

Submerged Heritage Potopljena baština

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IMPRESSUM

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Trenutak pronalaska antičke uljanice s reljefnim ukrasom kazališnih maski na Sestrici / The moment in which an ancient oil lamp with relief decoration of theatre masks at Sestrice was found (Photo: M. Kaleb)

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Ronilac iznosi jednu od amfora s nalazišta na otoku Sestrice kod Rovinja / The diver brings out one of the amphorae from the site off the island of Sestrice near Rovinj (Photo: M. Kaleb)



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Third Night of Museums at ICUA Zadar

Night of Museums culture events in 2018 were staged across Croatia on the 26th of January, with ICUA Zadar taking part for the third time. Visitors had an opportunity to view the Croatian Underwater Heritage exhibition free of charge at the ICUA gallery with the expert guidance of staff and volunteers. The gallery's permanent exhibition was completely renewed for this occasion bringing to the fore the display cases donated by the state museum in Dresden. Additional event content this year at the former St Nicholas church saw University of Zadar professors Igor Borzić PhD and Karla Gusar PhD presenting a new book on the archaeological excavations conducted by ICUA Zadar in the St Nicholas complex in Zadar. This three-hundred-page monograph details the multiannual archaeological and historical investigation of the St Nicholas monastic complex and was written by Luka Bekić PhD, Šime Vrkić, Mladen Pešić and Roko Surić.



2. The authors of the St Nicholas monograph with professors at the University of Zadar / Autori monografije Sv. Nikola s profesorima Sveučilišta u Zadru (Photo: M. Kaleb)

Gilding on Metal Lecture

Marta Stanić MA, a restorer with the University of Dubrovnik, offered a fascinating presentation at ICUA Zadar on the 26th of February 2018 on gilding techniques for metal objects. On hand for the lecture were restorers, conservators and archaeologists from Zadar.



1. As with every Night of Museums event the ICUA gallery saw many visitors / U Galeriji MCPA Zadar vladala je velika gužva, kao i za svaku Noć muzeja (Photo: R. Surić)

Treća Noć muzeja u MCPA Zadar

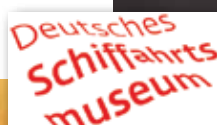
Noć Muzeja 2018, kulturni događaj koji se odvija na području cijele Hrvatske, održan je 26. siječnja, a treću godinu za redom u njemu je sudjelovao i MCPA Zadar. Posjetitelji su mogli besplatno razgledati izložbu "Hrvatska podvodna baština" u Galeriji MCPA pod stručnim vodstvom zaposlenika i volontera. Za ovu prigodu u potpunosti je obnovljen stalni postav galerije pri čemu su do izražaja došle nove vitrine iz donacije Državnog muzeja u Dresdenu. Ove godine su kao dodatni događaj u bivšoj crkvi sv. Nikole, profesori zadarskog sveučilišta prof. dr. Igor Borzić i prof. dr. Karla Gusar predstavili novu knjigu o arheološkim iskopavanjima MCPA Zadar na području sv. Nikole u Zadru. Ova monografija na tri stotine stranica govori o nekoliko godina arheoloških i povijesnih istraživanja unutar samostanskog sklopa Sv. Nikole, a napisali su je doc. dr. sc. Luka Bekić, Šime Vrkić, Mladen Pešić i Roko Surić.



3. Marta Stanić discusses gilding techniques / Na predavanju Marte Stanić govorilo se o pozlati (Photo: M. Stanić)

Inland Navigation Symposium in Germany's Jena

An international conference was staged in the German city of Jena on the topic of *River Valleys, Boats and Ports: Finds from Antiquity and the Middle Ages* (*Flusstäler, Flussschiffe, Flusshäfen - Befunde aus Antike und Mittelalter*). The gathering pooled dozens of specialists from across Europe and was organised by Dr Achim Hack, Dr Peter Ettel and Lars Kröger MA and the Friedrich-Schiller University of Jena. The lectures pointed to the great interest and value of traces of river navigation, with the Croatian contribution being a presentation of the Roman wreck in the Kupa River.



4. The congress in Jena in the medieval university cafeteria Zur Rosen / Kongres u Jeni održao se u srednjovjekovnoj sveučilišnoj menzi Zur Rosen (Photo: L. Bekić)

Tübingen hosts 23rd DEGUWA Conference

The Eberhard Karls University of Tübingen in Germany hosted the 23rd DEGUWA conference. The event was staged from the 15th to 18th of March 2018 on the topic of Water as a Resource (*Gewässer als Ressource*) with the lectures elaborating on the diverse uses of water and the appropriate requisite conditions. Among the many interesting lectures was one on the joint ICUA / RGK-DAI investigation of the shipwreck off the Island of Veruda. The international conferences organised by the German DEGUWA organisation always see an excellent turnout from researchers across Europe and is a showcase venue for all current news and new trends in the investigation of underwater heritage.

ICUA Joins UNESCO UNITWIN Underwater Archaeology Network

The 6th meeting of the UNESCO UNITWIN (University Twinning and Networking) network for underwater

Predavanje o pozlati metalnih predmeta

U MCPA Zadar se 26. veljače 2018. održalo zanimljivo predavanje o tehnologiji pozlate metalnih predmeta. Predavanje je održala Marta Stanić, mag. art., restauratorica sa Sveučilišta u Dubrovniku. Predavanju su nazočili zadarski restauratori i konzervatori te arheolozi.

Skup o plovidbi kopnenim vodama u Jeni

U njemačkom gradu Jena je održana je međunarodna konferencija s temom: "Riječne doline, brodovi i luke: nalazi iz antike i srednjeg vijeka (*Flusstäler, Flussschiffe, Flusshäfen - Befunde aus Antike und Mittelalter*). Ovaj skup na kojem je sudjelovalo više desetina stručnjaka iz cijele Europe, organizirali prof. dr. Achim Hack, prof. dr. Peter Ettel i Lars Kröger, M.A. te Sveučilište Friedrich-Schiller iz Jene. Predavanja su pokazala koliko mogu biti zanimljivi i vrijedni tragovi plovidbe u rijekama, a od hrvatskih tema predstavljen je rimski brodolom u rijeci Kupi.

Dvadeset treća DEGUWA konferencija održana uTübingenu

Na sveučilištu Eberhard Karls u Tübingenu, Njemačka, održana je 23. u nizu konferencija DEGUWA. Skup je održan od 15. do 18. ožujka 2018. godine. Tema skupa bila je "Vode kao sredstvo" (*Gewässer als Ressource*), tako da su predavanja razradila raznolikost načina korištenja voda i njihove odgovarajuće pozadinske uvjete. Među ostalim zanimljivim predavanjima bio je zastupljen projekt MCPA i RGK-DAI - istraživanje brodoloma kod



5. DEGUWA conference participants at Tübingen's Stiftskirche / Sudionici skupa DEGUWA u Tübingenu ispred Stiftskirche (Photo: H. Böhm)

archaeology was staged at UNESCO headquarters in Paris. The meeting took place on the 25th and 26th of April and was hosted by UNESCO and Flinders University of Australia, which currently coordinates the work of this network. The International Centre for Underwater Archaeology was granted the status of a recognised partner of the UNESCO UNITWIN network, making it the 35th UNESCO education institution in underwater archaeology. The UNESCO UNITWIN international network in underwater archaeology was set up with the objective of building and strengthening capacities through international cooperation and mobility. The intention of this international network is to improve the protection and investigation of underwater cultural heritage by creating networks between universities and professional training institutions that are active in the field of underwater archaeology and to be a bridge between the academic community, industry, governments and the public at large.

Lecture on Underwater Archaeology in Mexico

Andrés Raymundo Zuccolotto Vilalobos, a restorer and underwater archaeologist with the San Luis Potosí University in Mexico, gave a lecture at ICUA Zadar. The lecture focused on underwater cultural heritage in Mexico and in particular at the Reserva de la Biosfera Banco Chinchorro national park. His lecture was staged on the 8th of June 2018 before numerous gathered underwater archaeologists and restorers.

7. Andrés Raymundo Zuccolotto Vilalobos lectures at ICUA Zadar / Andrés Raymundo Zuccolotto Vilalobos drži predavanje u MCPA Zadar (Photo: M. Kaleb)



otoka Veruda. Međunarodne konferencije u organizaciji njemačke udruge DEGUWA uvijek su odlično posjećene od strane znanstvenika iz čitave Europe te mjesto na kojem se mogu pratiti sve aktualnosti i novi trendovi u istraživanju podvodne baštine.

Članstvo MCPA u UNESCO-ovoj UNITWIN mreži za podvodnu arheologiju

U Središnjem uredu UNESCO-a u Parizu održan je 6. sastanak UNESCO - UNITWIN (University Twinning and Networking) mreže za podvodnu arheologiju. Sastanak se održao 25. i 26. travnja 2018. g. u organizaciji UNESCO-a i Sveučilišta Flinders iz Australije,



6. Participants of the UNESCO UNITWIN Network for Maritime Archaeology meeting in Paris / Sudionici skupa UNESCO - Unitwin mreže u Parisu (Photo: UNESCO)

koje trenutno koordinira rad mreže. Međunarodnom centru za podvodnu arheologiju pritom je dodijeljen status „Priznatog partnera” UNESCO - UNITWIN mreže čime je postao 35 članica UNESCO-vih obrazovnih institucija u podvodnoj arheologiji. UNESCO - UNITWIN međunarodna mreža za podvodnu arheologiju osnovana je u cilju izgradnje i jačanja kapaciteta kroz međunarodnu suradnju i mobilnost. Namjera je međunarodne mreže unaprjeđivanje zaštite i istraživanja podvodne kulturne baštine stvaranjem veza između sveučilišta i ustanova za profesionalno osposobljavanje koje djeluju na području podvodne arheologije te da bude most između akademskog svijeta, industrije, vlade i javnosti.

Predavanje o podvodnoj arheologiji u Meksiku

Restaurator i podvodni arheolog sa Sveučilišta San Luis Potosí, Meksiko, Andrés Raymundo Zuccolotto Vilalobos održao je predavanje o u MCPA Zadar.

Continued excavation within the St. Nicholas complex in Zadar

For the purpose of adaptation of the former monastery of St. Nicholas to host the large Underwater Archeology Presentation Center of ICUA Zadar, it is necessary to carry out protective archeological research on multiple sites within the complex. This year, investigations were carried out in the yard, in the area where a new pavilion of experimental archeology shall stand. Traces of numerous periods, from the large waste pit with 19th-century finds belonging to the Austrian military hospital, through the medieval cemetery, up to Roman walls and large sewers, were discovered at this site. The research will continue next year.



8. Students of archaeology excavating in the St. Nicholas in Zadar / Studenti arheologije iskopavaju u sv. Nikoli u Zadru (Photo: L. Bekić)

Moscow Hosts International Marine Science Conference

An international conference was staged in Moscow from the 19th to 22nd of November of this year focusing on various fields of marine science. The Marine Research and Education (Морские исследования и образование) conference was hosted at a number of venues in the Russian capital including the zoological museum, the faculties of biology and of geology at the Lomonosov Moscow State University and the P. P. Shirshov Institute of Oceanology of the Russian Academy of Sciences. The section on underwater cultural heritage was held at the Shirshov institute and included lectures by experts with ICUA Zadar.



Tema predavanja je bila podvodna kulturna baština u Meksiku, a posebice stanje u nacionalnom parku Reserva de la Biosfera Banco Chichorro. Njegovo predavanje održano je 08. lipnja 2018. g. pred brojnim podvodnim arheolozima i restauratorima.

Nastavljeno iskopavanje u sklopu sv. Nikole u Zadru

U svrhu uređenja prostora bivšeg samostana sv. Nikole u veliki prezentacijski centar podvodne arheologije MCPA Zadar, potrebno je obaviti zaštitna arheološka istraživanja na više mjesta unutar sklopa. Ove godine su u srpnju provedena istraživanja unutar dvorišta, na prostoru gdje će se nalaziti novi paviljon eksperimentalne arheologije. Na tom mjestu otkriveni su tragovi iz brojnih razdoblja, od velike otpadne jame s nalazima iz 19. st. koji pripadaju austrijskoj vojnoj bolnici, preko srednjovjekovnog groblja pa sve do rimskih zidova i velike kanalizacije. Istraživanja će se nastaviti i naredne godine.

Međunarodna konferencija posvećena podvodnim znanostima u Moskvi

Od 19. do 22. studenog 2018. u Moskvi je održana velika međunarodna konferencija posvećena raznim znanstvenim disciplinama koje se bave podvodnim svijetom. Konferencija pod imenom "Морские исследования и образование" (Морские исследования и образование) održavala se na nekoliko mjesta u gradu; neke sekcije u Zoološkom muzeju i Biološkom fakultetu M. V. Lomonosova MGU, Geološkom fakultetu MGU te na Oceanografskom institutu P. P. Širšova RAN. Upravo na potonjem odvijala se sekcija o podvodnoj kulturnoj baštini na kojoj su predavanja održali i stručnjaci MCPA Zadar.



