositra i kositrenog posuđa, olovni prstenovi, željezni čavli te masivne bronzane matice. Iako nam je većina predmeta već bila poznata s ranijih istraživanja, zapaženi su i neki predmeti koji će zasigurno upotpuniti sliku o brodolomu Veruda.

U sklopu ovogodišnje kampanje istraživanja Verude, provedeno je i nekoliko pregleda, odnosno rekognosciranja obližnjeg područja. Tajnovita priča o topu koji je vertikalno zabijen u jednu depresiju s jugozapadne strane otoka Veruda i dalje ostaje nerazjašnjenja jer pregledom ni ove godine nije pronađen. Osim podmorja otoka, ponovno je pregledan prolaz Seline gdje se nalazi velika količina arheološke građe koja datira od vremena antike pa sve do 18. st. U podmorje prolaza između otoka Veruda i kopna, raznovrsni predmeti široke datacije dospjeli su uslijed dugogodišnjeg sidrenja na ovom području.

Kroz sljedećih nekoliko godina, planiran je nastavak sustavnog nadzora zaštite nalazišta Veruda u podmorju istoimenog otočića nedaleko Pula, a u tijeku je i priprema velike monografije, krune istraživanja ovog novovjekovnog bisera čije smo tajne pokušali razotkriti tijekom posljednjih 6 godina.

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# A NEW APPROACH TO PROTECTING THE UNDERWATER HERITAGE OF AFRICA'S ATLANTIC COAST

## UNE NOUVELLE APPROCHE À LA PROTECTION DU PATRIMOINE SUBAQUATIQUE DE LA FAÇADE ATLANTIQUE DE L'AFRIQUE

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**1. Recherche archéologique subaquatique, Gorée 2019 / Underwater archaeological research, Gorée 2019 (Photo: M. Wele)**

There is a great wealth of underwater cultural heritage lying off the Atlantic coast of Africa and in the continent's inland waters, all speaking to the cultural identity of the coastal communities, but also witness to a very long history and the many maritime links to other parts of the world. Today this submerged heritage represents an important, but little-known facet of Africa's maritime cultural landscape. It is made up of a great number of underwater sites of cultural heritage that bear witness to the human occupation of Africa's western shores from as far back as 3000 BCE. There are also other notable sites of historical and cultural interest, and shipwrecks from both military conflicts and the transatlantic slave trade, standing as silent and tragic witnesses of the great conflicts that mark the history of human civilization.

In 2018 the UNESCO Regional Office in Dakar

Au large des côtes de la façade atlantique de l'Afrique, comme dans les eaux intérieures, repose un riche patrimoine culturel subaquatique, symbole de l'identité culturelle des communautés côtières mais aussi témoin de l'ancienneté et de la multiplicité des connexions maritimes à travers le monde. Cet héritage immergé représente aujourd'hui un élément important, mais méconnu, du paysage culturel maritime en Afrique. Il est constitué d'un vaste éventail de sites culturels immergés témoignant de l'occupation humaine des côtes ouest africaines depuis 3000 ans avant J.C. Nous pouvons citer également d'autres sites d'intérêt historique et culturel et aussi des épaves de guerres et du commerce transatlantique des esclaves qui sont les témoins silencieux et tragiques des plus grands conflits de l'histoire des civilisations.

Depuis 2018, le Bureau régional de l'UNESCO à Dakar a lancé une initiative afin de d'articuler les actions des pays de la façade atlantique pour la protection du patrimoine subaquatique, fédérant les acteurs autour d'une nouvelle approche thématique prenant en compte l'unité géographique « Atlantique » et la complémentarité des Conventions UNESCO concernant le patrimoine.

Ce travail a permis à l'UNESCO Dakar, en premier lieu, de bâtir avec ses partenaires un cadre de réflexion sur les interconnexions entre la Convention de 2001 sur la protection du patrimoine culturel subaquatique et les autres Conventions relatives au patrimoine mondial (1972), au patrimoine immatériel (2003) et puis la lutte contre le trafic illicite des biens culturels (1970). En second lieu, et grâce à l'implication des universitaires africains, ce travail a permis la mise en place d'une formation en





2.  
**Formation UNESCO en  
 archéologie subaquatique,  
 Mozambique 2019 /  
 UNESCO training in  
 underwater archaeology,  
 Mozambique 2019  
 (Photo: A. Monteiro)**

launched an initiative that articulates the efforts of the Atlantic seaboard countries aimed at protecting underwater heritage, focusing the work of stakeholders on a new approach that takes into account the Atlantic geographic component and the complementarity of UNESCO conventions that deal

with our heritage.

This enabled UNESCO Dakar to, first and foremost, work with its partners to build a framework within which to contemplate aspects of the 2001 Convention on the Protection of the Underwater Cultural Heritage that it shares with other conventions; those on the protection of world heritage (1972), intangible heritage (2003) and the struggle against the illicit traffic in cultural goods (1970). Secondly, and thanks to the involvement of African academics, this work has made it possible to set up underwater archaeology training that addresses specific regional research issues. Finally, synergies have been developed with defence and security forces to counter the threats endangering our underwater cultural heritage.

This article presents some of the results of this

archéologie subaquatique adaptée aux problématiques de recherche dans la région. Finalement, des synergies ont été développées avec les forces de défense et de sécurité pour faire face aux menaces qui pèsent sur le patrimoine culturel subaquatique.

Cet article, présente quelques résultats de ce travail, qui passe par la formation du capital humain, la mise en place de stratégies de protection du patrimoine subaquatique, des recherches et publications scientifiques ainsi que des efforts de mise en valeur.

L'une des actions centrales de ce travail sur le patrimoine culturel subaquatique de la façade atlantique d'Afrique constitue la formation de ressources humaines qualifiées en archéologie subaquatique afin de créer une nouvelle vague d'experts locaux. Ainsi et afin de stabiliser un centre de référence dans la durée, l'UNESCO accompagne l'Université Cheikh Anta Diop au Sénégal dans le développement d'un nouveau programme de formation en archéologie subaquatique.

Ceci vient en complément aux formations court terme dispensées par exemple par les Directions du patrimoine de Cabo Verde et du Sénégal, notamment dans le cadre d'un projet régional sur le patrimoine culturel subaquatique, financé par les Fonds FEDER de l'Union Européenne et dont l'UNESCO Dakar est partenaire. Ce projet a permis de former plus de 15 spécialistes en gestion des biens culturels immergés avec le soutien du



work, involving the formation of human capital, the implementation of underwater heritage protection strategies, scientific research and publication, and the efforts aimed at highlighting this field of activity.

One of the core activities of this work on the underwater cultural heritage of Africa's Atlantic coast is the training of qualified underwater archaeologists that aims to create a new body of local experts. With the objective of creating a stable and durable reference centre UNESCO is also supporting the Cheikh Anta Diop University in Senegal in developing a new underwater archaeology training program.

This complements short-term training provided, among others, by the Cabo Verde and Senegal heritage departments, in particular in the framework of a regional underwater cultural heritage project funded through the European Union's ERDF instrument to which UNESCO Dakar is a partner. This project provided training for over fifteen specialists in the management of underwater cultural property with the support of the Underwater Archaeology Centre in Cádiz. There have also been other training opportunities provided by specialized centres such as the CAIRIM archaeology, research and resources centre in Mozambique, and the International Centre for Underwater Archaeology in the Croatian coastal city of Zadar, which in 2019 provided training for four specialists.

As C. Westerdahl notes<sup>1</sup>, Africa's Atlantic shoreline is a treasure trove of maritime culture. Perhaps the most appropriate approach to our analysis and comprehension of the underwater cultural heritage of this region is an integrated examination of the human use of the broader maritime sphere that includes its material, cultural, social and intellectual aspects. This approach allows us to undertake new investigations in a manner that puts the local communities at the heart of our research efforts.

It is important to first better understand the different aspects of underwater cultural heritage in this geographic area. To give some examples of underwater archaeological sites, we have taken the example of Senegal, which can be considered a prototype in terms of the analysis of underwater archaeological investigation. Among the specific characteristics of submerged sites, we can point to:

- Sites associated with the cultures and civilizations of coastal peoples (the example of the submerged parts of the protohistoric shellfish mounds with tumuli in the Saloum Delta);
- Natural marine sites, considered by the local community as cultural sites (there is the example of the Madeleine islands, the site of a prehistoric shipyard that the Lébou



**3. Démonstration de surveillance des sites autour de Gorée, janvier 2019 / Demonstration of site monitoring around Gorée, January 2019**  
(Photo: P.Debust)

Centre d'archéologie subaquatique de Cadix. D'autres opportunités de formation offertes par des centres spécialisés sont également recherchées, que ce soit le CAIRIM, au Mozambique ou ICUA à Zadar (Croatie), qui ont permis de former 4 experts en 2019.

La façade atlantique africaine renferme, au sens de C. Westerdahl<sup>1</sup>, des paysages culturels maritimes exceptionnels. L'étude intégrée de l'utilisation humaine de l'espace maritime en y incluant les aspects physiques, culturels, sociaux et cognitifs est peut-être l'approche la plus appropriée pour analyser et comprendre le patrimoine culturel subaquatique de cette région. Cette approche permet d'aborder de nouvelles problématiques de recherche mettant les communautés locales au cœur de cette étude.

Il s'agit d'abord de mieux comprendre les différents aspects du patrimoine culturel subaquatique dans cette unité géographique. Pour citer quelques exemples des sites archéologiques subaquatiques, nous avons pris l'exemple du Sénégal qui peut être considéré comme un prototype dans le cadre de l'analyse des problématiques de recherche en archéologie subaquatique. Parmi les particularités des sites immergés, nous pouvons citer:

- Des sites liés aux cultures et civilisations des peuples côtiers (exemple des parties submergées des amas coquilliers protohistoriques à tumulus funéraires du Delta du Saloum);
- Des sites naturels marins, considérés par la communauté locale comme des sites culturels (exemple de l'île de la



community now holds to be sacred as a place inhabited by the guardian spirit of the Dakar region. This sacred aspect of the island explains why we often find cultural remains there, including pottery and other sacred objects on the seabed that, according to the local population, are the product of ritual and mystical practices that have always been performed there);

- Wrecks that bear witness to the interactions between Africa and the rest of the world that have now been appropriated by local fishermen. There is the example of Second World War wrecks in the waters off Dakar<sup>2</sup> that are now hard to identify on account of the specific place names used by the fishermen. This has to do with the fact that these historical wrecks later become artificial reefs at which marine species reproduce, making them ideal fishing sites<sup>3</sup>. In one case we made oral inquiries in Dakar to find a Swordfish downed in 1940 during the naval battle at Dakar. After comparing the field data, we realized that the Swordfish wreck was now referred to as the Doudou wreck, named after an old fisherman from Anse Bernard (a Dakar fishing wharf).