9. Underwater heritage poster section at the P. P. Shirshov Institute of Oceanology of the Russian Academy of Sciences / Sekcija postera podvodne baštine na Oceanografskom institutu P. P. Širšova Ruske akademije znanosti (Photo: L. Bekić)

EXCAVATION CONTINUES AT THE BARBIR ANTIQUITY HARBOUR IN SUKOŠAN

NASTAVAK ISTRAŽIVANJA ANTIČKE LUKE BARBIR U SUKOŠANU

Mladen Pešić mpesic@icua.hr

The Barbir site at Sukošan, discovered in 1973, is listed in Croatia's Registry of Cultural Property under number Z-29. In 2017 staffers with ICUA launched a project to investigate this antiquity period landing and to undertake the first archaeological excavations. Two trenches were investigated, each two by two metres, in the sandy bottom of the inner section of the antique harbour. The dig was conducted at Trenches 1 and 2, which were opened in order to gain better insight into the structure of the antique mole. During the investigation we discovered wooden structures related to the construction of Mole 1, which were dated using the radiocarbon method to the fourth century, while the overall analysis of the small finds from the Barbir harbour site confirmed that this area saw intensive use in the period from the late first to late fifth century.¹

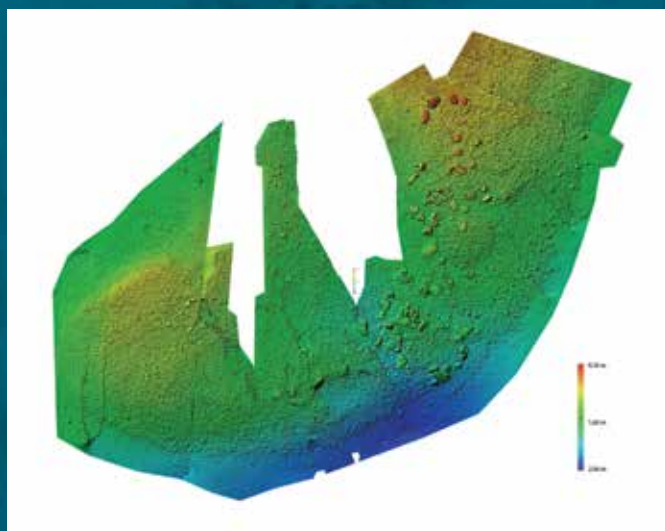
The underwater archaeological investigation of the harbour in Sukošan in 2018 continues on our work launched last year. In 2017 we began orthophoto imaging and the production of a 3D model of the features observed on the seabed at this antiquity period harbour. A series

of photographs were shot for processing in the Agisoft Photoscan software application and the result was a high-resolution image of a part of the Mole 1 area.

This year, in the frame of the VirtualArch project and in collaboration with the City of Zadar, we have



1. An example of an orthophoto image following computer processing / Primjer ortofoto snimke nakon kompjuterske obrade (Produced by: D. Badovinac)



2. A digital elevation model of the visible stone structure of Mole 1 / Digitalni elevacijski model vidljivih kamenih struktura Mola 1 (Produced by: D. Badovinac)

Nalazište Barbir, Sukošan upisano je u Registar kulturnih dobara RH pod brojem Z-29. Otkriveno je 1973., a tokom 2017. su djelatnici MCPA započeli projekt istraživanja ovog antičkog pristaništa i prva arheološka iskopavanja. Tada su na nalazištu istražene dvije sonde dimenzija 2x2 m na području unutrašnjeg dijela antičke luke na pjeskovitom dnu. Arheološka iskopavanja su obavljena i unutar Rova 1 i 2 koji su otvoreni radi uvida u strukturu gradnje antičkog mola. Tokom istraživanja su otkrivene drvene strukture vezane uz gradnju Mola 1 koje su pomoću C14 metode datirane tokom 4. st., a ukupna analiza pokretnih arheoloških nalaza iz luke Barbir potvrdili je da se ovaj prostor intenzivno koristio u periodu od kraja I. stoljeća pa sve do kraja 5. stoljeća.¹

Podvodna arheološka istraživanja antičke luke u Sukošanu tokom 2018. godine predstavljala su nastavak istraživanja koja su pokrenuta prošle godine. Tijekom 2017. godine smo započeli izradu ortofoto snimke i 3D modela nepokretnih struktura koje su zabilježene

secured funding for underwater imaging and data processing.

VirtualArch, a project the full name of

which is Visualize to Valorize – For a Better Utilisation of Hidden Archaeological Heritage in Central Europe, aims to contribute to the sustainable use and protection of not seen and lesser known archaeological sites, underwater and underground, in the programme area. The project include fieldwork aimed at producing survey imaging of sites, underwater photographic imaging and photographing of sites, producing orthophoto images and digital elevation models (DEMs).



As part of the implementation phase of the project we are collaborating with David Badovinac, our long time associate from the Aegir Visuals company in neighbouring Slovenia, who has undertaken imaging and data processing tasks. Over twenty thousand photos were shot in the course of six working days of the complete underwater structure of Moles 1 and 2. The site was surveyed by Maja Grgurić of the University of Zadar. During the underwater imaging detailed photography covered the entire area accessible to divers for imaging and related to the structure of the moles at depths of half a metre to 3.5 metres. The processing and merging of all the images shot created an orthophoto image of the visible stone structures at the surface of the seabed that constitute the antique harbour at Sukošan. The shots were first merged into a single image based on the individual days on which they were shot and later merged to create a view of the whole of the structure of Moles 1 and 2. After the images were overlapped based on the date of imaging we obtained a picture of the size of the site, the distribution of structures within it and their exact interrelations. The final result was a detailed image of all the features of the harbour at the site, which will help us better understand them.

This year we continued with the excavation of Trenches 1 and 2, with the total excavated area of Trench 1 now at four by one metres, while Trench 2 was excavated to an area of three by one metres. Progress at the dig was relatively slow on account of the large quantity of stones that had to be removed in the process. The maximum depth of the cultural layer was observed in the northeast end of Trench 2 and stood at 130 centimetres. In total we registered six different layers in the trenches, the most interesting of which is a layer that can be dated to the fourth century and that yielded the recovery of numerous finds. In this layer we found potsherds that are attributable to Aegean and African production (a lid of the Hayes 196 form, a sherd from a shallow bowl of the Hayes 61 A form dateable to between 325 and 400/420'), a piece of



3. Excavation at Trench 1 / Iskop unutar Rova 1 (Photo: M. Pešić)

u podmorju antičke luke. U tu svrhu snimljen je niz fotografija koje su naknadno obrađene u programu *Agisoft Photoscan*, a rezultat je slika dijela područja Mola 1 velike razlučivosti.

Ove godine smo u sklopu projekta *VirtualArch* u suradnji s gradom Zadrom osigurali financijska sredstva za obavljanje podvodnih snimanja i obradu podataka. *VirtualArch* je akronim za naziv projekta „*Visualize to Valorize – For a better utilisation of hidden archaeological heritage in Central Europe*“ čiji je cilj doprinijeti održivom korištenju i zaštiti nevidljivih i manje znanih arheoloških podvodnih i podzemnih nalazišta unutar programskog područja. Unutar projekta je obuhvaćen rad na terenu radi izrade geodetske snimke nalazišta, podvodno fotografsko snimanje i fotografiranje nalazišta, izrada ortofoto snimke i izrada digitalnog elevacijskog modela (DEM, *digital elevation model*).

U sklopu izvedbene faze projekta ugovorili smo suradnju s našim dugogodišnjim suradnikom Davidom Badovincem iz firme Aegir Visuals iz Slovenije koji je obavljao snimanja i obradu podataka. Tokom šest radnih dana napravljeno



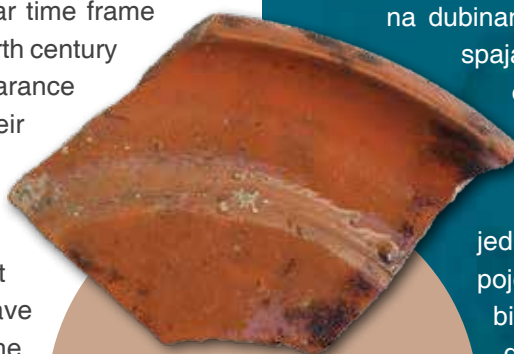
4. An orthophoto image of the west profile of Trench 1 / Ortofoto snimak zapadnog profila Rova 1 (Produced by: R. Surić)

worked wood of still unidentified purpose, seeds of olives, peaches, grapes and walnut shells, and a large group of antique coins. We registered 28 coins, some of which are highly corroded making it impossible to identify the imagery and legend, while others are well enough preserved that they can be approximately identified. In general, they are all from a similar time frame covering a period around the mid-fourth century as can be concluded from their appearance and size. The hypothesis, given their concentration at one very localised spot, is that they wound up on the seabed in this period, likely when a mariner or local inhabitant lost a pouch in which they may have been kept. The coins are from the period of the emperors Constantine II (337–340), Constans (337–350) or Constantius II (337–361) with the head of the emperor depicted on the obverse and various images on the reverse. One bears the legend VOT XX MVLX XXX and can be dated to the period around the mid-fourth century, while from the inscription SMKE in the exergue we can conclude that it was minted in the Turkish mint at *Cyzicus* (BAR 72).³ Another coin bears the image of the veiled emperor's head (*Divo Constantino*) and a person on the reverse clad in a toga standing between the inscription VN MR (BAR 73). These coins were struck in honour of the deceased emperor Constantine the Great, and minted during the reign of emperor Constantius II.⁴ On two coins we observe the mark of the mint at Aquileia. On the reverse of one is the image of two soldiers holding a spear and shield, between which is a banner (the *Gloria Excercitus* motif) and in the exergue the mint mark AQS (BAR 76).⁵ On the reverse of the other are two victories holding a wreath and the inscription AQT in the exergue, and it may be a coin of the emperor Constans or Constantius II (BAR 119).⁶

The dig at Trench 2 yielded the recovery of small finds and



5. Worked wood from Trench 1 / Obrađeno drvo iz Rova 1 (Photo M. Kaleb)



6. An African produced bowl of the Hayes 61 A form / Zdjela afričke proizvodnje forme Hayes 61 A (Photo: M. Kaleb)



7. An African produced lid of the Hayes 196 A form / Poklopac afričke proizvodnje forme Hayes 196 A (Photo: M. Kaleb)

je preko 20 000 fotografija cjelokupnih podvodnih struktura Mola 1 i 2. Geodetska snimanja nalazišta izvršila je Maja Grgurić sa Sveučilišta u Zadru. Prilikom podvodnih snimanja detaljnim fotografijama je pokriveno cjelokupno područje koje je ronocu dopuštalo da obavi snimanje, a vezano je uz antičku strukturu molova na dubinama od 0,50 m do 3,5 m. Obradom i spajanjem svih fotografija, izrađena je ortofoto snimka vidljivih kamenih struktura na površini morskog dna koje čine antičku luku u Sukošanu. Snimke su se prvo spajale u jedinstvenu cjelinu prema svakom pojedinom danu kada su napravljene, da bi se naknadno njihovim povezivanjem dobila cjelokupna struktura Mola 1 i 2. Nakon preklapanja slika po daniima snimanja, dobili smo uvid u veličinu nalazišta, raspored struktura na njemu te njihove točne međusobne odnose. Završni rezultat je detaljna slika cjelokupnih nepokretnih struktura antičke luke na nalazištu koje će pomoći njihovom boljem razumijevanju.

Ove godine se nastavilo i s iskopom Rovova 1 i 2, čime je ukupna istražena površina Rova 1 iznosila 4 x 1 m, dok je Rov 2 istražen u dimenzijama 3 x 1 m. Iskopavanja su napredovala relativno sporo radi velike količine kamena koji se morao skidati prilikom iskopa. Maksimalna debljina kulturnog sloja zabilježena je na sjeveroistočnom dijelu Rova 2 i iznosila je 130 cm. Ukupno je zabilježeno 6 različitih slojeva koji se javljaju unutar sonde, a najzanimljiviji je bio sloj koji se može datirati u period 4. st. i koji u kojem su otkriveni brojni nalazi. Unutar tog su sloja nađeni ulomci keramičkih posuda koje se mogu pripisati egejskoj i afričkoj proizvodnji (poklopac forme Hayes 196, ulomak plitke zdjele forme Hayes 61 A koja se može datirati od 325. do 400./420.²), obrađenog drvo za sada nedefinirane namjene, sjemenke masline, breskve, grožđa i ljuske oraha te veća skupina antičkih



BAR 72



BAR 73



BAR 76



BAB 119

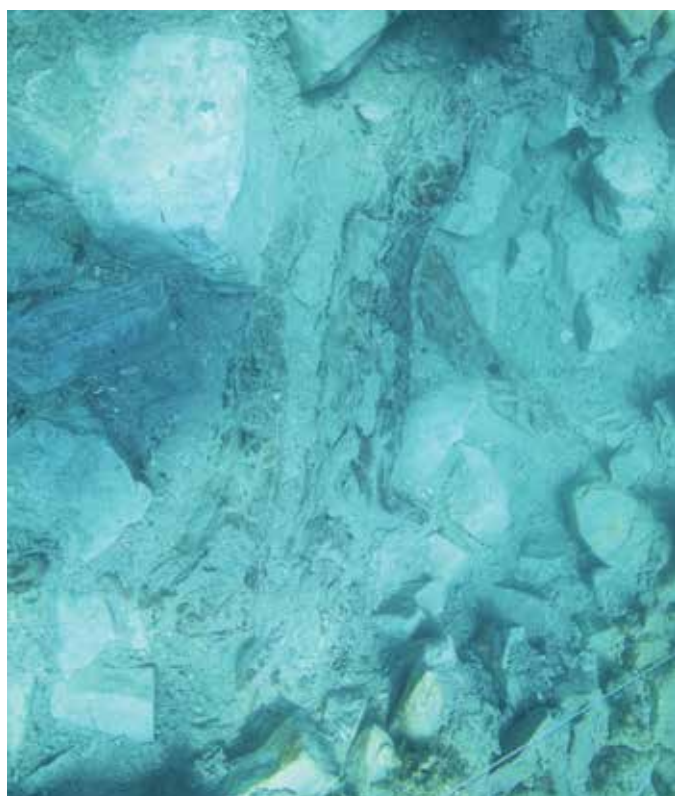


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5

8. Part of a late antique coin from Trench 1 / Dio kasnoantičkih novčića iz Rova 1 (Photo: M. Pešić)

offered new insight into the construction methods used in building antiquity period landing structures. In the course of this year's dig we uncovered a layer that consisted of a series of unworked timbers. We observed four large logs (with diameters of 15 to 18 centimetres) and three smaller logs (with diameters of less than 10 centimetres). Although not arranged in any order we can see that they



9. The layer with wooden finds in Trench 2 / Sloj s nalazima drva unutar Rova 2 (Photo: M. Pešić)

novčića. Zabilježeno je 28 komada novčića od kojih su neki dosta korodirani, pa se na njima ne može definirati prikaz i tekst, dok su neki dovoljno dobro očuvani da se mogu pobliže definirati. Generalno govoreći, svi pripadaju u slično razdoblje u periodu oko sredine 4. st., što se može zaključiti prema njihovom izgledu i veličini. Pretpostavka je da su na morsko dno dospjeli u istom periodu, budući da su koncentrirani na jednom užem mjestu, vjerojatno nakon što je neki mornar ili lokalni stanovnik zagubio vrećicu u kojoj su mogli biti čuvani. Novčići su datirani u period careva Konstantina II (337. - 340.), Konstansa (337. - 350.) ili Konstancija II (337. - 361.) s glavom cara prikazanom na aversu, i različitim prikazima na reversu. Jedan nosi natpis VOT XX MVLT XXX te se može pobliže datirati u period oko sredine 4. st., dok se prema natpisu SMKE u odsječku može zaključiti da je kovan je u Turskoj kovnici *Cyzikus* (BAR 72).³ Drugi na aversu ima prikaz glave cara s velom (*Divo Constantino*), a na reversu jednu osobu u togi koja stoji između natpisa VN MR (BAR 73). Ti su novčići izrađivani u čast pokojnog cara Konstantina Velikog, a kovan je za cara Konstancija II.⁴ Na dva novčića se prepoznaje oznaka kovnice u Aquileji. Jedan na reversu ima prikaz dva vojnika koji drže koplje i štit između kojih je zastava (motiv *Gloria Excercitus*) i u odsječku oznaku kovnice AQS (BAR 76).⁵ Drugi na reversu ima prikaz dvije viktore koje drže vijence, na odsječku ima oznaku AQT i mogao bi pripadati caru Konstansu ili Konstanciju II (BAR 119).⁶

Iskop unutar Rova 2 nam je osim pokretnih arheoloških nalaza pružio nova saznanja o načinu gradnje antičke pristanišne strukture. Tokom ovogodišnjih iskopavanja otkriven je sloj koji se sastojao od niza drvenih neobrađenih balvana. Unutar sonde su zabilježena četiri veća balvana (promjer 15-18 cm) i tri manja (promjera manje do 10 cm).

were laid parallel to the direction of the outer edge of the mole. At places they lie next to one another and at others over one another. These were evidently structural elements used in the course of the construction of the mole, perhaps to reduce the load of the stone fill along its vertical structure. The mole was built by ramming vertical piles that formed the outer edge (discovered in 2017), whereupon the interior was filled with sandy material, followed by the laying of the above mentioned logs, with the final layer of the structure composed of large random stones laid atop the wood.

In general the founding of this harbour can be placed in the period from the mid-first to mid-second century as indicated by the dating of the wooden elements from the trenches in the harbour, and individual small archaeological finds. We do not yet know how much of the space was in use during this initial phase given that it was most likely negated by subsequent construction and broadening of the harbour. The second phase is dated on the basis of the analysed material and the radiocarbon analysis to the fourth century, although intensive activity at this harbour continued after this period.

In all, the excavation at the Barbir antiquity harbour site at Sukošan has shown exceptional potential with regard to our knowledge of the construction systems applied at antique landings. There are still many questions outstanding requiring further illumination and we hope for further excavation with the aim of obtaining a clearer picture of the function of the harbour in the broader Zadar area in antiquity and its status in the coastal and hinterland economy.



10. Awaiting the next dive in the hot September sun / U iščekivanju zarona na vrućem rujanskom suncu (Photo: M. Pešić

Iako nisu slagani u pravilnom redu, može se definirati da su bili položeni paralelno uz pravac vanjskog ruba antičkog mola. Na nekim mjestima su položeni jedan uz drugi, a na pojedinim mjestima se nalaze jedan preko drugog. Očigledno je da se radi o strukturalnim elementima koji su se koristili prilikom gradnje antičkog mola, možda da se smanji opterećenje kamena koji je zasipan uz vertikalnu strukturu mola. Antički je mol građen na način da je nakon zabijanja vertikalnih pilona koji su tvorili vanjski rub mola (otkrivenih 2017.), njegova unutrašnjost zasipavana pjeskovitim materijalom, zatim su se polagali navedeni balvani, da bi završni sloj strukture mola bio sastavljen od većeg nepravilnog kamenja koje je nabacano na drvo.

Generalno govoreći, sam nastanak luke se može smjestiti u period od polovice 1. do polovice 2. st. kada su datirani drveni elementi iz sonde unutar luke, te pojedini pokretni arheološki nalazi. Za sada još ne znamo koliki prostor se koristio tokom te prve faze, budući da su nju najvjerojatnije negirale naknadne gradnje i proširenje luke. Druga faza datirana je na osnovu analiziranog materijala i C 14 analiza u period 4. st., ali je intenzivan život u luci nastavljen i nakon toga.

Sveukupna istraživanja antičke luke u Barbir u Sukošanu pokazala su izniman potencijal koji je vezan uz otkrivanje sustava gradnje antičkih pristanišnih struktura. Postoje još mnoge nepoznanice koje još trebamo otkriti, te se nadamo i daljnjim istraživanjima radi jasnijih definiranja funkcija luke unutar šireg zadarskog prostora u antici, te njenoj važnosti u ekonomskom sustavu priobalja i zaleđa.

1 Pešić 2017, 11-16.

2 Hayes 1972, 107.

3 RIC 1981, 52, Pl. 25. 132;

<http://www.tesorillo.com/aes/066/066.htm>.

4 RIC 1981, Pl. 22. 68, Pl. 24. 48, Pl. 25. 46, Pl. 27. 112;

<http://www.tesorillo.com/aes/017/017.htm>.

5 RIC 1981, Pl. 13. 25;

<http://www.tesorillo.com/aes/030/030.htm>.

6 RIC 1981, Pl. 13. 87;

<http://www.tesorillo.com/aes/107/107.htm>.

Bibliography / Literatura:

Hayes, J. W. 1972. - Late Roman Pottery, London–Roma.

RIC 1981.- The Roman Imperial Coinage, Vol VIII, London.

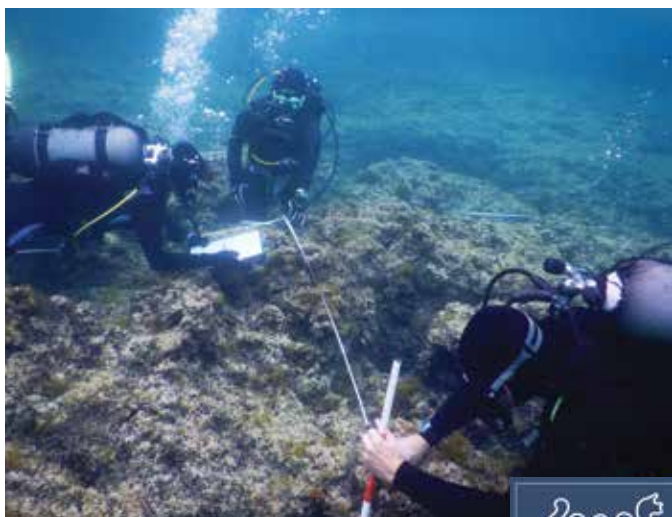
Pešić, M. 2017. - Excavations at the antiquity period harbour at the Barbir site in Sukošan / Istraživanja antičke luke Barbir u Sukošanu, Submerged Heritage / Potopljena Baština 7, Zadar. 11-16.

<http://www.tesorillo.com> (8.11.2018)

SYSTEMATIC EXCAVATION STARTS AT ROVINJ'S VELIKA SESTRICA ISLAND ROMAN WRECK SITE

ZAPOČETO SUSTAVNO ISTRAŽIVANJE RIMSKOG BRODOLOMA KOD OTOKA VELIKA SESTRICA KOD ROVINJA

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1. Step one was to set up a measured grid of fixed points / Prvo je postavljeno izmjereno mrežište fiksnihih točaka (Photo: M. Pešić)

The International Centre for Underwater Archaeology in Zadar's multiannual Shipwrecks of Rovinj project, supported by the City of Rovinj Tourism Board, this year saw the launch of excavation at a new site. It was discovered in 2013 based on a report submitted by Marko Srećec of the Old Diver diving club at Kolone Cove (Bekić 2013, 47). ICUA Zadar staffers examined the location following the report to determine whether it was in fact the site of a wreck. The initial survey saw the recovery of eleven typologically identifiable archaeological finds, most of which can be attributed to parts of the Forlimpopoli type amphora. Also observed at the site was an abundance of stone slabs and cuboid blocks of various sizes that may have been a part of the ship's cargo.

U sklopu dugogodišnjeg projekta "Rovinski brodolomi" koji Međunarodni centar za podvodnu arheologiju u Zadru provodi uz pomoć Turističke zajednice Grada Rovinja, ove godine započela su istraživanja na novom nalazištu. To je nalazište otkriveno 2013. g. na dojavu Marka Srećeca iz ronilačkog centra Old Diver u Kolonama (Bekić 2013, 47). Tada su djelatnici MCPA Zadar pregledali i ovu lokaciju kako bi provjerili da li je uistinu riječ o ostacima brodoloma. Već na prvom pregledu pronađeno je 11 tipološki odredivih arheoloških nalaza, koje većinom možemo pripisati dijelovima amfora tipa "Forlimpopoli". Uz njih na nalazištu je primijećeno i mnoštvo pločastih i kvadratnih kamenih blokova raznih dimenzija za koje se sumnja da možda pripadaju teretu broda.

Nakon što je prošle godine završeno istraživanje



2. One of the larger stone slabs on the seabed / Jedan od većih pločastih kamenih blokova na dnu (Photo: L. Bekić)



3. Excavation began at small cavity J1 / Prvo se iskopavala manja pećina J1
(Photo: L. Bekić)

With the excavation of the late antique shipwreck at the Piruzi rocks completed last year, the archaeological team moved this year to the Velika Sestrica site. Joining the ICUA Zadar staffers again for this campaign were members of the Bavarian Society for Underwater Archaeology (Bayerischen Gesellschaft für Unterwasserarchäologie - BGfU) from Germany. Joining the City of Rovinj Tourism Board in providing funding for excavation this year was the Croatian culture ministry. The excavations were conducted from the 13th to 21st of June 2018 with the Old Diver centre at Kolone Cove, as the nearest diving facility, serving as our logistics base.

Luka Bekić PhD served as field director for this underwater campaign, with Mladen Pešić serving as deputy field director. Also on the team were Max Fiederling, Michael Heinzlemier, Marko Runjajić, Maja Kaleb, Roko Surić, Borna Krstulović, Marko Srećec and Kees Post.

Sherds from the cargo of pottery are scattered over a relatively broad area on the seabed, with most, however, at a depth of about two metres and lying around a long flat rock. The sherds are found in the larger cavities in the

kasnoantičkog brodoloma kod hridi Piruzi, arheološka ekipa se ove godine prebacila na otočić Velika Sestrica. Osim djelatnika MCPA Zadar, u istraživanjima su već tradicionalno sudjelovali i članovi Bavorskog društva za podvodnu arheologiju (Bayerischen Gesellschaft für Unterwasserarchäologie - BGfU) iz Njemačke, a uz TZ Grada Rovinja, ove godine je sredstva za istraživanje doznačilo i Ministarstvo kulture RH. Istraživanje je provedeno u razdoblju od 13. do 21. lipnja 2018. g., a kao logistička baza korišten je ronilački centar *The Old Diver* u Kolonama, kao najbliži ronilački centar.

Stručni voditelj radova podvodnog arheološkog istraživanja bio je doc. dr. sc. Luka Bekić, a zamjenik voditelja Mladen Pešić. U istraživanju su sudjelovali i Max Fiederling, Michael Heinzlemier, Marko Runjajić, Maja Kaleb, Roko Surić, Borna Krstulović, Marko Srećec te Kees Post.

Ulomci keramičkog tereta razbacani su na razmjerno velikoj površini morskog dna, međutim najviše ih je na dubini od oko 2 m, u okolici duge kamene pločaste stijene. Leže u većim jamama u živoj stijeni kao i u nekim nadsvođenim pećinastim prosjecima. Pločasto i kvadratasto kamenje raspršeno je na otprilike istom prostoru kao i keramički ulomci. Stoga je radna ekipa dobila različite zadatke. Neki su dobili zadatak izraditi fotogrametrijski nacrt morskog dna,



4.
Fragments of glass urns
/ Ulomci staklenih urni
(Photo: M. Kaleb)



5. It seems that the best finds are always recovered on the final date of excavations / Najbolji nalazi uvijek se nađu zadnji dan istraživanja

(Photo: M. Pešić)

bedrock and in some vaulted recesses. The stone slabs and cuboids are scattered over about the same area as the potsherds. The team members were therefore given different assignments. Some of the team was tasked with creating a photogrammetric map of the seabed, while others began setting the baseline and fixed points that would be used to produce a drawing of the site based on analogue measurements, indicating the positions of the larger stone blocks and the cavities that would be excavated. With this taken care of a third group was able to begin work on the excavation of the interesting crevices between the rocks. Excavation thus began in cavity 1, a low and elongated recess. The excavation immediately yielded the recovery of sherds of the neck and handles of amphorae and one base from a glass vessel. The excavation continued in the following cavities, with seven excavated in total in the course of this campaign.



dok su drugi započeli s postavljanjem osnovne linije i fiksnih točaka kojima će se analognim izmjerama izraditi osnovni nacrt nalazišta, s položajem većih kamenih blokova i jama koje će se istraživati.