We see this issue cropping up at many other sites on the Atlantic coast and opens our consideration of some fascinating topics of investigation.

The analysis of some of the underwater archaeological sites in Senegal tells of the diversity of this kind of cultural heritage off Africa's Atlantic shores. Effective protection of these sites requires an approach involving all the stakeholders, especially of the local communities that are at the heart of this protection process.

Primarily this means a more robust engagement of the local communities in the protection of this submerged heritage, by promoting the common threads the 2001 Convention shares with the 2003 UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage. The example given here is of the Second World War wrecks off the Dakar peninsula. Raising awareness among local fishermen here facilitates first and foremost access to information, but it also encourages the protection of these sites by the fishermen, considering—as noted above—that they double as artificial reefs for the reproduction of marine species. These actions reinforce in the local communities the sense that these underwater archaeological sites are a part of their own heritage.

On the other hand, the 1972 Convention Concerning the Protection of the World Cultural and Natural Heritage bridges the conservation of natural and cultural sites and establishes the criteria for inscription on the World Heritage List. A number of cultural and mixed world heritage sites are located underwater, and some are covered by the World Heritage Marine Program<sup>4</sup>. It is also

Madeleine, site qui fut un chantier naval préhistorique et qui aujourd'hui d'après la communauté Lébou, est sacré car habité par le génie protecteur de la région de Dakar. Cet aspect sacré de l'île explique que l'on y retrouve fréquemment des vestiges tels que des poteries et autres objets sacrés dans les fonds marins et qui selon la population locale, sont issus des pratiques rituelles et mystiques toujours effectuées);

- Des épaves, témoins des interactions entre l'Afrique et le reste du monde et qui aujourd'hui sont appropriées par les pêcheurs locaux. Ici, nous pouvons donner l'exemple des épaves issues de la seconde Guerre mondiale à Dakar<sup>2</sup> qui sont rendues difficilement identifiables du fait de la toponymie spécifique utilisée par ces pêcheurs. Ceci est lié au fait que l'épave, vestige historique, devient un récif artificiel pour la reproduction des espèces marines, et donc un lieu privilégié pour la pêche<sup>3</sup>. Par exemple, nous avons entamé des enquêtes orales à Dakar pour retrouver un Swordfish sabordé et coulé en 1940 lors de la bataille navale de Dakar. Après confrontation des différentes données de terrain, nous nous sommes rendus compte que l'épave du Swordfish avait changé de nom pour devenir épave Doudou, du nom d'un vieux pêcheur d'Anse Bernard (un quai de pêche de Dakar).

Cette problématique est extensible à de nombreux autres sites de la façade atlantique et ouvre la réflexion sur des sujets de recherche passionnants.

L'analyse de quelques sites archéologiques subaquatiques au Sénégal montre la diversité du patrimoine culturel subaquatique de la façade atlantique africaine. Une protection efficace de ces sites, exige une approche impliquant tous les acteurs concernés, et en première ligne les communautés locales qui sont au cœur de ce processus de protection.

Il s'agit d'abord de mieux impliquer les communautés locales dans la protection de ce patrimoine englouti, en favorisant les liens entre la Convention 2001 et la Convention 2003 de l'UNESCO pour la sauvegarde du patrimoine culturel immatériel. L'exemple est donné avec les épaves de la Seconde Guerre mondiale au large de la presqu'île de Dakar. Une sensibilisation des pêcheurs locaux de cette zone permet d'abord de faciliter l'accès à l'information mais aussi d'encourager une protection de ces sites par ces pêcheurs puisque, comme nous l'avons évoqué plus haut, ces sites sont aussi des récifs artificiels pour la reproduction des espèces. Ces actions permettront de renforcer l'appropriation des sites archéologiques subaquatiques par les communautés locales.

D'autre part, la Convention de 1972 concernant la protection du patrimoine mondial, culturel et naturel fait





the

4.

***Epave du Tacoma,  
site de mémoire de la  
seconde guerre mondiale  
/ Wreck of Tacoma, site  
of memory of the Second  
World War  
(Photo: M. Wele)***

case that underwater cultural heritage often coexists with land sites that have been classified under the UNESCO World Heritage List, but was not part of the classification criteria process. Here we can mention the anchor cemetery site of Cidade

Velha (Cabo Verde), inscribed in 2009; the submerged cannons of Kunta Kinteh island (Gambia), inscribed in 2003; the partially submerged shellfish mounds of the Saloum Delta (Senegal), inscribed in 2011; and the wrecks associated with transatlantic trade off Gorée island, inscribed in 1978. Some of these underwater sites are often located in the buffer zone of a classified site.

An assessment of the contribution of the underwater archaeology component of these world heritage sites would certainly contribute to heightening their status. Indeed, the sites inscribed on the UNESCO World Heritage List located in maritime cultural landscapes are laboratories of sorts that allow us to test the complementary aspects of the UNESCO conventions of 1972 and 2001.

One of the objectives of the work of UNESCO Dakar and its partners is to shed light on the other heritage found in the world heritage sites situated in marine environments that remain largely unknown to the broader public.

Much of the cultural property discovered at underwater sites is looted and trafficked, and is ultimately sold at

le lien entre la conservation des sites naturels et culturels et définit les critères pour leur inscription sur la Liste du Patrimoine Mondial. Un certain nombre de sites culturels et mixtes du patrimoine mondial sont situés sous l'eau et certains sont couverts par le Programme marin du patrimoine mondial<sup>4</sup>. De plus, le patrimoine culturel subaquatique cohabite souvent avec des sites terrestres qui ont été classés sur la Liste du patrimoine mondial de l'UNESCO sans pour autant participer aux critères de classement. Nous pouvons citer le site archéologique dit « cimetière des ancres » de Cidade Velha (Cabo Verde), inscrite en 2009 ; les canons submergés de l'île Kunta Kinteh, inscrite en 2003 ; les amas coquilliers en partie submergés du Delta du Saloum (Sénégal), inscrit en 2011 et les épaves liées au commerce transatlantique au large de l'île de Gorée, inscrite en 1978. Certains de ces sites subaquatiques se situent souvent dans la zone tampon du site classé.

Analyser l'apport des sites archéologiques subaquatiques sur ces sites du patrimoine mondial pourrait sans doute participer à leur rayonnement. En effet, les sites inscrits sur la Liste du patrimoine mondial de l'UNESCO et qui se trouvent dans des paysages culturels maritimes constituent des laboratoires permettant d'expérimenter la complémentarité à l'œuvre entre les conventions UNESCO de 1972 et de 2001.

Car un des objectifs visés par le travail porté par l'UNESCO Dakar et ses partenaires est de faire découvrir l'autre patrimoine que renferment ces sites du patrimoine mondial situés dans des milieux marins et qui demeure jusque-là méconnu par le grand public.

De nombreux biens culturels découverts sous l'eau sont victimes de pillages et font l'objet de trafics avant



art markets around the world. To address this threat, UNESCO Dakar and its local partners are working together to explore the common points of the 1970 Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property and the 2001 Convention. This committed cooperation has seen significant progress achieved. In Senegal, the involvement of defence and security forces in the protection of underwater cultural heritage is a positive protective measure that helps curb looting. Cabo Verde, which ratified the 2001 Convention in April of 2019, has also shown its willingness to deal with the threats to its underwater cultural heritage by setting up a national commission in which the coast guard plays an important role.

In the space of just under two years an innovative collaboration has seen the UNESCO Regional Office for West Africa (Sahel) work with its member states on Africa's Atlantic coast and other partners to lay the groundwork for a new approach, developing concrete actions ranging from strengthening local capacities in underwater archaeology, collaboration with security forces and new ratifications of the UNESCO 2001 Convention (Cabo Verde, Guinea and Senegal in progress), to activities aimed at raising public awareness of this heritage. This work has also paved the way for innovative research on the origins of underwater cultural heritage, thus providing UNESCO with additional tools for the proper implementation of the 2001 Convention in this region.

There are, however, still great challenges facing the underwater cultural heritage of the Atlantic coast, notably the threat posed by the exploitation of natural resources, planning development in maritime regions, insufficient local underwater archaeology expertise, and the underfunding of investigative activities.

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<sup>1</sup> Westerdahl, Christer, 1992, 21.

<sup>2</sup> The Senegalese capital of Dakar was one of the theatres of World War II operations: a naval battle was fought here pitting the free French forces led by the general Charles de Gaulle and his English allies against a French force based in West Africa. / Dakar, capitale du Sénégal fut l'un des théâtres d'opérations de la seconde guerre mondiale avec une bataille navale opposant les forces françaises libres du General De Gaulle et les alliés des anglais à la force française basée en Afrique occidentale.

<sup>3</sup> Wele, 2016.

<sup>4</sup> Report on the evaluation of the 2001 Convention on underwater cultural heritage, June of 2019. / Rapport évaluation de la Convention de 2001 sur le patrimoine culturel subaquatique, juin 2019.

d'être vendu sur des marchés d'art à travers le monde. Pour faire face à cette menace, l'UNESCO Dakar et ses partenaires locaux explorent ensemble les liens entre la Convention de 1970 concernant les mesures à prendre pour interdire et empêcher l'importation, l'exportation et le transfert de propriétés illicites des biens culturels et la Convention de 2001. Des avancées importantes ont été acquises grâce à cette coopération engagée. Au Sénégal, l'implication des forces de défense et de sécurité dans la protection du patrimoine culturel subaquatique est une bonne pratique de mesure de protection qui permet de freiner les cas de pillages. Le Cabo Verde, qui a ratifié la Convention de 2001 en avril 2019, a également montré sa volonté de faire face à ces menaces pesant sur son patrimoine culturel subaquatique en mettant en place une commission nationale au sein de laquelle les garde-côtes occupent une place importante.