Zahvaljujući tome, treća skupina već je mogla započeti s iskopavanjem zanimljivih procijepa među stijenama. Iskopavanje je tako započelo u jami 1, odnosno niskoj ali izduženoj pećini. Već na početku istraživanja u pećini su pronađeni ulomci grla i ručaka amfora kao i jedno dno staklene posude. Nastavljeno je iskopavanje u narednim jamama, pa ih je tako istraženo sveukupno sedam u ovoj kampanji.

Osim iskopavanja u jamama, ronionci su prikupljali i površinske ulomke dijagnostički značajnih ulomaka po cijelom prostoru nalazišta. Svaki površinski prikupljen ulomak dobio je svoj broj te mu je položaj dokumentiran trilateracijom s najbližih fiksnih točaka. Na taj način je započela izrada karte rasprostiranja važnijih nalaza.

Sveukupno je prikupljeno 190 posebnih nalaza, uglavnom tipološki prepoznatljivih ulomaka amfora ali i dijelova staklenih i keramičkih posuda, tegula, uljanica, metala itd. Posebice je zanimljiva cjelovita uljanica s oznakom Fortis, koja na gornjem dijelu ima reljef dvije kazališne maske. Pronađeno je pet ulomaka nekih većih staklenih urni kao i jedna bakrena pločica. Velika većina amfora, preko 107 ulomaka, pripada tipovima Forlimpopoli amfora u raznim inačicama veličine. Slijedeća po redu je amfora tipa Dressel 2-4, od koje je prepoznato 7 ulomaka. Postoji još desetak ulomaka zasad neprepoznatih amfora.

Na kraju ostaje pitanje kamenih blokova razasutih na morskom dnu. Veći blokovi su ucrtani u nacrt nalazišta te su im izmjerene dimenzije. Manji blokovi koji su se nalazili u istraživanim jamama su zasebno nacrtani u svojim dimenzijama. Uzeto je nekoliko blokova i uzoraka kako bi se napravila geološka analiza. Ako se potvrdi da je riječ o kamenu koji ne potječe s otoka Sestrice, možemo zaključiti kako je riječ o brodskom teretu kamenih poluproizvoda.



6. The finds are deposited deep in the clefts between the rocks / Nalazi su zatrpani duboko u procjepima između stijena (Photo: M. Pešić)

Along with the excavation in the cavities our divers collected diagnostically significant surface finds across the whole of the site area. Each collected surface find was immediately assigned a number and its position was documented using the triangulation method from the closest fixed points. This was the first step in producing a

map of the distribution of key finds.

A total of 190 special finds were collected, for the most part typologically identifiable amphorae sherds, but also including sections of glass and other ceramic vessels, tegulae, oil lamps, metals and so forth. Of particular interest is an integrally preserved oil lamp with the Fortis mark bearing a relief image of two theatrical masks on its upper section. Five fragments from large glass urns and one small copper plate were recovered. The majority of the amphorae sherds, 107, are from the Forlimpopoli type of various size variations. The next most represented are from the Dressel 2-4 type, with seven identified sherds. There are also some ten other sherds from for now unidentified amphorae.



7. A Forlimpopoli type amphora / Amfora tipa "Forlimpopoli"
(Photo: M. Kaleb)

There is also the question of the stone blocks scattered across the seabed. The larger blocks are indicated in the site drawing and their dimensions have been measured. Separate drawings and measurements were made of the smaller blocks found in the excavated cavities. Several blocks and samples were taken for geological analysis. If we get confirmation that the stone does not originate from Sestrica Island we can conclude that this was a cargo of stone intermediate goods.

The larger stone blocks measure about 50 x 50 x 30 centimetres, while the smaller blocks measure about 30 x 30 x 15 centimetres. The cuboid blocks are about 24 x 20 x 10 centimetres or less. There are also interesting conical blocks, one of which has traces of drilling at three points, possibly indicating the initial stages of the fabrication of a stone anchor. The final conclusions regarding this possible stone cargo will, however, have to await a more detailed analysis of both the material and the forms.

This year's underwater excavation in the Rovinj area was conducted at the remains of an as yet unidentified antique shipwreck with a cargo of amphorae and, possibly, of stone intermediate goods off Velika Sestrica Island. This is the first excavation campaign at the site of what for now appears to be a second century Roman wreck, this conclusion being based on the recovered amphorae and other artefacts that belonged the ship's crew. Further investigation, planned for the coming year, will shed more light on the details of the ship and of the possible cargo of stone intermediate goods.

Veći kameni blokovi su dimenzija oko 50 x 50 x 30 cm, dok su manji oko 30 x 30 x 15 cm. Kvadratasti blokovi su otprilike dimenzije 24 x 20 x 10 cm i manji. Zanimljivi su i stožasti oblici blokova, od koji jedan ima tragove bušenja na tri mjesta, pa izgleda kao da je započeta izrada kamenog sidra. No konačni sud o potencijalnom kamenom teretu morati će se donijeti tek nakon detaljne analize materijala i oblika.

Ovogodišnje podvodno istraživanje na području grada obavljeno je na ostacima dosada nepoznatog antičkog brodoloma s teretom amfora i mogućih kamenih poluproizvoda kod otočića Velika Sestrica, blizu Rovinja. Ovo je bila prva kampanja iskopavanja nalazišta za kojeg se zasad smatra da pripada rimskom brodolomu iz 2. st., sudeći po pronađenim nalazima amfora ali i drugih predmeta koji su pripadali posadi broda. Daljnje istraživanje, koje se planira u narednoj godini, razotkriti će više pojedinosti o samom brodu ali i o mogućnosti postojanja tereta kamenih poluproizvoda.

Bibliography / Literatura:

Bekić, L. 2013 - Archaeological survey of Seabed in the Broader Rovinj and Pula Areas in 2013 / Rekognosciranje šireg podmorja Rovinja i Pule 2013. Submerged heritage / Potopljena baština 3, 2013. 46 - 50.



8. The Sestrica Island wreck excavation team, from left to right: / Ekipa istraživača brodoloma Sestrice; s lijeva: Kees Post, Maja Kaleb, Mladen Pešić, Michael Heinzlemier, Roko Surić, Luka Bekić, Max Fiederling, Borna Krstulović and Marko Runjajić
(Photo: M. Srećec)

REMNANTS OF AN ANTIQUE WRECK OFF RIVANJ ISLAND'S CAPE ZANAVIN

OSTATCI ANTIČKOG BRODOLOMA KOD RTA ZANAVIN NA OTOKU RIVNJU

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One of the positions examined during the survey of Zadar County in 2016 at which the remnants of the cargo of an antique shipwreck were discovered is on the north end of Rivanj Island. Numerous amphorae sherds were observed on a sandy bottom largely covered with dense growth of Mediterranean tapeweed on a slope dropping from a depth of four to ten metres, including characteristic sections of the base, necks with rims, and handles. What makes this wreck interesting is the find of several large conglomerates formed of fused amphorae sherds. Found along with the amphorae were several sherds of fine African ware and several fragments of coarse ware. The manual removal of sediment from one part of the site established that sand covers a thicker cultural layer of amphorae sherds.

This year we produced detailed documentation of the surface layer of finds with the aim of establishing the precise spread of the finds. Site documentation was

1. A conglomerate of amphorae among the Mediterranean tapeweed off Cape Zanavin / Konglomerat amfora među posidonijom na rtu Zanavin (Photo: R. Surić)



Prilikom provedbe rekognosciranja Zadarske županije 2016. godine jedna od pregledanih pozicija na kojoj su otkriveni ostatci tereta antičkog brodoloma se nalazila na sjevernom dijelu otoka Ravnja. Na padini od 4 do 10 metara dubine, na pješčanom dnu koje uglavnom prekriva gusta morska trava posidonija uočeni su brojni ulomci amfora, a među njima i karakteristični dijelovi dna, grla s obodima i ručke. Ono što čini ovaj brodolom zanimljivim je pronalazak nekoliko velikih konglomerata koje čine slijepljeni ulomci amfora. Osim amfora, pronađeno je i nekoliko ulomaka fine afričke keramike, te nekoliko fragmenata grubih posuda. Ručnim uklanjanjem sedimenta na jednom dijelu nalazišta utvrđeno je da pijesak krije deblji kulturni sloj ulomaka amfora.

Ove je godine napravljena detaljnija dokumentacija površinskog sloja nalazišta radi točnog utvrđivanja rasprostriranja nalaza. Dokumentiranje nalazišta odvijalo se u sklopu Naprednog tečaja podvodne arheologije u kojoj je sudjelovalo više podvodnih arheologa iz cijelog svijeta. Šaroliku ekipu su uz djelatnike MCPA činili Nada Kamel (Egipat), Liisa Randmaa (Estonija), Alice Neet (Nizozemska), Andrés Zuccolotto Villalobos (Meksiko), Ivan Gorlov (Rusija) i Vitalie Bodolica (Rumunjska).

Tečaj se sastojao od teorijskih predavanja tokom jutra na kojima su se studentima prezentirale metode 2D i 3D dokumentacije, rad u Site Recorder-u, metode fotogrametrije, organiziranje arheološkog istraživanja i publikacija nalazišta, konzerviranje i restauriranje podvodnih nalaza te metode pretraživanja i iskopavanja. Studenti su imali priliku poslušati i gostujuće predavanje Romana Scholza sa Njemačkog Arheološkog Instituta (DAI). Poslijepodnevni dio tečaja organiziran je na nalazištu rt Zanavin do kojeg smo svakodnevno putovali brodom. Tijekom boravka na brodu studenti su se upoznali s osnovama upravljanja brodom, postavljanja i rukovanja Side Scan Sonarom. Uslijed loših vremenskih uvjeta vježbe arheoloških sondažnih iskopavanja s



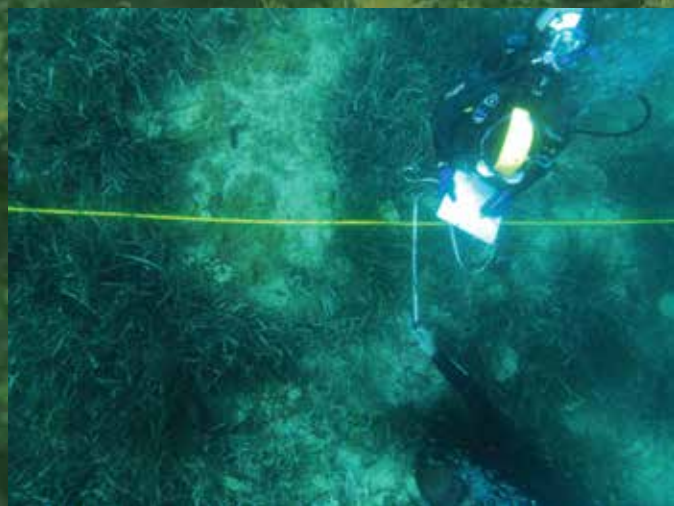
2. Participants of the advanced underwater archaeology course with ICUA instructors / Polaznici tečaja Napredni tečaj podvodne arheologije i instruktori MCPA (Photo: L. Bekić)

conducted in the frame of the advanced underwater archaeology course that saw the participation of a number of underwater archaeologists from around the world. The diverse team included ICUA staffers joined by Nada Kamel (Egypt), Liisa Randmaa (Estonia), Alice Neet (the Netherlands), Andrés Zuccolotto Villalobos (Mexico), Ivan Gorlov (Russia) and Vitalie Bodolica (Romania).

The course consisted of theoretical lectures in the morning, at which students were presented methods of producing 2D and 3D documentation, work in Site Recorder, photogrammetry methods, the organisation of archaeological excavation and the publishing of sites, the conservation and restoration of underwater finds and methods for surveying and excavation. The students also had an opportunity to hear guest lecturer Roman Scholz of the German Archaeological Institute (DAI). The afternoon portion of the course work was staged at the Cape Zanavin site, which included a daily boat trip to this location. While on board the vessel the students learned basic boating skills, and installing and handling a side scan sonar. When inclement weather prevented work at this site the students practiced archaeological trench excavation, including setting up and using a water dredge, in the Barbir antiquity period harbour site in Sukošan.

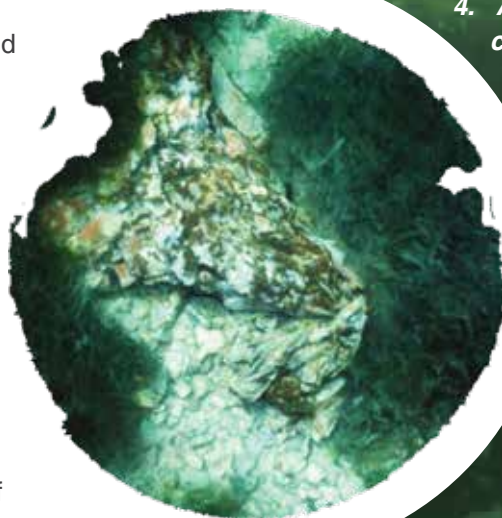
pripremom i uporabom vodene pumpe studenti su odradili na području antičke luke Barbir u Sukošanu.

Radi osiguravanja broda od sjeverozapadnih vjetrova koji na sjevernom dijelu Rivnja mogu snažno puhati, prvi je dan uz nalazište postavljeno fiksno sidro koje je omogućilo sigurno sidrenje, ali i kao orijentir studentima za zaranjanje na nalazište. Početak pozicioniranja na nalazištu označavao je postavljene 4 fiksne točke (A, B, C i D) koje omeđuju područje na kojem je koncentracija nalaza najveća. Udaljenost između točaka A i B iznosi 30 metara, a između A i D iznosi 20 metara što područje istraživanja i dokumentiranja smješta unutar



3. Documenting groups of finds using the baseline & offset method / Dokumentiranje skupine nalaza metodom "Baseline i offset" (Photo: M. Pešić)

To secure our boat against the wind blowing from the northwest, which can be quite strong on the north end of Rivanj, we installed a fixed anchor near the site that provided for secure anchorage and as an orientation point for students when diving to the site. Initial positioning at the site included the installation of four fixed datum points (A, B, C and D) that form a perimeter around the area in which the concentration of finds is greatest. The distance between points A and B is 30 metres, and 20 metres between points A and D, which places the excavation and documentation area within a parallelogram covering some 600 square metres. The large conglomerates, individual finds and groups of finds are located within the excavation zone.



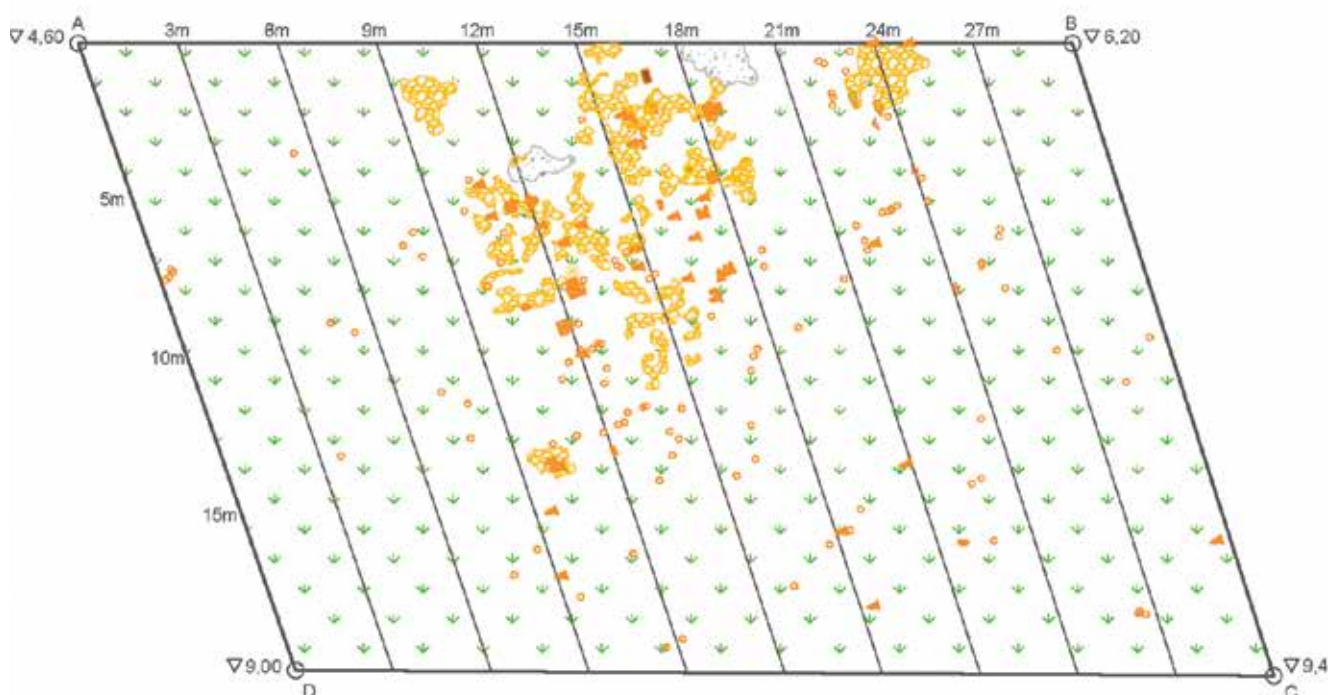
4. A detail of the 3D model of a conglomerate with amphora sherds / Detalj 3D modela konglomerata s amforama (Produced by: R. Surić)

paralelograma površine oko 600 m². Unutar područja istraživanja nalaze se veliki konglomerati, pojedinačni nalazi i nalazi u skupinama.

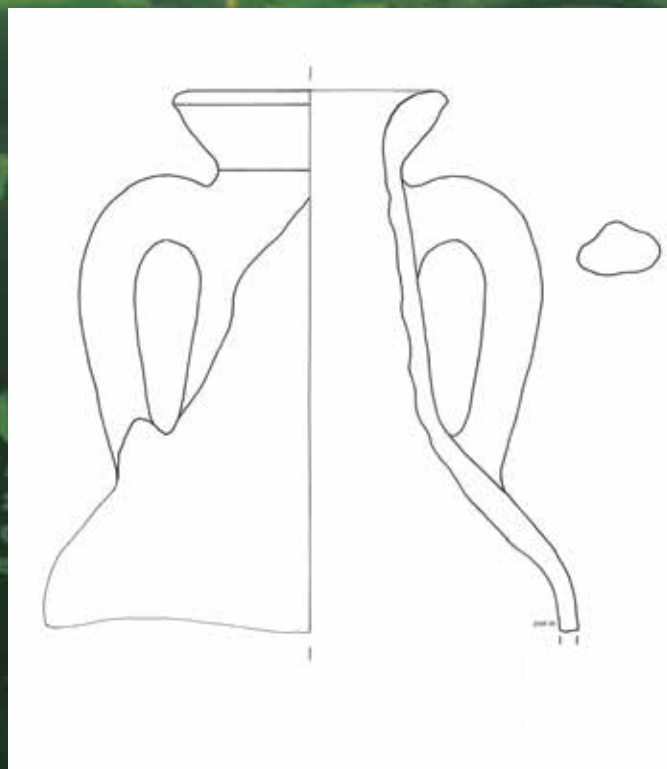
Dokumentiranje nalazišta izvedeno je metodom "Baseline i offset" na način da je nalazište omeđeno fiksnim točkama podijeljeno na 10 polja, odnosno sektora, dimenzija 20x3 metra unutar kojih su mjerenjem pozicionirali nalazi. Metoda dokumentiranja "Baseline i offset" funkcionira na način da se postavi baseline (mjerna traka - metar) između 2 fiksne točke koje su u našem slučaju oznake iste udaljenosti na mjernoj traci (npr. 3 metra na liniji A-B i 3 metra na liniji C-D), a zatim da se pomoću drugog metra izmjeri najkraća moguća udaljenost (ujedno mora činiti pravi kut) od pronađenog nalaza do baseline-a. Kada je riječ o pojedinačnom nalazu, uzimana je samo 1 mjera od točke u njegovom središtu, a kad je riječ o skupini nalaza ili konglomeratu, uzimano je više mjera kako bi se dobilo polje unutar kojeg su nalazi. Posebni nalazi dobili su svoje brojeve, fotografirani su, a dio njih je uzet radi detaljnijih tipoloških analiza koje će nam dati točnije podatke o njihovom porijeklu. Istovremeno s mjerenjem nalaza, čitavo se nalazište fotografiralo kako bi se izradio 3D model nalazišta. Na ovom nalazištu je potvrđena problematika izrade 3D modela u prisutnosti guste posidonije. Pomicanje trave uslijed strujanja mora

Site documentation was performed applying the baseline & offset method such that the site, bordered by the fixed points, is divided into ten fields (sectors) covering 20 by three metres within which finds are positioned by measurement. The baseline & offset documentation method works by setting up a baseline (a tape measure) between two fixed points which are, in our case, markers at the same distance on the tape measure (e.g. three metres on the A-B line and three metres on the C-D line) and then using another tape measure to measure the shortest distance (at a right angle) from the find to

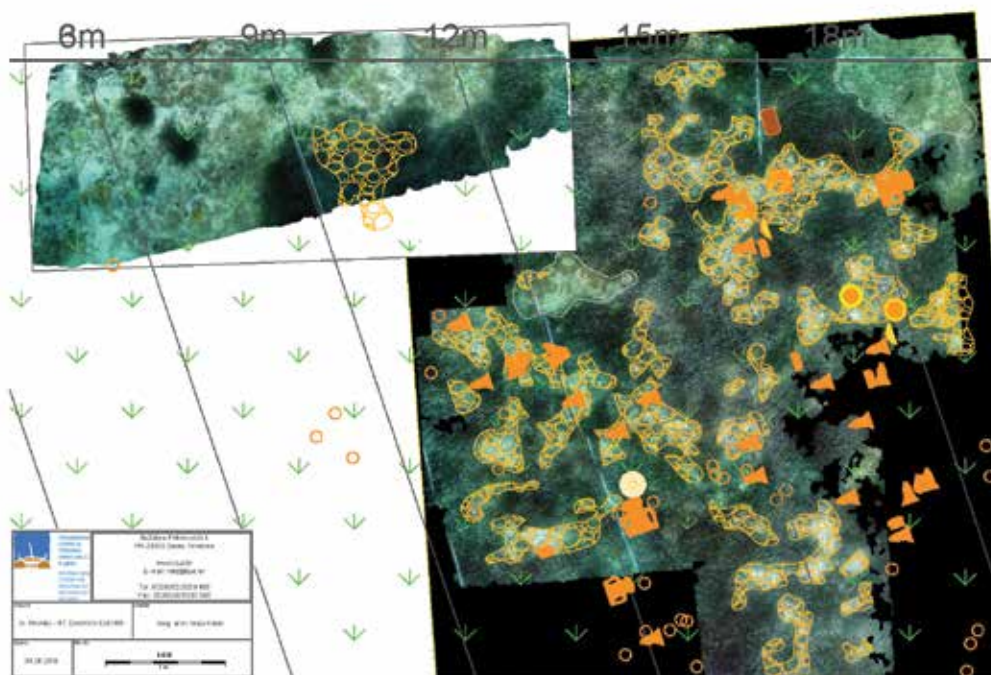
5. Map of the site off Cape Zanavin / Plan nalazišta rt Zanavin (Produced by: M. Kaleb)



the baseline. For individual finds only one measurement was taken from the central point on the find, while for groups of finds or conglomerates multiple measurements were taken to indicate a field within which the finds/conglomerates are situated. Special finds were assigned numbers and photographed, with some extracted for more detailed typological analysis that will provide more precise data on their provenance. Concurrent with the measurement of the find locations the entire site was photographed for the production of a 3D model of the site. The problems associated with creating a 3D model when dense growth of Mediterranean tapeweed is present was confirmed at this site. The movement of the tapeweed caused by the marine currents does not hamper the work of the diver during photography, but it does cause problems for the Agisoft PhotoScan software in mapping pixels on the photographs. For this reason the 3D model has blank fields where the software was unable to successfully perform calculations. A combined method of measurement and model production during surface documentation of finds has been shown to be a good practice—we established that both have advantages and drawbacks. The greatest drawback to the measurement method is the fact that a twenty-metre tape measure may have slack caused by currents, waves or handling by



7. Drawing of an Africana III A amphora from the Cape Zanavin site / Crtež afričke amfore Africana III A sa rta Zanavin (Drawing: M. Pešić)



6. A detail of the site map with overlapped orthophoto and drawn documentation / Detalj plana nalazišta s preklapljenom ortofoto i nacrtom dokumentacijom (Produced by: M. Kaleb)

less experienced divers, which will produce an erroneous measurement. The chief drawback to photogrammetry, along with the movement of seaweed, was the fact that some finds are concealed by growth of Mediterranean tapeweed. These finds could not be captured by

ne ometa ronionca tijekom fotografiranja, ali ometa računalni program Agisoft PhotoScan u povezivanju piksela na fotografijama. Iz navedenog razloga, na 3D modelu su prisutna nepopunjena polja koja program nije uspio obraditi. Kombiniranje metoda mjerenja i izrade modela prilikom površinskog dokumentiranja nalaza pokazalo se kao dobra praksa budući da smo zaključili da svaka od njih ima određene prednosti i nedostatke. Najveći je nedostatak metode mjerenja činjenica što se

mjerna traka dužine 20 m pod utjecajem struja, valova ili manje iskusnih ronionca može pomaknuti, što u konačnici može rezultirati krivim izmjerama. Kod fotogrametrije je najveći problem uz gibanje morske trave bila i činjenica da se nalazi skrivaju i ispod posidonije. Te nalaze nije bilo moguće zabilježiti objektivom kamere, ali ih ronionci koji pretražuju dno prilikom mjerenja mogu uočiti. U konačnici smo tek sa preklapanjem obija metoda uspjeli dobiti kvalitetnu sliku rasporeda površinskih nalaza.

photography, although divers searching the bottom will be able to see them. In the final tally it was only by combining both methods that we were able to produce a quality image of the distribution of surface finds.

We identified fine sigillata ware, cooking ware and transport pottery (amphorae) as making up part of the ship's cargo during the initial examinations of the site. The sigillata ware is represented with plates of the Hayes 50 form and bowls with hanging rims of the Hayes 58 form. These are products of workshops in the Tunis area and both forms can be dated to the fourth century.¹ The cooking ware is represented by fragments of Pantellerian ware of dark fabric with a temper of volcanic sand. This pottery was manufactured on Pantelleria, and island situated between Tunis and Sicily that was a frequent stop on the Mediterranean route between Africa and Italy. Mariners used it in antiquity as a port of call where they could replenish supplies and engage in commercial exchange. All of the amphorae finds from this wreck are preserved in a fragmented state and most are of the Africana III A form, one is of the Africana III B form, and all documented spikes can be attributed to one of the two cited forms. A total of 42 amphora spikes were registered on the surface, but we can expect there to be significantly more in the lower layers. The pottery analysis conducted on the amphorae indicates various production sites on the eastern Tunisian coast during the fourth century². Also recovered was one find of an amphorae plug. Among the finds of construction material were one brick and two vaulting tubes (*tubi fittili*). These terracotta tubes were used primarily as a structural element in the construction of vaults, but are also often found at the sites of wrecks with African cargoes of amphorae, where they were used as plugs.