En l'espace de moins de deux ans une collaboration innovante entre le Bureau régional de l'UNESCO pour l'Afrique de l'Ouest Sahel et ses Etats membres situés sur la façade atlantique de l'Afrique et autres partenaires a permis de conceptualiser une nouvelle approche, développer des actions concrètes allant du renforcement des capacités locales en archéologie subaquatique, à la collaboration avec des forces de sécurité, des nouvelles ratifications de la Convention UNESCO de 2001 (Cabo Verde, Guinée et Senegal en cours), ou des actions de sensibilisation en faveur de ce patrimoine. Egalement, ce travail a permis de lancer une recherche innovante sur l'originalité du patrimoine culturel subaquatique, permettant ainsi à l'UNESCO de disposer d'outils complémentaires pour la bonne mise en œuvre de la Convention de 2001 dans la zone.

Cependant, des défis majeurs demeurent pour le patrimoine culturel subaquatique de la façade atlantique, notamment la menace des activités d'exploitation des ressources naturelles et l'aménagement des espaces maritimes, la faible expertise locale en archéologie subaquatique et le faible financement des activités de recherche.

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# ZADAR COUNTY UNDERWATER ARCHAEOLOGICAL SURVEY

## PODVODNI ARHEOLOŠKI PREGLED ZADARSKE ŽUPANIJE

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There are many paths to the discovery of an underwater archaeological site, but the best way to go about it is the systematic underwater archaeology survey of an area. In 2019 we continued our work surveying possible archaeological sites across Zadar County. ICUA Zadar carried out this archaeological reconnaissance survey work in the period from 18th June to 4th December of 2019. Surveys conducted in previous years identified many sites of which there had not been previous knowledge in the scientific community. The locations of these sites have been precisely determined, they have been documented, and entered into the ICUA database, and have thus broadened our knowledge of the cultural heritage of Zadar County.

Our 2019 campaign of underwater archaeological survey in Zadar County saw us visit fourteen locations across the islands of the Zadar archipelago. Most of the survey locations were selected on the basis of reports from local residents that had identified material that indicated the possible presence of cultural remains.

The year's first surveys were at locations near Bribinj, a hamlet on Dugi Otok island. four separate positions were surveyed. The first two are to the south side of Bribinj in the Jaz and Bok coves. The cove Jaz was fully explored but, outside of sporadic sherds of predominantly post-medieval pottery, there were no finds that would point to an archaeological site. During the survey of Bok Cove, which is relatively well protected from northerly winds, we observed numerous artefacts on the sandy seabed, at depths ranging from fifteen to twenty metres, of antiquity, medieval and post-medieval period origin. These artefacts were deposited here over its long utilisation as an anchorage.

The following survey site was to the south of Utra islet, which sits at the entrance to Lučina Cove. Besides for its position, this location is also interesting on account of



**1. Choosing survey sites is always fraught with challenges / Teška odluka koju poziciju pregledati (Photo: M. Kaleb)**

Do otkrića podvodnog arheološkog lokaliteta može se doći na razne načine, no najbolji način je sustavni podvodni arheološki pregled nekog područja. Tijekom 2019. godine nastavljen je pregled potencijalnih arheoloških lokacija diljem Zadarske županije. MCPA Zadar je rekognosciranje proveo u razdoblju od 18. lipnja do 4. prosinca 2019. Pregledima iz prijašnjih godina otkriveni su brojni lokaliteti za koje se prije u stručnim krugovima nije imalo saznanja. Takvi lokaliteti ubicirani su, dokumentirani i uneseni su u bazu podataka MCPA, a na taj način upotpunili su sliku poznavanja podvodne kulturne baštine Zadarske županije.

Ovogodišnje podvodno arheološko rekognosciranje Zadarske županije provedeno je na 14 različitih lokacija diljem zadarskog arhipelaga. Većina lokacija za pregled odabrano je na osnovu dojava lokalnog stanovništva koje je na određenim pozicijama prepoznalo materijal za koje





**2.**  
***The find of sherds  
of a late Roman  
ribbed amphora /  
Nalazi ulomaka  
kasnoantičke  
narebrene amfore  
(Photo: M. Kaleb)***

the remains of a small stone church on the south shore of the islet. The survey of the seabed to the south side of the islet did not, however, identify any artefacts.

The fourth position to be surveyed was in Lučina Cove. This investigation follows up on a report from our colleague Maja Kaleb indicating the presence of post-medieval underwater finds in the cove. The decision was made to move forward with the survey and documentation of the position. Along the eastern shores of the inlet, at a depth of three metres, we identified two separate heaps of post-medieval construction material, including brick and mortar, and a significant quantity of potsherds, glass and other small finds.

In order to more clearly identify the nature of this site we opted to open and investigate two trenches in the area covered by the larger of the two heaps, each sized two by two metres. Trenches A and B were set one next to the other, such that they share one profile. Investigation of the trenches was done by excavating the sediment with the aid of a dredge, with all recovered finds placed in baskets and lifted to our boat. All finds were documented aboard our boat, weighed and counted, with the data entered into tables we had prepared in advance. This helps us gain a broader picture of the type and abundance of finds and, thereby, of the character and extent of the site. We recovered in excess of 3,800 finds, weighing in at 601 kilograms. The majority of the finds can be characterised as construction debris, this being brick, fragments of roof tiles and chunks of mortar. By far the most significant finds are of post-medieval ceramic ware - the typological analysis of these sherds can be used to date the entire site. Other recovered artefacts include clay pipes, fragments of glass, bones and metal nails. A preliminary typological analysis of the archaeological material puts the site in the early nineteenth century. Based on the character of the site and the type of archaeological material we can identify this as a ballast heap.

Taking part in the excavation work at the Lučina site were

su sumnjali da se radi o arheološkim nalazima.

Prvi ovogodišnji pregled napravljen je na pozicijama uz mjesto Brbinj na Dugom Otoku. Napravljen je pregled na četiri odvojene pozicije. Prve dvije nalaze se na južnoj strani mjesta Brbinj u uvali Jaz i uvali Bok. Pregledana je čitava površina uvale Jaz, no osim pojedinačnih, sporadičnih ulomaka uglavnom novovjekovne keramike, nisu pronađeni nalazi koji bi definirali da se na tom prostoru nalazi arheološki lokalitet. Pregledom uvale Bok koja je relativno dobro zaštićena od sjevernih vjetrova, su na pjeskovitom morskom dnu na dubini između 15 i 20 metara uočeni brojni arheološki nalazi iz antičkog, srednjovjekovnog i novovjekovnog perioda. Nalazi su na morsko dno dospjeli za vrijeme korištenja ove uvale za sidrenje u raznim povijesnim periodima.

Idući prostor koji je pregledan nalazi se južno od otočića Utra, koji se smjestio na ulazu u uvalu Lučina. Osim zbog pozicije, ova lokacija zanimljiva je i zbog činjenice da se na prostoru južne obale otočića, nalaze zidani ostaci kamene crkvice. Pregledom morskog dna na južnoj strani otočića nisu pronađeni arheološki nalazi.

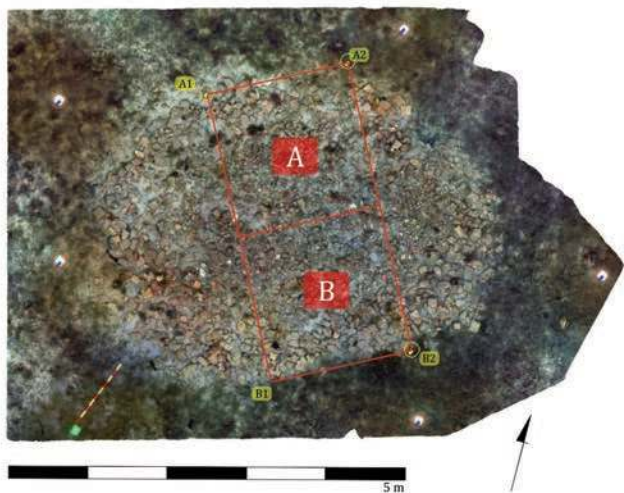
Četvrta pozicija koja je pregledana nalazi se u uvali Lučina. Na osnovu informacija dobivenih od kolegice Maje Kaleb, da se na prostoru uvale nalaze podvodni arheološki nalazi iz novovjekovnog perioda. Odlučeno je da se te pozicije pregledaju i dokumentiraju. Uz istočnu obalu uvale, na dubini od 3 m otkrivene su dvije odvojene hrpe s novovjekovnim građevinskim materijalom poput opeka i žbuke, a pronađeno je i dosta ulomaka keramike, stakla te ostalih sitnih nalaza.

Kako bi se jasnije definirao karakter ovog nalazišta odlučeno je da će se na prostoru veće hrpe istražiti dvije arheološke sonde dimenzija 2x2 m. Sonda A i B postavljene su jedna pored druge, na način da dijele jedan profil. Istraživanje u sondi provedeno je na način da se



**3. Excavation at the Lučina site / Iskopavanje na lokalitetu Lučina (Photo: M. Kaleb)**





**4. An orthophoto model of the ballast heap with indicated trenches and photo-points / Ortofoto model balastne hrpe s označenim sondama i fototočkama (Model by: R. Surić; plan by: Geomodus d.o.o. Zadar)**

participants of a one-week underwater survey workshop. Through their involvement in this type of investigative work the course participants acquired knowledge and experience in underwater archaeological investigation, documentation and the identification of archaeological material. The workshop participants also took part in underwater surveys of possible archaeological sites among the islands of the Zadar archipelago.

An archaeological site was identified in the waters off Vrgada island back in 2016. This is the first century wreck

of a ship carrying a cargo of construction material<sup>1</sup>. The

objective of this visit to the site was to create a photogrammetric model of the wreck. No artefacts were removed in the course of the imaging process, nor was the distribution of finds at the site in any way

5.