Given that no trench excavation was conducted at the Cape Zanavin site this year we have not thus far identified remains of a ship's structure. We hope to ascertain in the course of future archaeological excavation whether any such remains are to be found beneath the layer of fragmented amphorae or if they were entirely destroyed during the sinking of the vessel by the actions of waves and marine currents.

8.
*An intact terracotta vaulting
tube (tubi fittili) / Cjelovito
očuvani tubi fittili
(Photo M. Kaleb)*



Kao dio tereta broda već smo prilikom prvih pregleda prepoznali fino sigilatno posuđe i kuhinjsku keramiku, te transportnu keramiku - amfore. Sigilatno posuđe zastupljeno je s tanjurima tipa Hayes 50 i zdjelama sa spušenim obodom formi Hayes 58. Radi se o proizvodima radionica s područja Tunisa, a obje se forme mogu datirati u period 4. st.¹ Kuhinjska keramika zastupljena je s fragmentima Pantelleria ware posuda tamne fature s primjesama vulkanskog pijeska. Ova keramika se proizvodila na otoku Pantelleria koji se nalazi između Tunisa i Sicilije, a bio je česta postaja na mediteranskoj ruti između Afrike i Italije koja je služila antički pomorcima kao luka u kojoj su se mogli opskrbiti namirnicama ili obaviti trgovačku razmjenu. Svi nalazi amfora s brodoloma su fragmentarno sačuvane, a većina ih pripada formama afričkih amfora Africana III A, jedan formi Africana III B, a sva dokumentirana šiljata dna se mogu pripisati jednoj od dvije navedene forme. Ukupno je u površinskom sloju zabilježeno 42 šiljata dna amfora, ali za očekivati je da bi ih u slojevima moglo biti znatno više. Keramičke analize koje smo obavili na amforama pokazale su da su se proizvodile na različitim mjestima na istočnoj obali Tunisa a proizvodile su se tokom 4. st.² Uz navedene nalaze prikupljen je i jedan nalaz čepa amfore, dok skupini nalaza koji su služili kao građevinski materijal ubrajamo jednu opeku i 2 primjera predmeta *tubi fittili*. *Tubi fittili* su keramički tuljci koji su prvenstveno služili kao konstruktivni građevinski element pri izradi lukova, ali često se nalaze i na brodolomima s afričkim teretom amfora gdje su se koristili kao njihovi čepovi.

Budući da se ove godine nisu obavljala sondažna istraživanja na rtu Zanavin, za sada ostatci brodske konstrukcije nisu zabilježeni. Da li se oni nalaze ispod sloja razlomljenih amfora ili su nestali prilikom brodoloma uslijed djelovanja valova i morskih struja, tek se nadamo utvrditi tokom budućih arheoloških istraživanja.

1 Hayes 1972, 73, 96.

2 Bonifay 2004, 122.

Bibliography / Literatura

Bonifay, M., 2004. - Etudes sur la céramique romaine tardive d'Afrique, BAR International Series 1301, Oxford.
Hayes, J.W., 1972.- Late Roman Pottery, London-Roma.

UNDERWATER ARCHAEOLOGICAL SURVEY OF ZADAR COUNTY IN 2018

PODVODNI ARHEOLOŠKI PREGLED PODMORJA ZADARSKE ŽUPANIJE 2018. g.

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1. Divers at the top of the deposit of material from the dredging of Katine harbour / Ronioci na vrhu sipine materijala iz jaružanja luke Katine (Photo: L. Bekić)

2018 saw continued work on the discovery of new, and the survey of already known archaeological sites in Zadar County. Some of the locations in question were discovered in the course of now regular surveys organised in the frame of the inter-ministerial maritime coordination body, and others on the basis of reports submitted by our associates. A number of the positions were surveyed in the frame of rescue archaeology work preceded by construction works during the erection of modern maritime structures.

The start of the year, in February, saw dredging of Katine harbour in the town of Pag. ICUA Zadar conducted archaeological supervision of all construction works. The works were conducted in a manner that saw a platform-mounted dredger located within the harbour from which a floating pipe with a diameter of around 30 centimetres transported sediment to a location about a kilometre to the northwest, outside the city harbour area. Archaeologists

Tokom 2018. godine nastavljeno je otkrivanje novih i pregled već poznatih arheoloških nalazišta na području zadarske županije. Dio njih je rezultat otkrivanja tokom već ustaljenih pregleda organiziranih u sklopu Koordinacije Ministarstava, a dio ih je otkriven dojavom naših suradnika. Pojedine pozicije bile pregledane u sklopu zaštitnih radova koja su prethodila građevinskim radovima prilikom gradnji modernih struktura u podmorju.

Početkom godine, u veljači, vršilo se jaružanje luke Katine u gradu Pagu. MCPA Zadar provodio je arheološki nadzor nad ovim radovima. Radovi su obavljani na način da je unutar luke bila platforma sa jaružalom, a s nje je pomoću plutajuće cijevi promjera oko 30 cm sediment transportiran na lokaciju oko kilometar sjeverozapadno, van gradske luke. Arheolozi su ronili na toj lokaciji pregledavajući visoki stožac pješčanog sedimenta koji se nalazio na ravnom dnu, dubine do 23 m. Na ovoj gomili iskopanog materijala, pronalazili su se pojedinačni ulomci keramike i drugih nalaza, poput drvenog koloturnika. Nažalost, nalazi su bili usitnjeni i oštećeni tijekom jaružanja, a posebice tijekom transporta kroz cijev do mjesta odlaganja. Stoga je puno više uspjeha bilo tijekom pregledavanja unutar same luke, jer su ovdje nalaženi bolje očuvani predmeti. Naravno, bilo je važno uskladiti zarone sa strojem za jaružanje, kako bi vidljivost za arheologe bila optimalna. Sveukupno su obavljena dva ronilačka pregleda na mjestu istovara sedimenta te tri progleda u samoj luci Katine.

Tijekom suradnje u sklopu projekta "Koordinacija nadzora na moru" u lipnju 2018. g. pregledana je komunalna i trajektna luka u Molatu, na istoimenom otoku. Unutar uvale raste prilično gusta posidonija, te u njoj nije bilo moguće uočiti arheološke nalaze. Međutim, поближе nautičkim vezovima postoji nekoliko "proplanaka" unutar trave na kojima se na pijesku mogu pronaći pojedini arheološki nalazi. Ovakve čistine između trave potječu od postavljanja sidrenih blokova i samog sidrenja običnim



conducted dives at this location to examine the tall conical heap of sandy sediment lying on the flat seabed at a depth of up to 23 metres. Individual potsherds and other finds, such as a wooden pulley, were found on this heap of excavated material. Unfortunately, the finds were fragmented and damaged in the course of dredging and especially while being transported through the pipe to the deposit zone. There was much greater success, consequently, during the survey within the harbour itself, as the finds here were of artefacts in a better state of preservation. It was, of course, necessary to time the dives with the operation of the dredging machine in order to ensure optimal visibility for archaeologists. In all there were two diving surveys at the sediment deposit zone and three surveys within Katine harbour.

3. A wing section with serial number / Dio krila sa serijskim brojem (Photo: I. Luković)



2. An almost intact amphora from the harbour on Molat Island / Gotovo cijela amfora iz luke na Molatu (Photo: L. Bekić)

sidrima. No najviše arheoloških nalaza pronađeno je uz samo trajektno pristanište. Očito je tijekom izgradnje novog mola iskopano i prevrnuo mnogo morskog sedimenta u kojem su se nalazili brojni nalazi. Oni se nalaze duž cijelog novog mola. Još više nalaza je upravo na mjestu gdje trajekt pristaje i okreće se, jer je zbog male dubine djelovanje propelera toliko snažno da je otkopalo veliki prostor morskog dna. Ovdje na morskome dnu leže brojni ulomci i veći dijelovi antičkog i novovjekovnog posuđa. Pronađena je i gotovo cijela amfora tipa Lamboglia II. Očito je ova uvala stoljećima korištena kao sigurna luka.

U cilju osmišljavanja novog međunarodnog projekta u suradnji s RGK - DAI Frankfurt, u kolovozu su pregledane dvije lokacije na Pakošanskom području. Kao prvo to je bio zaron kod ostataka rimskog valobrana i pristaništa kod Kumenta. Tu je još ranije otkrivena velika kamena struktura dužine oko 60 metara, koja od obale ide do maksimalne dubine od 2,6 m. Struktura od masivnog kamena je očuvana preko metar visine. Sudeći po površinskim nalazima riječ je o rimskom pristaništu iz 1. do 3. st.

Također je napravljen zaron na gomili novovjekovnih opeka sjeverno od otočića Veli Škoj kod Pakošana. Ova lokacija prvi puta je pregledana još 2011. g. a pronašao ju je Marko Meštrović. Ova gomila vjerojatno je ostatak iskrcavanja brodskog balasta u novovjekovnom razdoblju, jer nisu uočeni tragovi drvene brodske konstrukcije.



4. Extraction of the other aircraft wing section /
Vađenje drugog dijela krila zrakoplova
(Photo: R. Scholz)

Our collaborative efforts in the frame of the national maritime supervision coordination project saw a survey of the municipal and ferry port on Molat Island in June of 2018. There is quite dense growth of Mediterranean tapeweed in the cove where archaeological finds could not be observed. There are, however, a number of clear sections within the fields of tapeweed near the berthing areas where individual finds could be found on the sandy bottom. These clear areas are created when

6. Divers examine the lead anchor stock with inscription /
Ronioci pregledavaju prečku olovnog
sidra s natpisom (Photo: L. Bekić)



Zajedno s djelatnicima RGK-DAI obišla se i lokacija na otoku Ugljanu, kod Malog Lukorana, od kuda se sumnja da je izvučen dio zrakoplova JNA srušenog 1991. g. kao što je bilo objavljeno u lokalnim medijima. Nakon što je snimljeno na rivi u Malom Lukoranu, krilo je odneseno u nepoznatom smjeru. Krilo je navodno pripadalo zrakoplovu tipa Galeb, a na sebi je imalo oznaku jugoslavenske zvijezde i broj. U medijima se navodi da je Galeb G-2 evidencijskog broja 23147 pripadao kapetanu JNA Neši Vrangellovskom, koji je nestao na zadarskom području, 5. rujna 1991. g. Tijekom ronjenja pronađen je drugi, prednji dio krila koji po svemu sudeći pripada već izvađenom i nestalom dijelu. Ovaj novi dio je izvađen i poslan u restauratorsko-konzervatorsku radionicu MCPA Zadar. Pronađen je i jedan manji dio zrakoplova zelene boje, koji bi mogao pripadati nekom američkom zrakoplovu iz 2. Svjetskog rata. Pretpostavlja se da su sve ove dijelove zrakoplova pred Malim Lukoranom iz mreža iskrcale ribarske koče, koje su ih zakačile negdje u dubljem moru.



5. Hundreds of amphorae at the wreck site near Vela
Letovica / Stotine amfora na brodolomu kod Vele
Letovice (Photo: L. Bekić)

U kolovozu 2018. g. voditelj ronilačkog centra Foka s otok Paga, Vedran Dorušić, prijavio je nalaz antičkog brodoloma Konzervatorskom odjelu u Zadru. Na zahtjev KO Zadar djelatnici MCPA Zadar izašli su na uviđaj. Nalaznik je pokazao mjesto na kojem je zatekao veliku gomilu cjelovitih amfora, nedaleko uvale Letovica na zapadnoj obali otoka Paga, na dubini oko 35 metara. Odmah po zaronu bilo je jasno kako se radi o netaknutom brodolomu trgovačkog broda iz 1. st. prije Krista, koji je prevozio teret amfora tipa Lamboglia II. Sedamdesetak metara udaljena od gomila amfora nalazi se i oveća olovna prečka sidra s natpisom u reljefu na oba krila. S obzirom su ostaci broda i tereta neopljačkani i netaknuti, riječ je o vrlo rijetkom i važnom nalazištu.



7. A donation of a Breda machine gun from a German vessel destroyed near Vir / Donacija strojnice Brede s njemačkog broda uništenog kod Vira (Photo: M. Kaleb)

either anchor blocks are dropped or regular anchors are used. Most of the archaeological finds were, however, recovered in the immediate area of the ferry landing. A large quantity of marine sediment containing numerous finds was evidently excavated and turned over in the course of the construction of this new mole. The finds are to be found along the entire length of the new mole. There are even more finds at the site where the ferry docks and turns—with the small depth, namely, the thrust created by the propellers is of such strength that it has dug out a large section of the seabed. Lying on the seabed here are numerous sherds and large sections of antique and post-medieval ware. An almost complete Lamboglia II

Jurica Vučetić s otoka Vira u rujnu 2018. g. donirao je MCPA Zadar protuzrakoplovnu strojnicu Breda iz Drugog svjetskog rata, pronađenu u moru kod otoka Vira. Strojnica najvjerojatnije pripada njemačkom minolovcu koji je u blizini svjetionika potonuo tijekom napada engleskih zrakoplova 1944. g. Kako je ovaj brod splitski Brodospas dovukao uz obalu i isplio za staro željezo, strojnica je očito zaostala na morskom dnu, na mjestu gdje su se ovi radovi obavljali. Nakon preuzimanja i konzervatorsko - restauratorske obrade, strojnica će biti izložena u Galeriji podvodne arheologije MCPA Zadar. Isti dan obavljeno je i ronjenje van lučice Srpljica na Viru, prilikom kojeg je na morskom dnu uočeno polomljeno kameno sidro, koje je izronjeno i sada se nalazi na konzervatorskoj obradi u radionici MCPA Zadar.