**Some of the ceramic artefacts found during the investigation of the ballast heap / Dio keramičkih nalaza koji su otkriveni prilikom istraživanja balastne hrpe (Photo: R. Surić)**



sediment iskopavao pomoću mamut sisaljke, a svi arheološki nalazi stavljeni su u košare koje su vađene na brod. Svi nalazi su se na brodu dokumentirali, vagali i brojali, a ti podaci unošeni su u specijalne tablice. Na ovaj način nastojati će se dobiti šira slika o tipu i brojnosti arheoloških nalaza, a time i o karakteru i veličini nalazišta. Pronađeno je preko 3800 nalaza koji teže 601 kg. Većina nalaza može se okarakterizirati kao građevinski otpad, a riječ je o opekama, ulomcima krovnog



**6. An orthophoto model of the wreck with a cargo of roof tiles at the Kranje site on Vrgada; the roof tiles are indicated in red / Ortofoto model brodoloma s teretom krovnog crijepa na lokalitetu Kranje na Vrgadi, crvenom bojom označene hrpe crijepa (Photo: R. Surić)**

crijepa i dijelovima žbuke. Najznačajniji nalazi su ulomci novovjekovnog keramičkog posuđa, jer se tipološkom analizom tih ulomaka može datirati cijeli lokalitet. Od ostalih nalaza pronađene su i keramičke lule, ulomci stakla, kosti te metalni čavli. Preliminarnom tipološkom analizom arheološkog materijala lokalitet se može datirati u početak 19. st. Na osnovu karaktera nalazišta i vrste arheološkog materijala, ovaj lokalitet može se okarakterizirati kao balastna hrpa.

U sondažnom istraživanju na lokalitetu Lučina sudjelovali su i polaznici jednotjedne radionice podvodnog pregleda. Sudjelovanjem na ovakvom istraživanju polaznici su stekli znanje i iskustvo iz podvodnog arheološkog istraživanja, dokumentiranja i definiranja arheološkog materijala. Polaznici radionice sudjelovali su i u podvodnom pregledu potencijalnih arheoloških lokacija u zadarskom arhipelagu.

U podmorju otoka Vrgade još 2016. godine je otkriveno arheološko nalazište brodoloma s teretom građevinskog materijala koji se datiraju u 1. st.<sup>1</sup> Cilj ovogodišnjeg posjeta tom lokalitetu bila je





**7. Creating a photogrammetric model of the wreck at Kranje on the island of Vrgada / Izrada fotogrametrijskog modela brodoloma Kranje na otoku Vrgadi (Photo: M. Kaleb)**

disturbed. It was established that the site has two distinct areas.

Two sites were surveyed off Vir based on a report from Jurica Vučetić, a resident of the island. At Radnjača Cove we discovered a large number of amphorae sherds and construction material. The sherds date to the broad period from the first century BCE to the third century CE. The second survey location is in the waters of Cape Vrljja. Although its prominent position gives it great apparent archaeological potential, we did not identify cultural remains in the survey area.

On Ugljan island we surveyed the seabed at three separate locations. The first two lie to the east of the small islander town of Ugljan. All of these locations were selected based on reports from Ugljan resident Svemir Luštica. The first survey location is in Činta Cove (faced by Cape Činta). Along the eastern shores of this inlet, at a depth of three metres, we discovered a concentration of Roman period roof tiles. The following survey location was in the neighbouring Čeprijanda Cove - the survey of the seabed revealed an almost complete dearth of archaeological material.

The third location explored in the waters surrounding Ugljan lies to the west side of this Adriatic island. At Jankova Cove, where the rocky bottom transitions to

izrada fotogrametrijskog modela brodoloma. Prilikom snimanja nisu se uzimali arheološki nalazi niti se na bilo koji način remetio raspored nalaza na lokalitetu. Ustanovljeno je da je lokalitet podijeljen na dvije cjeline.

Na osnovu dojave Jurice Vučetića s otoka Vira, pregledane su dvije lokacije na tom otoku. U uvali Radnjača otkriven je veći broj keramičkih ulomaka amfora i građevinskog materijala. Pronađeni ulomci mogu se datirati u široki vremenski period od 1. st. pr. Kr do 3. st. Druga lokacija pregleda nalazi se u podmorju rta Vrljja. Iako se zbog istaknutog položaja radi o poziciji s velikim arheološkim potencijalom, nije pronađen arheološki lokalitet na poziciji pregleda.

Na otoku Ugljanu pregledano je podmorje na tri odvojene pozicije. Prve dvije pregledane pozicije nalaze se istočno od mjesta Ugljan na istoimenom otoku. Sve lokacije odabrane su na osnovu dojave Svemira Luštica iz Ugljana. Prva lokacija pregleda nalazi se na prostoru uvale i rta Činta. Uz istočnu obalu uvale, na dubini od oko 3 m otkrivena je koncentracija rimskog krovnog crijepa. Iduća lokacija na kojoj je izvršen podvodni pregled nalazi se u susjednoj uvali Čeprijanda, no podvodnim pregledom uvale gotovo da nije pronađen niti jedan arheološki nalaz.

Treća lokacija koja je pregledana na otoku Ugljanu nalazi se na zapadnoj strani otoka. U Jankovoj uvali, na mjestu gdje kameno dno prelazi u pješčano otkriveni su ostaci antičkog pristaništa. Na lokalitetu su otkriveni brojni keramički ulomci amfora, antičkog građevinskog materijala i keramičkih posuda. Ostaci pristaništa prepoznaju se u kamenoj strukturi širine 50 m. Sudeći po tipološkoj analizi arheoloških nalaza može se pretpostaviti da je operativna obala bila najviše u funkciji od 2. do 5. st.

Iduće pregledane lokacije nalaze se u podmorju južnog dijela otoka Sestrinja. Prva pozicija koja je pregledana je podmorje otočića Veliki Paranak. Pregledom nije uočen arheološki lokalitet, a na zapadnom dijelu otočića,

**8. Dive preparations at Radnjača Cove on Vir island / Priprema za zaron u uvali Radnjača na otoku Viru (Photo: M. Kaleb)**







**9. A diver during the surveying of the remains of an antiquity period dock in Jankova Cove on Ugljan island / Ronilac tijekom pregleda ostataka antičkog pristaništa u Jankovoj uvali na otoku Ugljanu (Photo: R. Surić)**

sandy, we discovered the remains of an antiquity period quay. Numerous ceramic sherds were discovered at the site from amphorae, as were fragments of antiquity period construction material and ceramic ware. The remains of the quay are visible as a masonry structure with a breadth of fifty metres. Judging from the typological analysis we can posit that the operational wharf saw its peak of peak of activity in the period from the second to fifth century.

The following locations we examined are situated in the waters off the south side of Sestrunj island. The first position we surveyed was in the waters of the diminutive islet of Veliki Paranak, where we did not identify an archaeological site. To the west of this islet, at a depth of eight metres, we found the upper section of a ribbed late Roman amphora.

The next two locations were surveyed on the basis of a report from islander Tomislav Švorinić of Sestrunj, who indicated the presence of artefacts in this area. The first of these positions was in Karanke Cove, situated to the southeast of the island facing the Rivanj channel.

na dubini oko 8 m otkriven je gornji dio narebrene kasnoantičke amfore.

Iduće dvije lokacije pregledane su na osnovu dojave Tomislava Švorinića iz Sestrunja, koji nas je uputio na postojanje arheoloških nalaza na ovom prostoru. Prva pozicija pregleda bila je uvala Karanke koja se nalazi na jugoistočnom dijelu otoka u Rivanjskom kanalu. Pregledano je podmorje čitave uvale, a na njenom najzapadnijem dijelu otkrivena je nakupina kamena s mnoštvom ulomaka keramičkog arheološkog materijala uokolo nje. Ova hrpa dimenzija je oko 50 x 40 m i od obalnog dijela se pruža do dubine od 3 m. Ovakva kamena nakupina može se okarakterizirati kao operativna obala ili pristanište za brodove u antičko vrijeme. Preliminarnom analizom arheološkog materijala koji je pronađen na ovom lokalitetu možemo zaključiti kako je pristanište najviše funkcioniralo u periodu od 1. st. pr. Kr. do kraja 1. st. po Kr.

U obližnjoj uvali Muline otkriven je kameni nasip ovalnog oblika koji se jednim dijelom spaja s postojećim suhozidnim molom na južnoj obali ove uvale. Uokolo

**10. The find of the upper section of an amphora at the antiquity period dock at Jankova Cove on Ugljan island / Nalaz gornjeg dijela amfore na antičkom pristaništu u Jankovoj uvali na otoku Ugljanu (Photo: R. Surić)**





We explored the seabed in the whole of the cove and discovered in its westernmost end a concentration of stones with an abundance of ceramic archaeological material around it. This mound covers some fifty by forty metres and runs from the shore to a depth of about three metres. This mound may be characterised as an antiquity period operational wharf or quay. The preliminary analysis of the archaeological material found at the site leads us to conclude that the dock structure saw its peak of activity in the period from the first century BCE to the end of the first century CE.

An oval bank of stones was discovered in nearby Muline Cove, part of which connects with an existing drystone mole structure on the south shore of this cove. Around this mound we saw a large number of fragmented archaeological ceramic material. For the most part these are sherds that can be attributed to Lamboglia 2 form amphorae, dated to the period from the first century BCE to the end of the first century CE. As was the case in the neighbouring inlet, here again we found an antiquity period dock. What remains unclear is why there would be two, by all accounts contemporaneous, docks at such close proximity.

This year's archaeological reconnaissance has contributed to our overall understanding of the archaeological potential awaiting discovery in the waters of Zadar County. The significance of continuity in surveying efforts of this kind is most evident if seen through the prism of the daily threats faced by our underwater cultural heritage. The burgeoning of the tourism industry, and the rapid growth in diving and fishing activity, is accompanied by the growing probability of any given site suffering some level of devastation. It is, in fact, through these multiannual efforts to monitor known archaeological sites and survey locations with substantial archaeological potential that we can make our contribution to the protection and promotion of the archaeological wealth of Zadar County.

<sup>1</sup>Kaleb, Pešić, 2016, 39, 40.



11.  
*The find of the upper section of a ribbed amphora / Nalaz gornjeg dijela narebrene amfore (Photo: R. Surić)*

nasipa nalazi se veći broj ulomaka keramičkog arheološkog materijala. Uglavnom se radi o ulomcima koji se mogu pripisati amforama Lamboglia 2 koja se datira u period od 1. st. pr. Kr. do kraja 1. st. Kao i u susjednoj uvali i u ovom slučaju se radi o antičkom pristaništu. Ostaje nejasno iz kojeg razloga se na maloj međusobnoj razdaljini nalaze dva, po svemu sudeći istovremena pristaništa.

Ovogodišnji program rekognosciranja doprinio je cjelokupnom poznavanju arheološkog potencijala koji se krije u podmorju Zadarske županije. Važnost kontinuiteta ovakvih pregleda vidi se najviše kroz prizmu svakodnevnih ugroza koje prijete podvodnoj kulturnoj baštini. Porastom turizma, kao i ronilačkih i ribarskih aktivnosti raste i vjerojatnost da će neki lokaliteti pretrpjeti određeni stupanj devastiranja. Upravo se višegodišnjim monitoringom poznatih arheoloških lokaliteta i pregledom pozicija s većim arheološkim potencijalom doprinosi zaštiti i promociji arheološkog blaga Zadarske županije.

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#### 12. The survey of the masonry structure in Karanke Cove on Sestrunj island / Pregled kamene strukture u uvali Karanke na otoku Sestrunju (Photo: R. Surić)





# INTERNATIONAL CONFERENCE “CONSERVATION AND RESTORATION IN UNDERWATER ARCHAEOLOGY: EXPERIENCES, METHODS AND NEW DISCOVERIES”

## MEĐUNARODNA KONFERENCIJA „KONZERVACIJA I RESTAURACIJA U PODVODNOJ ARHEOLOGIJI: ISKUSTVA, METODE I NOVE SPOZNAJE”

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The International Centre for Underwater Archaeology in Zadar in partnership with the University of Zadar, and under the patronage of the Ministry of culture and Zadar County, hosted an international conference “Conservation and restoration in underwater archaeology: experiences, methods and new discoveries” – CRUA 2019 in Zadar, Croatia from 24th to 26th October 2019.



The conference was thematically divided into three panels: *In situ* preservation of underwater archaeological materials and sites, *Application of new materials and technologies for conservation practice and continued review of established methods* and *Relevant methods for the preservation of underwater archaeological findings*.



CRUA 2019 is a conference primarily intended for experts in the conservation and restoration profession of underwater archaeological finds and sites, but open to anyone interested in this interdisciplinary activity.



**1. St. Nicholas church, opening of the CRUA 2019 conference, Assistant Minister Hrvoje Manenica, PhD / Crkva sv. Nikole, otvorenje međunarodne konferencije, pomoćnik ministrica dr. sc. Hrvoje Manenica (Photo: M. Kaleb)**





**2. St. Nicholas church, opening of the CRUA 2019 conference / Crkva sv. Nikole, otvorenje međunarodne konferencije (Photo: F. Trcera)**

The aim of the international conference was to present professional and scientific projects and the main purpose was to bring the importance of protecting and preserving the underwater cultural heritage closer to people.

The lectures were delivered by representatives of different institutions from Croatia and abroad and 23 lecturers from 13 countries (Slovenia, Italy, France, United Kingdom, Germany, Spain, Portugal, USA, Colombia, Republic of Korea and Croatia) participated at the conference.

The keynote speakers who moderated the conference panels and discussions were Quoc Khoi Tran (ARC-Nucléart, CEA, France), Barbara Davidde (High Institute for Conservation and Restoration, Ministry of Cultural Heritage and Tourism, Italy), Jean-Bernard Memet (A-CORROS Expertises, France) and Peter D. Fix (Texas A&M University, USA).

The CRUA 2019 conference was attended by 70 experts (15 countries) from different areas of specialization within the field of conservation and restoration.

The first day of the conference, Thursday, October 24th 2019, was held at the former St. Nicholas church. Welcome addresses were held by the Director of the ICUA in Zadar Mladen Pešić and the Assistant Minister in the Ministry of Culture Hrvoje Manenica, PhD. The conference was opened by Zadar County Prefect Božidar Longin.

The first panel under the title *In situ preservation of underwater archaeological materials and sites* was opened by the key speaker Barbara Davidde with her presentation "*In situ* conservation of underwater archaeological built heritage sites".

U organizaciji Međunarodnog centra za podvodnu arheologiju u Zadru te uz partnerstvo Sveučilišta u Zadru, a pod pokroviteljstvom Ministarstva kulture i Zadarske županije, od 24. do 26. listopada 2019. godine održana je međunarodna konferencija pod nazivom „Konzervacija i restauracija u podvodnoj arheologiji: iskustva, metode i nove spoznaje” – CRUA 2019.

Konferencija je bila podijeljena na tri glavne teme : *In situ* zaštita podvodnih arheoloških lokaliteta, Primjena novih materijala i tehnologija za konzervatorsku praksu i Relevantne metode za očuvanje podvodnih arheoloških nalaza.

CRUA 2019 je konferencija primarno namijenjena stručnjacima iz konzervatorsko-restauratorske struke podvodnih arheoloških nalaza i nalazišta, ali otvorena i za sve one koje zanima ova interdisciplinarna djelatnost. Cilj međunarodne konferencije bio je predstaviti stručne i znanstvene projekte, a osnovna svrha približiti građanstvu važnost zaštite i očuvanja podvodne kulturne baštine.



**3. St. Nicholas church, Keynote lecturers Barbara Davidde and Quoc Khoi Tran / Crkva sv. Nikole, glavni predavači Barbara Davidde i Quoc Khoi Tran (Photo: M. Kaleb)**

Predavanja su održali predstavnici različitih institucija iz Hrvatske i inozemstva, a sudjelovalo je 23 predavača iz 11 zemalja (Slovenija, Italija, Francuska, Velika Britanija, Njemačka, Španjolska, Portugal, SAD, Kolumbija, Republika Koreja, Hrvatska). Glavni predavači i moderatori panela bili su Quoc Khoi Tran (ARC-Nucléart, Francuska), Barbara Davidde (Institute for Conservation and Restoration, Ministry of Cultural Heritage and Tourism, Italija), Jean-Bernard Memet (A-Corros Expertise, Francuska) te Peter D. Fix (Texas A&M Sveučilište, SAD).

Na CRUA 2019 konferenciji sudjelovalo je ukupno 70-tak stručnjaka konzervatorsko-restauratorske struke različitog specijalističkog usmjerenja iz 15 zemalja.

Prvi dan konferencije, četvrtak 24. listopada 2019. godine, održan je u bivšoj crkvi sv. Nikole. Pozdravne





#### **4. ICUA Zadar workshop for ceramics / MCPA Radionica za keramiku (Photo: F. Trcera)**

The following lecturers gave their presentations:

- Josh B. Martin, University of Exeter, South West England, United Kingdom: "When does *In Situ* preservation stop being the First Option for protecting underwater cultural heritage?";
- Carla R. Andreu, Universidad Externado de Colombia, Columbia: "Local capacity building for the sustainable conservation of underwater archaeological material. The case of Bocachica's shipwreck, Cartagena de Indias";
- Andrea S. Catalá, Balearic Institute of Maritime Archaeology – IBEAM, Spain: "Ses Llumetes: The first century A.D. Roman shipwreck. A case of study for in situ preservation";
- Andrej Gaspari, Irena Šinkovec, University of Ljubljana, Faculty of Arts, Museum and Galleries of Ljubljana, Slovenia: "The Ljubljanica River Phenomenon - towards the implementation of the master plan for the integrated research, enhanced protection and presentation of an outstanding archaeological site"; presented by Katja Kavkler.

After delivered lectures and each debate presentation, the 2001 UNESCO Convention on the Protection of Underwater Cultural Heritage was also discussed.

The UNESCO Convention speaks about the conservation of underwater cultural heritage in situ as the first option in the protection of underwater archaeological finds and sites, but also of what happens when it cannot be carried out. The lecturers shared their experiences and ways of protecting the underwater sites, introducing the participants with the working methods and materials they use in their work. They have equally presented very positive experiences with the local communities' involvement and familiarization with the work of conservators and archaeologists, demonstrated documentation methods and ways of monitoring and showing such sites and findings.

Within the second topic entitled *Application of new materials and technologies for conservation practice*, the

govore održali su ravnatelj MCPA Zadar Mladen Pešić te pomoćnik ministrice kulture dr. sc. Hrvoje Manenica. Konferenciju je otvorio župan Zadarske županije Božidar Longin.

Prvi panel pod nazivom *In situ zaštita podvodnih arheoloških lokaliteta* otvorila je glavna predavačica Barbara Davidde sa svojim izlaganjem „In situ konzervacija podvodnih arheoloških nalazišta”.

Uslijedila su izlaganja sljedećih predavača:

- Josh B. Martin, Exeter Sveučilište, Velika Britanija: „Kad *In situ* zaštita prestaje biti Prva opcija za očuvanje podvodne kulturne baštine”;
- Carla R. Andreu, Sveučilište Externado, Kolumbija: „Izgradnja lokalnih kapaciteta za održivu zaštitu podvodnog arheološkog materijala. Slučaj brodoloma Bocachica, Cartagena de Indias”;
- Andrea S. Catalá, Balearski institut za pomorsku arheologiju – IBEAM, Španjolska „Ses Llumetes: rimski brodolom iz prvog stoljeća nove ere. Slučaj studije za *In situ* zaštitu”;
- Andrej Gaspari, Irena Šinkovec, Sveučilište u Ljubljani, Filozofski fakultet, Muzeji i galerije grada Ljubljane, Slovenija: „Fenomen rijeke Ljubljanice – prema provedbi glavnog plana integriranog istraživanja, pojčane zaštite i predstavljanja izvanrednog arheološkog nalazišta” – predstavila Katja Kavkler.

Nakon održanih predavanja te diskusije o svakoj pojedinoj temi, raspravljalo se i o samoj UNESCO-ovoj Konvenciji o zaštiti podvodne kulturne baštine iz 2001. godine. UNESCO-va Konvencija govori o očuvanju podvodne kulturne baštine in situ kao prvoj opciji u zaštiti podvodnih arheoloških nalaza i nalazišta, ali i tome što se događa u slučajevima kada se ona ne može provesti. Predavači su prenijeli svoja iskustva i načine zaštite podvodnih lokaliteta, upoznali slušaoce s metodama rada i

#### **5. University of Zadar, Keynote lecturer Peter D. Fix / Sveučilište u Zadru, predavanje glavnog predavača Petera D. Fixa (Photo: F. Trcera)**







next keynote speaker was Quoc Khoi Tran with a lecture entitled "Conservation of Composite Archaeological Artefacts by Radiation - Resin Curing".