Hrid Kamenjak je pregledana tokom 2016. godine kada su otkriveni i ostatci brodoloma sa amforama forme Spatheion 1. Ove smo godine obavili još jedan pregled ostataka brodoloma radi uvida u stanje nalazišta, te širi pregled uokolo hridi. Jaka morska struja je otežavala ronjenje, ali se ipak uspjelo pregledati čitavo područje uokolo hridi, no nisu locirani novi arheološki nalazi. Pregledom ostataka brodoloma zaključeno je da je njegovo stanje i dalje nepromijenjeno, a među nalazima su osim amfora Spatheion 1 definirani manji ulomci amfora Late Roman 2 i 3, te ulomci afričkog sigilatnog posuđa formi Hayes 61 A i 59 A.¹ Datacija brodoloma se

8. A dive from a vessel of the Custom's Administration near the isle of Kamenjak / Zaron s broda Carinske uprave kod otočića Kamenjaka (Photo: L. Bekić)



amphora was recovered. This cove was evidently used as a safe haven for centuries.

With the objective of laying the groundwork for a new international project in collaboration with RGK-DAI Frankfurt, August saw surveys of two locations in the Pakoštane area. The first was a dive at the remnants of a Roman breakwater and landing at Kumenat. A large stone structure of a length of about sixty metres had already been discovered here, running from the shore to a maximum depth of 2.6 metres. This massive stone structure is preserved to a height in excess of one metre. Judging by the surface finds this was a Roman period landing of the first to third century.

Another dive was made at the site of a heap of post-medieval bricks to the north of Veli Škoj Islet near Pakoštane. This location was first surveyed in 2011 and discovered by Marko Meštrov. The heap is likely the result of the offloading of ship's ballast in the post-medieval period as no traces of a wooden ship structure were observed.

RGK-DAI staffers also joined us at a location off Ugljan Island, near Mali Lukoran, where a section of a Yugoslav People's Army aircraft downed in 1991 was alleged to have been brought on shore in the local media. The wing section disappeared after being seen on the waterfront in Mali Lukoran. It is alleged to be from a Galeb type aircraft with the aircraft's number and the Yugoslav red star insignia. The press reports that Galeb G-2 number 23147 was flown by Yugoslav air force captain Neša Vrangellovski, downed in the Zadar area on the 5th of September 1991. The dive yielded the recovery of another part, this time the front section of the wing, likely associate with the looted section. This new section was extracted and sent to the restoration and conservation workshop at ICUA Zadar. Another small part was found of a green coloured aircraft that may be from a United States World War II plane. It is presumed that all these aircraft sections were deposited near Mali Lukoran from the nets of fishing trawlers that drew them up from deeper waters.

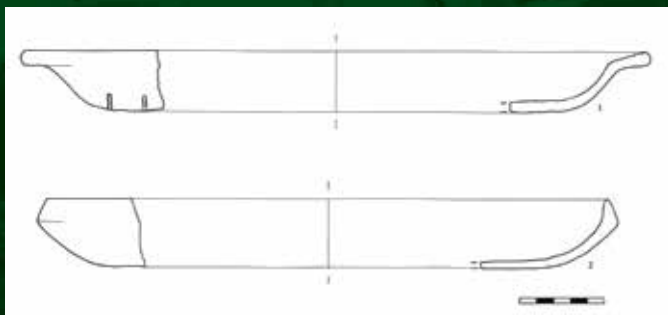
In August of 2018 Vedran Dorušić, the head of the Foka diving club on the island of Pag, reported the find of an antique shipwreck to the culture ministry's conservation department in Zadar. At the request of the department ICUA Zadar staffers undertook an examination of the site. Dorušić indicated the location at which he observed a large heap of intact amphorae, not far from Letovica Cove on the west coast of the island at a depth of about 35 metres. Once the dive commenced it was immediately clear that this was the unspoilt wreck of a first century BCE merchant vessel that had transported a cargo of



9. The amphorae at Kamenjak / Amfore kod Kamenjaka (Photo: L. Bekić)

može smjestiti u prvu trećinu 5. st.

Po dojavi Đanija Igliča koji je u uvali Vrulje u Zadru primijetio arheološke nalaze na dnu uz modernu obalu, obavljen je pregled šireg područja koje se nalazi u marini Tankerkomerc. Vrlo brzo je na dubini od oko 4 metra uočena hrpa kamena i keramičkih nalaza veličine 5 x 5 m. Površinskim je pregledom među keramičkim ulomcima prepoznat niz nalaza egejske, italske i



10. A drawing of African ware at the Hrid Kamenjak rocks / Crtež afričkih posuda s hridi Kamenjak (Drawing: M. Pešić)

afričke proizvodnje koji se mogu datirati od 1. do 3. st. Uz iznimno slabu vidljivost, ronionci su pregledali i šire područje uvale, ali na muljevitom dnu nisu zabilježeni drugi arheološki nalazi. Prema podacima koje smo dobili od očevidaca, prilikom iskopa morskog dna radi gradnje marine Tankerkomerc na ovom je području nađena veća količina pokretnih arheoloških nalaza. Pregledana hrpa u podmorju je vjerojatno deponirani materijal nastao prilikom tih iskopa. Iz navedenog je zaključeno da se ovaj dio uvale zasigurno u antičkom razdoblju koristio kao sidrište, čemu u prilog govori povoljan i zaštićen položaj uvale koji se i danas koristi.



11. Ceramic finds in Vrulje Cove / Keramički nalaz iz uvale Vrulje (Photo: M. Pešić)

Lamboglia II amphorae. Some seventy metres from the heap of amphorae is a large lead anchor stock with an inscription in relief on both wings of the stock. Considering that the remains of the ship and its cargo are unspoiled and have not been looted, this is a very rare and important site.

In September of 2018 Jurica Vučetić from the island of Vir donated a World War II Breda anti-aircraft gun recovered from the waters off the island. The machine gun likely belonged to a German minesweeper that sank near the lighthouse during an attack launched by English aircraft in 1944. The Brodospas company of Split had salvaged this craft, dragging it near the shore and cutting it up for its steel, and the machine gun evidently remained on the seabed where the work was carried out. The machine gun will be on display at the ICUA Zadar underwater archaeology gallery following its reception and conservation-restoration treatment. A dive was conducted on that same day near the small harbour of Srpljica on the island of Vir during which a broken stone anchor was observed on the seabed. It has been extracted and is currently undergoing conservation treatment at the ICUA Zadar workshop.

The Hrid Kamenjak location was surveyed in 2016 at



12. An amphora on the stone embankment in Vrulje Cove / Amfora na kamenom nasipu u uvali Vrulje (Photo: M. Kaleb)

Prema podacima iz literature na Olibu je poznato nekoliko ostataka antičkih brodoloma koje smo tokom pregleda pokušali locirati, te doći do nešto više informacija o njima.² Pregledom južne strane otoka uz rt Zubinin, na stjenovitom dnu na dubini od oko 3 m između škrapa su uočene dvije koncentracije razlomljenih ulomaka amfora koje se mogu pripisati ostacima brodskog tereta. Jednu

13. Documenting the finds off Olib / Dokumentiranje nalaza na Olibu (Photo: M. Kaleb)



which time the discovery was made of the remains of a shipwreck with Spatheion 1 amphorae. This year we conducted another survey of the wreck in order to ascertain the state of the site and to conduct a broader examination around the rock. A strong sea current hampered the dive but we did succeed in surveying the entire area around the rock—no new archaeological finds were, however, observed. An examination of the remains of this wreck indicated that its condition has not changed. Among the finds are Spatheion 1 amphorae and smaller sherds of Late Roman 2 and 3 amphorae, and sherds of African sigillata ware of the Hayes 61A and 59A¹ forms. The wreck can be dated to the first third of the fifth century.

A survey was conducted of a broad area within the Tankerkomerc marina in Vrulje Cove in Zadar where Đani Iglič had reported a sighting of archaeological finds on the seabed alongside the modern waterfront. At a depth of about four metres divers soon observed a heap of stones and ceramic finds covering an area of five by five metres. A surface survey of the potsherds identified finds of Aegean, Italic and African production that can be dated to the period from the first to third century. Divers examined the broader area of this cove in very poor visibility but no other finds were observed on the silty seabed. Based on reports we have received from eyewitnesses a large quantity of small archaeological finds were found in this area in the course of excavation of the seabed for the construction of the Tankerkomerc marina. The heap examined on the seabed this time was likely deposited here during these excavation works. We can infer from this that this part of the cove was certainly in use as an anchorage during the antiquity period, a conclusion supported by the present day use of this favourable and protected cove.

The data in the literature indicates a number of known antiquity wrecks off the island of Olib that we tried to locate in the course of the survey to gain greater insight.² Two concentrations of sherds from fragmented amphorae were observed between fissures in the rocky bottom at a depth of about three metres during the survey of the south side of the island near Cape Zubinin that may be attributed to the remnants of a ship's cargo. One of these consists of amphorae sherds with bifid handles, the Dressel 2-4 form manufactured in northern Italy in the first century.³ The second concentration, about fifty metres from the first, consists of amphorae with wide rims and elongated handles and are of the Spanish Beltrán IIA form, dated to the first and second centuries and used to transport fish sauces.⁴ All of the finds are highly fragmented as a result of marine activity, but nevertheless speak to us of the intensive traffic that took place in this area during the early Roman Empire.



14. A team of the inter-ministerial coordinating body prepares for an outing / Ekipa iz Koordinacija Ministarstava se sprema na izlazak s brodom (Photo: M. Pešić)

od njih čine ulomci amfora s bifidnim ručkama znanima i kao Dressel 2-4 koje su se proizvodile na području sjeverne Italije tokom 1. st.³ Drugu nakupinu koja je od nje udaljena oko 50 m čine ulomci amfora sa širokim obodom i izduženim ručkama, a pripadaju španjolskim amforama Beltrán II A koje su datiraju u 1. - 2. st. i služile su za prijenos ribljih umaka. Uslijed djelovanja mora svi nalazi su izrazito fragmentirani, ali nam ipak govore o intenzivnom prometu koji se odvijao na ovom području tokom ranog period Rimskog carstva.

1 Hayes 1972, 100, 107

2 Brusić 1980, 162.

3 Caravale, Toffoletti 1997, 107.

4 Caravale, Toffoletti 1997, 127.

Bibliography / Literatura:

BRUSIĆ, Z. 1980. - Neki problemi plovidbe Kvarnerićem, Pomorstvo Lošinja i Cresa, Otočki ljetopis Cres-Lošinj 3, Mali Lošinj, 151-171.

CARAVALE, A., TOFFOLETTI, I. 1997. - Anfore antiche, Conoscerle e identificarle, Formello.

HAYES, J. W., 1972. - Late Roman Pottery, London-Roma.

MARITIME ARCHAEOLOGY IN CHINCHORRO BANK, MEXICO

ARQUEOLOGÍA MARÍTIMA EN BANCO CHINCHORRO, MÉXICO

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Since 2006, INAH's Vice-Directorate of Underwater Archaeology develops an interdisciplinary work through the project Inventory and diagnosis of the archaeological and historical heritage submerged in the Chinchorro Bank Biosphere Reserve, Quintana Roo, which began, as its name implies, with the inventory and diagnosis of the cultural resources located in this natural protected area, as a basis in order to define actions regarding its research, conservation, protection, dissemination, public use, and management. As a result of this inventory, we count nowadays with 69 archaeological and historical contexts conformed by cultural material remains whose chronologies fluctuate between the 16th and 20th centuries.

Our project involves archaeologists, biologists, geologists, restorers, architects and experts in corrosion, which allows to develop the study of archaeological contexts from different perspectives oriented to the comprehensive understanding of the formation and transformation processes of these contexts and the knowledge of their history.

Chinchorro Bank is part of the Mesoamerican Reef System, the second world largest barrier reef that runs from the northern part of the Yucatan peninsula to the islands of the Honduras Bay. It's located in the Caribbean sea, 30.8 km off the coast of the fishing village of Mahahual, belonging to the municipality of Othón P. Blanco, in the southern end of the Quintana Roo's state.

Chinchorro Bank has an area of 144,360 Ha, of which only 0.4% is dry land. It is made up of four keys: Cayo Lobos, located in the south; Cayo Centro, the largest one and where the camps and palafitos (stilt houses) of the fishing cooperatives are located, as well as the Operations Center of the Protected Natural Areas National Commission; and Cayo Norte, formed by two small islands, one of which houses a base of the Mexican Navy Secretariat.



1. Chinchorro Bank location / Localización de Banco Chinchorro (By: L. Carrillo)

Desde el 2006 se desarrolla en Banco Chinchorro el proyecto "Inventario y diagnóstico del patrimonio arqueológico e histórico sumergido en la Reserva de la Biosfera Banco Chinchorro, Quintana Roo, México", a través del cual se han registrado, hasta el momento, 69 contextos arqueológicos, conformados por objetos aislados o restos de embarcaciones de los siglos 16. al 20.