The following lecturers joined the second panel:

- Eleanor Schofield, Mary Rose Trust, United Kingdom: "The development of new conservation strategies for the Mary Rose collection";
- Katja Kavkler, Institute for the Protection of Cultural Heritage of Slovenia, Slovenia: "Artificial ageing of consolidated waterlogged wood samples: influence on structure";
- Filip Rogošić, Miona Miliša, Arts Academy at Split University, Croatia: "Sometimes kitchen dishes and utensils, many years home to various living creatures, tomorrow's museum items";
- Sanja Martinez, Ivana Šoić, Neven Peko, University of Zagreb, Faculty of Chemical Engineering and Technology, Sisak Municipal Museum, Croatia: "The application of a novel EIS based device on underwater metallic objects from Sisak Municipal Museum";
- Barbara Grassi, Superintendence Archaeology Fine Arts and Landscape for the provinces of Como, Lecco, Monza and Brianza, Pavia, Sondrio and Varese. Ministry of Cultural Heritage and Tourism, Italy: "From the recovery to the museum display of archaeological woods: restoration and experimentation activities of the wet wood";
- Iva Paduan, RestArs, Croatia: "Deterioration of

materijalima koje koriste u radu. Jednako tako, iznijeli su vrlo pozitivna iskustva o uključivanju i upoznavanju lokalnih zajednica s radom konzervatora i arheologa, prikazali metode dokumentacije te načine monitoringa i prezentiranja takvih nalazišta i nalaza.

U središtu druge teme pod nazivom *Primjena novih materijala i tehnologija za konzervatorsku praksu* predstavio se idući glavni predavač Quoc Khoi Tran s predavanjem pod nazivom „Konzervacija kompozitnih arheoloških artefakata putem radijacije – stvrđivanjem smole”.

Drugom panelu zatim su se pridružili sljedeći predavači:

- Eleanor Schofield, Fondacija Mary Rose, Velika Britanija: „Razvoj novih konzervacijskih strategija za Mary Rose zbirku”;
- Katja Kavkler, Institut za zaštitu kulturne baštine Slovenije, Slovenija; „Umjetno starenje konsolidiranih uzoraka zamrznutog drva: utjecaj na stukturu”;
- Miona Miliša / Filip Rogošić, Umjetnička akademija, Sveučilište u Splitu, Hrvatska: „Nekad kuhinjsko posuđe

6.

*University of Zadar,  
CRUA 2019 family photo /  
Sveučilište u Zadru, CRUA  
2019 zajednička fotografija  
svih sudionika  
(Photo: Archive ICUA  
Zadar)*





**7. Visit to the Mašković Caravanserai in Vrana, Knights Templar ruins / Posjet Maškovića Hanu, ostaci templarske utvrde (Photo: M. Kaleb)**

calcareous stone artefacts exposed to underwater conditions”.

There was another discussion after the lectures ended. The subject was the development of techniques and sciences which generates almost daily research news in every field.

It was emphasized the importance and the need that conservation and restoration of the underwater heritage keep up to date development. It was likewise pointed out the necessity for conservator-restorers to keep up to date with the latest techniques, to develop and adopt new methods and exchange information to enable the objects from underwater archaeological sites being explored in the best possible way and professionally conserved and restored.

A tour of the ICUA's Gallery of underwater archaeology and a visit to the ICUA's workshops was organized for the CRUA 2019 participants at the end of the first day.

The second day of the conference was held on Friday, October 25th 2019, at the University of Zadar. The Vice Rector for Development Strategy and Publishing Professor Josip Faričić, Ph.D. welcomed the audience on behalf of the University's Rector Prof. Diana Vican, Ph.D.

i pribor, dugi niz godina dom raznih živih bića, sutra muzejski predmeti”;

- Neven Peko / Sanja Martinez / Ivana Šoić, Fakultet kemijskog inženjerstva i tehnologije, Sveučilište u Zagrebu, Gradski muzej Sisak, Hrvatska: „Primjena novog uređaja temeljenog na EIS-u podvodnim metalnim predmetima Gradskog muzeja Sisak”;
- Barbara Grassi, Superintendence Archaeology Fine Arts and Landscape for the provinces of Como, Lecco, Monza and Brianza, Pavia, Sondrio and Varese, Ministry of Cultural Heritage and Tourism, Italija: „Od oporavka do muzejskog prikaza arheoloških drva: restauracija i eksperimentalne aktivnosti mokrog drva”;
- Iva Paduan, RestArs, Hrvatska: „Pogoršanje vapnenastih kamenih artefakata izloženih podvodnim uvjetima”.

Nakon odslušanih predavanja uslijedila je još jedna rasprava. Tema je bila razvoj tehnike i znanosti koje gotovo svakodnevno donose novine na svim poljima. Istaknuta je važnost i potreba da konzerviranje i restauriranje podvodne baštine prati spomenuti napredak te nužnost da konzervatori-restauratori idu u korak s vremenom, razvijaju i prihvaćaju nove metode i međusobno razmjenjuju informacije kako bi predmeti s podvodnih arheoloških nalazišta bili što bolje istraženi, te kvalitetno i stručno konzervirani i restaurirani.

Po završetku prvog dana predavanja sudionicima CRUA 2019 konferencije organiziran je razgled MCPA Galerije podvodne arheologije te posjet radionica Odjela za konzerviranje i restauriranje Međunarodnog centra za podvodnu arheologiju u Zadru.

Drugi dan konferencije održan je u petak, 25. listopada 2019. godine na Sveučilištu u Zadru. U ime rektorice Sveučilišta prof.dr.sc. Dijane Vican prisutnima se obratio prorektor za strategiju razvoja i izdavaštvo prof.dr.sc. Josip Faričić.

Treći panel pod nazivom „Relevantne metode za očuvanje podvodnih arheoloških nalaza” vodila su dva glavna predavača - Peter D. Fix sa svojim izlaganjem „Važnost dizajnerskih sredstava u planiranju složenih konzervatorskih projekata: Tri studije slučaja” i Jean Bernard Memet s predavanjem „In situ zaštita metalnih olupina: iskustva, metode i novi projekti”.

U okviru trećeg panela predstavilo se sljedećih osam predavača:

- Young-Hwa Jung, Nacionalni istraživački institut za pomorsku kulturnu baštinu, Odjel za kulturnu baštinu, Republika Koreja: „Konzervacija podvodne kulturne baštine i podvodna arheologija u Koreji”;
- Toby Jones, Newport Muzej i Umjetnička galerija, Velika



The third panel entitled “Relevant Methods for the Preservation of Underwater Archaeological Findings” was led by two keynote speakers - Peter D. Fix with his presentation “The Importance of Design Aids in Planning Complex Conservation Projects: Three Case Studies” and Jean Bernard Memet with the presentation “On site conservation of metallic shipwrecks: experiences, method and new project”.

Eight lecturers were presented within the framework of the third panel:

- Young-Hwa Jung, West Sea Cultural Heritage Division, National Research Institute of Maritime Cultural Heritage, Republic of Korea: “Conservation of underwater cultural heritage and underwater archaeology in Korea”;
- Toby Jones, Newport Museum and Art Gallery, Newport City Council: “The Newport Medieval Ship, United Kingdom: Challenges of Conservation, Re-assembly and Display”;
- José A. Gonçalves, National Centre for Nautical and Underwater Archaeology, CNANS, Portugal: “20 years of Portuguese experiences in the conservation of archaeological waterlogged wood”;
- Siniša Bizjak, Ivo Donelli, Ivana Duvnjak, Arts Academy, University of Split, Croatia: “Experiences in conservation of Ancient Roman sarcophagi from the river Jadro”;
- Markus Wittköpper, Niels Bleicher, RGZM Mainz, Dendrochronologie Zürich, Germany, Switzerland: “Let’s have a sandwich! Salvage, conservation and restoration of a Swiss Neolithic door. A case study”;
- Gabriele M. Zink, Schloß Gottorf Foundation of Schleswig-Holstein State Museums, Germany: “No shrinkage, please! Conservation of leather and rope from the shipwreck *Princess Hedvig Sophia*”;
- Elisa F. Tudela, University of Cadiz, Spain: “Lead anchor stock of the Cádiz Museum - Study of alterations and conservation treatment”;
- Anita Jelić, ICUA in Zadar, Croatia: “The Early Croatian Boats from Nin – Re-conservation”.

The aim of the third panel was to present current experiences in underwater heritage restoration. The presentations ended in a lively discussion concerning different methods and working tools. Useful were the parts



8.  
**Museum of  
Nin Antiquities /  
Muzej Ninskih  
starina  
(Photo: R. Surić)**

Britanija: „Srednjovjekovni brod Newport: izazovi očuvanja, ponovne montaže i prezentacije”;

- José A. Gonçalves, Nacionalni centar za nautičku i podvodnu arheologiju – CNANS, Portugal: „Dvadeset godina portugalskog iskustva u konzervaciji arheološkog vodenog drva”;
- Siniša Bizjak / Ivo Donelli / Ivana Duvnjak, Umjetnička akademija, Sveučilište u Splitu, Hrvatska: „Iskustva u konzervaciji drevnog rimskog sarkofaga rijeke Jadro”;
- Markus Wittköpper / Niels Bleicher, RGZM Mainz, Dendrochronologie Zürich, Njemačka, Švicarska: „Idemo na sendvič! Spašavanje, konzervacija i restauracija vrata iz švicarskog neolitika. Studija slučaja”;
- Gabriele M. Zink, Schloß Gottorf Foundation of Schleswig-Holstein State Museums, Njemačka: „Molim bez skupljanja! Konzervacija kože i konopca s brodoloma “Princeza Hedvig Sophia”;
- Elisa F. Tudela, Sveučilište Cádiz, Španjolska: „Skladište olovnog sidra Muzeja Cádiz – Studije promjena i konzervacije” i
- Anita Jelić, MCPA Zadar, Hrvatska: „Starohrvatski brodovi iz Nina - rekonzervacija”.

Cilj trećeg panela bio je predstaviti dosadašnja iskustava u restauraciji podvodne baštine. Nakon predavanja razvila se poduža rasprava na kojoj se razgovaralo o različitim metodama i sredstvima rada. Od velike koristi bili su i dijelovi debate u kojoj su restauratori naveli neke negativne strane pojedinih metoda kako bi kolegama pomogli u sličnim situacijama u kojima se nerijetko nađu. Zadnji panel ponajviše je bio vezan uz problematiku



of the debate in which the restorers stated some negative aspects of certain methods in order to help colleagues in similar situations they often find themselves. The last panel was mostly concerned with the problem of wet wood preservation, which presents a considerable challenge to all those involved in the area and raises many problems. Within the second day of the conference a poster session was organized comprising 13 posters from 6 countries (Slovenia, Germany, Greece, China, Mexico and Croatia) thus showcasing conservation restoration projects as well as interesting, innovative and latest researches.

After the lectures ended at the University of Zadar, for the CRUA 2019 participants was organized a visit to the Mašković Caravanserai in Vrana and a dinner at the Heritage Hotel.

On the third day, Saturday, October 26th 2019, a visit to the city of Nin and the tour of the Museum of Nin Antiquities was planned. Two 11th century Croatian ships are kept in the Museum of Nin Antiquities on which the ICUA Zadar performs reconstruction works. The issue was addressed earlier at the conference by a conservation-restoration project manager Anita Jelić. Very useful and interesting discussion was developed among the wet wood conservation experts who made their suggestions and shared their experiences in working on similar complex interventions. Upon completion of the visit to Nin, the three-day conference officially ended.

We can say that the CRUA 2019 conference was successful because of the large number of participants and the submitted papers, and the fact that the world's leading experts in the field of conservation and restoration of underwater archaeological finds gathered in one place. As the organizer we are particularly pleased as it points out that the topics we have discussed are current and significant.

We believe the conference has accomplished its mission in connecting the experts from different countries in the field of conservation and restoration with the aim to develop international professional and scientific cooperation and education as well as sharing experiences.

Attention of the general public was also drawn to the value and preservation of underwater cultural heritage as well as the path in which certain underwater archaeological finds undergo from the moment when they were found under the water to being shown in museum spaces.

Conservation and restoration as a multidisciplinary activities go hand in hand with the advancement of science while existing methods need to be constantly studied and shared and upgraded with new experiences.

konzerviranja mokrog drva što svima koji se bave tim područjem predstavlja priličan izazov i otvara mnoge probleme.

U tijeku drugog dana konferencije održana je i poster sesija s ukupno 13 postera iz 6 zemalja (Slovenija, Njemačka, Grčka, Kina, Meksiko i Hrvatska) na kojima su predstavljeni konzervatorsko-restauratorski projekti te zanimljiva, inovativna i aktualna istraživanja.

Po završetku predavanja na Sveučilištu u Zadru, za sudionike CRUA 2019 konferencije organiziran je posjet karavanseraju Maškovića hanu u Vrani uz druženje i večeru u Heritage hotelu. Treći dan konferencije, subota 26. listopada 2019. godine, bio je rezerviran za posjet gradu Ninu te obilazak Muzeja ninskih starina. Unutar Muzeja izložena su i dva starohrvatska broda iz 11. st. na kojima MCPA provodi radove rekonzerviranja. O samoj problematici ranije je na konferenciji govorila voditeljica projekta konzervatorica-restauratorica Anita Jelić te se na tu temu razvila vrlo korisna i zanimljiva diskusija među stručnjacima za konzerviranje mokrog drva koji su dali svoje prijedloge i podijelili svoja iskustva u radu na sličnim kompleksnim zahvatima. Po završetku posjeta Ninu, službeno je završila trodnevna konferencija.

Možemo reći da je CRUA 2019 konferencija bila uspješna radi iznimno velikog broja sudionika te prijavljenih radova, a na jednom mjestu našli su se najveći svjetski stručnjaci na području konzerviranja i restauriranja podvodnih arheoloških nalaza. To nas kao organizatore posebno raduje te ukazuje da su teme o kojima smo raspravljali aktualne i značajne.

Vjerujemo da je konferencija ostvarila svoj zadatak, a to je povezivanje konzervatora-restauratora iz različitih zemalja s ciljem razvijanja stručno-znanstvene suradnje i obrazovanja kao i razmjene iskustava.

Također se široj javnosti, putem predavanja i priopćenja u medijima, skrenula pažnja o vrijednosti i očuvanju podvodne kulturne baštine te pojasnio put kojim pojedini podvodni arheološki nalazi prolaze od trenutka pronalaska pod vodenom površinom do njihovog izlaganja u muzejskim prostorima.

Konzerviranje i restauriranje kao multidisciplinarna djelatnost ide u korak s napretkom znanosti, a postojeće metode treba konstantno ispitivati i dijeliti iskustva te ih nadograđivati s novim spoznajama.



# WHAT HAPPENS TO A CERAMIC ARTEFACT WITHOUT DESALINATION? THE CASE OF A LAMBOGLIA 2 AMPHORA

## ŠTO SE DOGAĐA S KERAMIČKIM PREDMETIMA BEZ DESALINIZACIJE? PRIMJER AMFORE TIPA LAMBOGLIA 2

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Countless archaeological artefacts have been and continue to be recovered from seas around the world, providing fascinating insights into past lives, work, and pastimes, into greater or lesser artistic talent, and into misfortunes and everything else typical to human life. For us these are treasures that we wish, above all, to protect and preserve so that they may serve in the years and centuries to come as lasting testaments to our shared human history. Ceramic artefacts are the most frequent and most numerous

marine archaeological finds. Unlike metal and organic materials that are, once on the seabed, subject-as a rule-to rapid degradation processes, pottery is relatively stable and more resistant to marine activity. Not entirely, of course, which is most often evident in damage done to the ceramic surface. These objects spend centuries in the very specific environment of salty marine water. When extracting an artefact from the wet environment of the sea the critical first step is to keep the object moist, by no means to let it dry out. This is critical because the salt diffused through the fabric presents no danger to the artefact when dissolved in water, but when it dries the ensuing crystallisation causes the salt to expand in volume and leads to cracking, crazing and microfissures. A “good” example of these outcomes is evidenced by a Lamboglia 2 amphora received in 2017 by the International Centre



**1. Amphora prior to conservation treatment / Amfora prije konzervatorsko-restauratorskih radova (Photo: Z. Vrgoč)**

U podmorjima diljem svijeta otkiveno je i još se skriva mnoštvo arheoloških nalaza koji nam pružaju zanimljive informacije o životu, radu, hobijima, većoj ili manjoj umjetničkoj nadarenosti, nesrećama i sve onome tipičnome za ljudski život. Za nas oni su bogatstvo koje prvenstveno želimo zaštititi i sačuvati kako bi u svim godinama i stoljećima koji dolaze ostali trajni svjedoci zajedničke ljudske povijesti. Najčešći i najbrojniji arheološki nalazi u podmorju su keramički predmeti. Za razliku od metalnih i organskih materijala kod kojih se, jednom kada se nađu na morskom dnu, proces degradacije u pravilu brzo razvija, keramički nalazi su





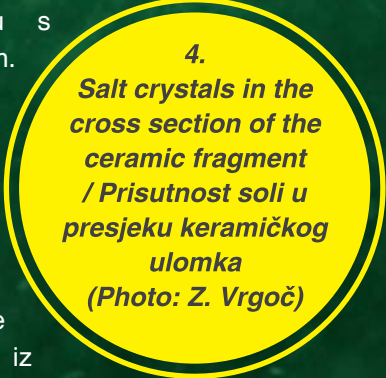
### 3. Postupak spajanja ulomaka keramike / The process of joining the ceramic fragments (Photo: Z. Vrgoč)

for Underwater Archaeology. A private client engaged the services of ICUA conservator-restorers to repair damage caused to this amphora when it fell from a metal stand it had stood on for years as an heirloom.

prilično stabilniji i otporniji na morsko djelovanje. Naravno, ne u potpunosti što je najčešće vidljivo na oštećenoj keramičkoj površini. Ti predmeti stoljećima se nalaze u specifičnoj okruženju – slanoj morskoj vodi. Po vađenju iz mora najvažniji je korak predmete zadržati u mokrom stanju, odnosno ne dozvoliti im da se osuše na zraku. Razlog tome su soli u strukturi predmeta koje otopljene u vodi ne predstavljaju velik problem, no u suhom stanju kristaliziraju čime im se povećava volumen te uzrokuju pucanja, napuknuća i mikropukotine na predmetima. Kao „dobar“ primjer posljedica tih procesa može nam poslužiti keramička amfora tipa Lamboglia 2, zaprimljena 2017. g. u Međunarodni centar za podvodnu arheologiju. Privatni investitor angažirao je konzervatore-restauratore MCPA da saniraju štetu na amfori nastalu padom amfore s metalnog postolja u kojem je godinama stajala kao dio obiteljskog naslijeđa.

Amfora je zbog toga bila fragmentirana, razbijena u 30-ak ulomaka. Već preliminarnim pregledom amfore moglo se ustanoviti da amfora nikada nije prošla postupak desalinizacije. Dokaz tome bile su vidljive soli kristalizirane u presjeku lomova amfore.

Prilična količina soli u keramičkoj strukturi dokazana je mjerenjima koncentracije klorida i električne provodljivosti na manjem fragmentu amfore potopljenom u kadu s deioniziranom vodom. Stoga je odlučeno da će amfora biti stavljena u postupak desalinizacije u vodovodnoj te potom u deioniziranoj vodi kako bi se precizno moglo pratiti izlučivanje soli, odnosno klorida iz





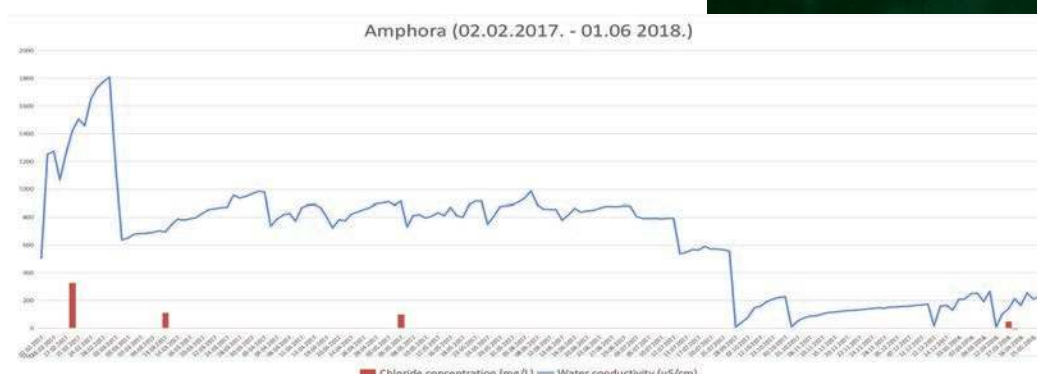
The amphora had fractured, broken into some thirty pieces. From the initial inspection it was immediately evident that this artefact had never undergone desalination treatment. This was obvious from the salt crystals visible in the cross-sections where the amphora had fractured.

Copious quantities of salt in the ceramic structure were confirmed by measurements of chloride concentration and of electrical conductivity on a small fragment submerged in a vat of deionised water. The solution was to subject the amphora to desalination treatment in fresh water and later in deionised water in order to precisely monitor the leaching of salts, i.e. chlorides, from the amphora. Given the visible minute fissures on the surface of the pottery it was clear right from the start that this process would prove neither simple nor easy and that the formation of new fissures on the amphora was to be expected.

The desalination procedure at ICUA began with the immersion of the amphora in a vat containing fresh water and the measurement of the electrical conductivity of the solution. The challenge faced by the conservator-restorers was evident from day one of desalination treatment: the amphora-upon contact with water-began visibly fragmenting.

The amphora not only developed fissures vertical to the surface, but also horizontally by layers. From the initial thirty fragments we thus came by the end of the desalination process to some one hundred fragments, many of which were delaminated layers of the amphora. In all phases of work the conservator-restorers handled the amphora with great care to prevent to the greatest possible extent any further fissuring. The desalination treatment lasted a full year and saw daily measurement of electrical conductivity and monthly measurement of chloride concentration in the solution.

#### **6. Daily measurements of the water conductivity and the measurements of the chloride concentration / Dnevna mjerenja provodljivosti vode i koncentracije klorida prikazano dijagramom** (By: M. Ćurković Madiraca)



#### **5. Measuring of the concentration of chlorides using potentiometric titration / Mjerenje koncentracije klorite na potencijometrijskom titratoru** (Photo: M. Ćurković Madiraca)

strukture amfore. Od početka je bilo jasno da taj postupak neće biti ni jednostavan ni lagan budući da su po površini keramike bile vidljive sitne pukotine te je bilo za očekivati i nova puknuća na amfori.

Desalinizacijski postupak u MCPA započeo je stavljanjem amfore u bazen s vodovodnom vodom i mjerenjem električne provodljivosti otopine. Problemi konzervatora-restauratora započeli su već prvi dan desalinizacije kada se amfora u dodiru s vodom naočigled počela sve više fragmentirati.

Amfora nije pucala samo okomito na površinu, već se lomila vodoravno po slojevima. Tako je od početnih 30-ak ulomaka do kraja desalinizacijskog procesa došlo do 100-njak fragmenata od kojih su mnogi bili razlistani slojevi amfore. Konzervatori-restauratori su u svim fazama pažljivo rukovali amforom pazeći da, koliko god je bilo u njihovoj moći, spriječe daljnja pucanja. Sam postupak desalinizacije trajao je godinu dana tijekom koje se svakodnevno pratila električna provodljivost otopine

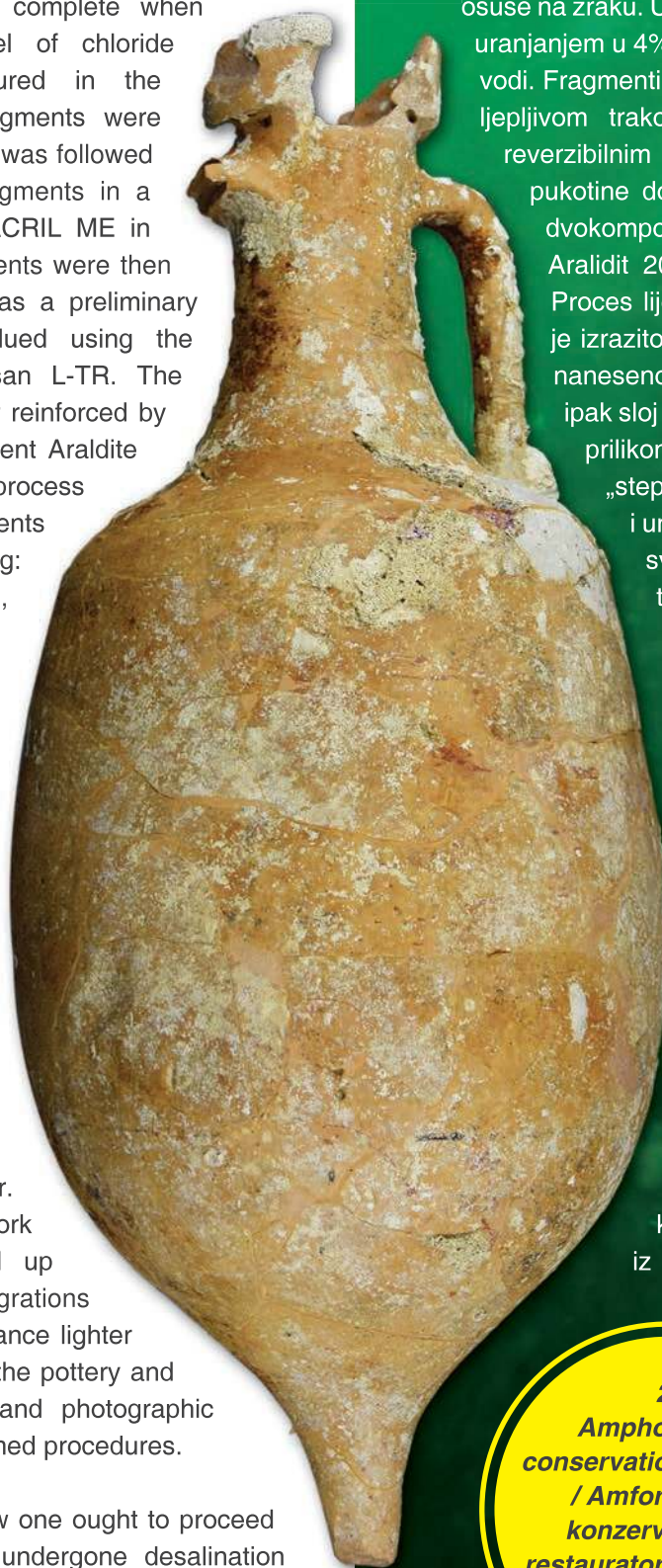
te mjesečna mjerenja koncentracije klorida u otopini.

Jednom mjesečno mijenjana je voda u bazenu. Kada je izmjerena minimalna konstantna koncentracija klorida u otopini, završilo se s desalinizacijskim



The water in the vat was replaced once a month. Desalination was deemed complete when a constant minimum level of chloride concentration was measured in the solution. The amphora fragments were then allowed to air dry. This was followed by consolidation of the fragments in a four per cent solution of ACRIL ME in deionised water. The fragments were then joined with adhesive tape as a preliminary measure, before being glued using the reversible adhesive Mecosan L-TR. The minute fissures were further reinforced by the injection of two-component Araldite 2020 epoxy adhesive. The process of gluing the ceramic fragments was exceedingly demanding: the layer of applied glue, namely, however thin, may cause unevenness, and we had to exercise the outmost caution to avoid this when joining the fragments, so that the outer and inner faces of the amphora would retain their original level surface. Only when this was achieved did we move forward with the necessary minor integrations on the amphora, done using alabaster plaster and worked with fine rasps and sandpaper. Conservation-restoration work on the amphora wrapped up with the toning of the integrations using acrylic colour to a nuance lighter than the original surface of the pottery and the production of written and photographic documentation on all performed procedures.

The question faced was how one ought to proceed with pottery that had not undergone desalination treatment upon extraction from the sea, and had dried out with salts in its structure that had no doubt already caused damage. Conservator-restorers currently offer a single feasible solution to this issue: the artefacts must be stored in controlled conditions, without major oscillations in moisture levels or temperature, and require constant monitoring. Having survived the initial shock of extraction from the marine environment, they require no further shocks, but rather careful handling and care to preserve them in the best possible condition in hope of some future conservation-restoration intervention.



postupkom. Fragmenti amfore potom su ostavljeni da se osuše na zraku. Uslijedila je konsolidacija ulomaka uranjanjem u 4% otopinu Acril Me u deioniziranoj vodi. Fragmenti su potom preliminarno slijepljeni ljepljivom trakom, a potom i trajno spojeni reverzibilnim ljeplilom Mecosan L-TR. Sitne pukotine dodatno su ojačane injektiranjem dvokomponentnog epoksidnog ljepila Araldit 2020 na mjesta manjim lomova. Proces lijepljenja keramičkih ulomaka bio je izrazito zahtijevan s obzirom da i samo naneseno ljepilo stvara premda tanki, ali ipak sloj te se moralo posebno paziti kako prilikom spajanja ne bi došlo do tzv. „stepenica“, odnosno kako bi i vanjska i unutarnja površina amfore ostala u svojoj savršenoj razini. Tek kada je to postignuto, uslijedile su izrade manjih integracija na amfori izvedene u alabaster gipsu te kasnije obrađene sitnim rašpama i brusnim papirom. Konzervatorsko-restauratorski postupci na amfori završili su toniranjem integriranih dijelova akrilnim bojama u nijansu blago svijetliju od originalne površine keramike te izradom pisane i fotodokumentacije o svim provedenim postupcima.

Na kraju se postavilo pitanje što učiniti s keramičkim predmetima koji nisu desalinizirani po vađenju iz mora već su osušeni i u svojoj strukturi imaju soli koje su im sigurno već naštetile?

Konzervatori-restauratori z a s a d a nude jedino i z g l e d n o rješenje ovog problema –

predmete treba pohraniti u kontrolirane uvjete, bez velikih oscilacija u vlazi i temperaturi te ih konstantno monitorirati. Budući da su predmeti već preživjeli prvotni šok po vađenju iz mora, ne bi ih se smjelo dodatno šokirati već se pažljivim ophođenjem i brigom pobrinuti da se što bolje očuvaju do nekih budućih konzervatorsko-restauratorskih zahvata.

**2.**  
**Amphora after**  
**conservation treatment**  
**/ Amfora nakon**  
**konzervatorsko-**  
**restauratorskih radova**  
**(Photo: Z. Vrgoč)**





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