De estos contextos actualmente se investigan dos pecios con más detalle: el 40 Cañones y El Ángel, cuyas labores de documentación incluyen su registro arqueológico, la realización de estudios de corrosión, de la flora y fauna asociada, de los parámetros físico-químicos del agua, así como la obtención de muestras de distintos materiales como referentes de temporalidades y posibles filiaciones culturales. En el proyecto participan arqueólogos, biólogos, geólogos, restauradores, arquitectos y expertos en corrosión, lo cual permite contar con el estudio de los contextos arqueológicos desde diferentes perspectivas



2. Shipwreck 40 Cañones 2010 / Embarcación 40 Cañones 2010. (Photo: L. González)

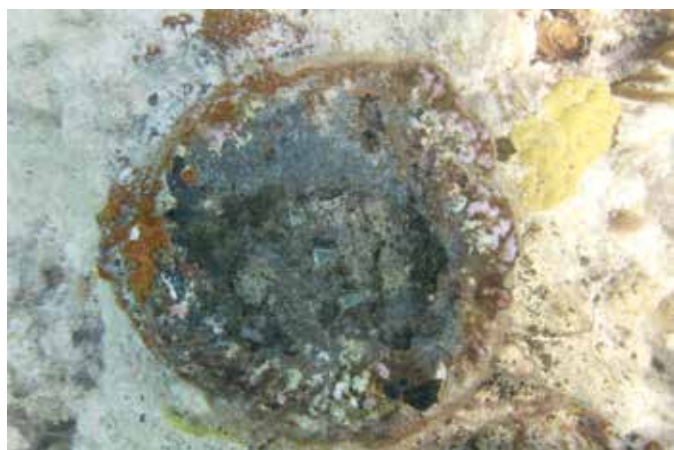
Due to its ecological diversity, which includes many habitats such as sea grasses, sandy areas, mangroves and beaches with many plant and animal species, it was awarded with the categories of Biosphere Reserve, RAMSAR site and MaB (Man and Biosphere).

Archaeological interventions

Chinchorro Bank is located in a geographical area that has been sailed since the sixteenth century, although before that time, Mayan navigators traveled the Yucatan Peninsula's coasts through a coastal navigation, without losing sight of the coast.

Sailboats, steamers and modern freighters of different nationalities have crossed the current Mexican Caribbean for purposes of exploration and colonization of territories; exploitation of resources and commercial activities mainly. Several of them, during their courses to Central, South or North America, suffered accidents due to adverse climatological conditions, human errors or even for premeditated actions.

Most of these incidents evidences are located on the



4. Shipwreck 40 Cañones / Embarcación 40 Cañones (Photo: C. Castillo)

orientadas a la comprensión integral de los procesos de formación y transformación de dichos contextos y conocimiento de su historia.

Banco Chinchorro forma parte del Sistema Arrecifal Mesoamericano, segunda barrera arrecifal más grande en el mundo - que corre desde la parte norte de la península de Yucatán hasta las islas de la Bahía de Honduras. Se localiza en el mar Caribe a 30.8 km de la costa del poblado de pescadores de Mahahual, perteneciente al municipio de Othón P. Blanco, en el extremo sur del estado de Quintana Roo.

B. Chinchorro tiene una superficie de 144,360 Ha, de las cuales sólo el 0.4% es tierra firme. Se conforma por cuatro cayos: Cayo Lobos, ubicado al sur; Cayo Centro que es el más grande y en donde se localizan los campamentos y palafitos de las cooperativas pesqueras así como el Centro de Operaciones de la Comisión Nacional de Áreas Naturales Protegidas, y Cayo Norte, conformado a su vez por dos pequeñas islas, una de las cuales alberga una base de la Secretaría de Marina Armada de México



3. Shipwreck 40 Cañones / Embarcación 40 Cañones (Photo: C. Castillo)

Por su diversidad ecológica, que incluye diversos hábitats como pastos marinos, zonas de arenales, manglares y playas con numerosas especies vegetales y animales, se le otorgaron las categorías de Reserva de la Biosfera, sitio RAMSAR y MaB (Man and Biosphere).

Intervenciones arqueológicas

Banco Chinchorro se ubica en una zona geográfica que ha sido navegada desde el siglo 16., aunque antes de esa época navegantes mayas recorrían las costas de la península de Yucatán mediante una navegación de cabotaje, sin aventurarse a perder de vista la costa.

Veleros, vapores y modernos cargueros de diversas nacionalidades han surcado el actual Caribe mexicano con fines de exploración y colonización de territorios, explotación de recursos y actividades comerciales principalmente. Varios de ellos, durante sus derroteros

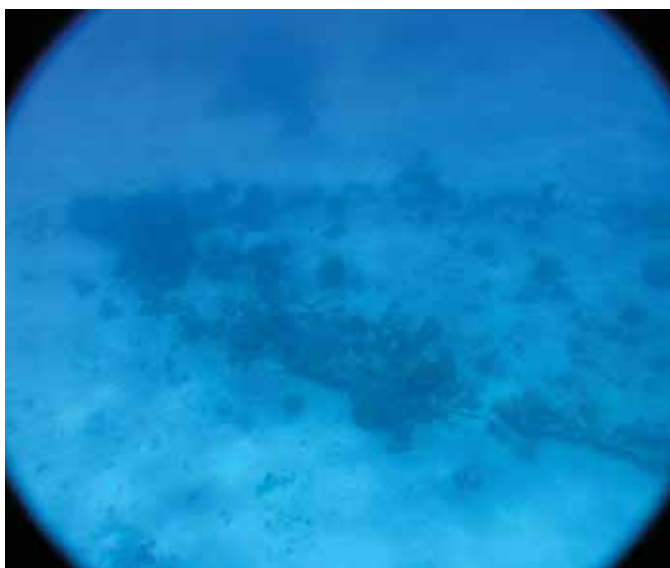


5. Shipwreck Cassel 2012 / Embarcación Cassel 2012. (Photo: C. Castillo)

eastern barrier of Chinchorro, which is not strange given the fact that most of the navigation routes were established since the sixteenth century in that direction, following the marine currents and in an attempt to avoid the risks represented by those areas identified from that time as dangerous for navigation, given the existence of many sandbanks and reefs.

For the integration of the archaeological chart, general registers and evaluations of the contexts were conducted as a basis to define the actions to be developed in each of them according to their archaeological and historical importance, integrity and threats.

Within the recorded contexts, 27 are isolated objects, among which 19 anchors of the Admiralty, Trotman, Danforth and Hall types stand out; the other 42 are shipwrecks sites. From these contexts two wrecks are currently studied in more detail: 40 Cañones and El Ángel, whose documentation work include their archaeological record; studies on corrosion, associated flora and fauna and the physical-chemical parameters of the water; and finally, the sampling of selected materials as referents of temporalities and possible cultural affiliations.



6. Shipwreck El Angel 2006 / Embarcación El Angel 2006. (Photo: E. Acevez)

hacia centro, sur o norteamérica, sufrieron accidentes por causas climatológicas adversas, errores humanos o incluso por acciones premeditadas.

La mayoría de estos siniestros se ubican sobre la barrera este de Chinchorro, lo cual no resulta extraño si se considera que la mayoría de las rutas de navegación se establecieron desde el siglo 16. hacia esa dirección siguiendo las corrientes marinas y en un intento por evitar los riesgos que representaban aquellas zonas identificadas desde esa época como peligrosas para la navegación, dada la existencia de numerosos bajos y arrecifes.

Para la integración de la carta arqueológica se llevaron a cabo registros generales y evaluaciones de los contextos como base para definir las acciones a desarrollar en cada uno de ellos de acuerdo con su importancia arqueológica e histórica, integridad y amenazas.

De estos contextos, 27 constituyen objetos aislados, entre los que sobresalen 19 anclas de los tipos almirantazgo, Trotman, Danforth y Hall; los otros 42 son naufragios, de los cuales se investigan dos con más detalle: el 40 Cañones y El Ángel.

40 Cañones

Este pecio se conforma por los restos de una embarcación a vela posiblemente de la segunda mitad del siglo 17. dispersos en un área de 37 x 20 m², a una profundidad máxima de 6 m. Conserva 36 cañones de hierro fundido y montículos de piedras de lastre. Bajo éstas se preservan restos de madera de la parte inferior del casco y, dispersos en el sitio, se encontraron fragmentos de botijas, platos, balas, municiones, herrajes y aparejos del barco, así como un ancla del tipo almirantazgo fabricada entre los siglos 16. y 17.

Es uno de los sitios más emblemáticos de la zona, hogar y sustento de una gran variedad de organismos marinos, incluyendo corales, esponjas, invertebrados y peces que habitan entre los cañones y sobre las piedras de lastre. Fue descubierto en la década de los setentas, y desde entonces es visitado (y expoliado) por buzos deportivos, buscadores de tesoros y pescadores furtivos.

Entre 1961 y 1982 fue visitado por miembros del Club de Exploraciones y Deportes Acuáticos de México, quienes extrajeron varios objetos e incluso dinamitaron el pecio en busca de tesoros. En 1977 este grupo invita al Arqlgo. estadounidense Jack Irion, quien intenta trabajar de forma científica el pecio, estableciendo que los restos pertenecían a una fragata de guerra inglesa, ello por una marca de fundición que el asoció con la fundidora inglesa Graham and Sons. Hacia 1984 el entonces Departamento de Arqueología Subacuática del Instituto Nacional de Antropología e Historia, realiza una visita de

40 Cañones

This wreck is made up of the remains of a sailing vessel, possibly from the second half of the seventeenth century, scattered in an area of 37 x 20 m², at a maximum depth of 6 m. It preserves 36 cast iron cannons, few remains of the wooden hull, ballast stones mounds, some fragments of metallic sheathing of the bottom's ship, fragments of orange and green glazed pottery, rims and sherds from jars, ammunitions, cannon balls, bronze sheaves, rigging and a metal plate with a fragment of adhered bone., as well as an anchor of the Admiralty type manufactured between the sixteenth and seventeenth centuries.

It is one of the most emblematic sites in the area, home and sustenance of a great variety of marine organisms, including corals, sponges, invertebrates and fish that live among the cannons and on the ballast stones. It was discovered in the seventies and, since then, it has been visited (and plundered) by scuba divers, treasure hunters and poachers.

Between 1961 and 1982 it was visited by members of the Club de Exploraciones y Deportes Acuáticos de México, who extracted several objects and even dynamited the wreck in search of treasures. In 1977 this group invited the archeologist Jack Irion, who stated that the remains belonged to an English war frigate because of a foundry brand found in some cannons that he associated with the English foundry Graham and Sons.

Towards 1984, the Vice-Directorate of Underwater Archaeology from the National Institute of Anthropology and History, carry out a general survey and recovered some objects, however, it is not until 2006 when the documentation of this important context was resumed.

The research work began with the wreck's site plan. Afterwards, some sections of what is still preserved from the lower section of the wooden hull were released and documented. Samples of wood and pottery were taken; foundry marks were identified in the trunnions of two cannons that, according to the analysis of Dr. Ruth Brown,



8. Shipwreck El Angel 2009 / Embarcación El Angel 2009. (Photo: J. Avilés)



7. Shipwreck El Angel 2008 / Embarcación El Angel 2008. (Photo: J. Avilés)

inspección y recupera algunos objetos, sin embargo no es sino hasta el 2006 cuando se retoma el estudio de este importante contexto.

El trabajo de investigación inició con la realización del plano del pecio. Después se liberaron y documentaron algunas secciones de lo que aún se preserva de la sección inferior del casco de madera. Se tomaron muestras de madera y de cerámica; se identificaron marcas de fundición en los muñones de dos piezas de artillería que de acuerdo con el análisis de la Dra. Ruth Brown, especialista en artillería, parecen indicar que son de origen sueco, y se realizaron mediciones del potencial de corrosión en coordinación con el Instituto de Investigación en Corrosión de la Universidad Autónoma de Campeche.

El estado de conservación de las piezas de artillería, cubiertas completamente por productos de corrosión y concreciones calcáreas, impide la obtención de sus calibres y medidas reales. Además, no hay que olvidar que estos objetos no constituyen un referente determinante de la nacionalidad o temporalidad de un naufragio. Por otro lado, el estudio de las muestras de cerámica señalan la posibilidad de que la fuente de la materia prima se ubique en alguna región de la Cuenca del Guadalquivir, y que las piezas correspondan con objetos tipo botijas u olive jars.

Los resultados del análisis histológico realizado por la Biol. C. Girón indicaron el uso de roble para la sobrequilla y pino para las tracas del forro interno. Finalmente, el Geol. O. Jiménez lleva a cabo el estudio del lastre, cuyos resultados permitirán acotar el origen o los puertos a los cuales arribó esta embarcación y en los que pudo abastecerse del mismo.

A la par del trabajo arqueológico se realiza la búsqueda de referencias de accidentes marítimos en el área bajo estudio en acervos históricos de México, Cuba, Guatemala y España. El hallazgo de un documento perteneciente al Archivo General de Indias de Sevilla,



9. Shipwreck El Angel 2010 / Embarcación El Angel 2010. (Photo: C. Castillo)

an artillery specialist, they seem to be of Swedish origin. Also, studies of corrosion deterioration processes were carried out in coordination with the Corrosion Research Institute of the Campeche's Autonomous University.

The state of conservation of the artillery pieces, completely covered by corrosion products and calcareous concretions, impede the record of their calibers and measurements. In addition, we have to keep in mind that these objects do not constitute a determining reference of the nationality or temporality of a shipwreck. On the other hand, the results of pottery analysis indicate that the fragments correspond to olive jars and the possibility that the source of the raw material is located in some region of the Guadalquivir Basin.

The results of the histological analysis realized by the biologist C. Girón, indicated the use of oak for the keelson and pine for the frames. Finally, the geologist O. Jiménez carried out the study of the ballast, whose results will allow to determine the departure port or the harbors to which this vessel arrived.

Along with the archaeological work, the search for references of maritime accidents in the area is carried out in historical archives of Mexico, Cuba, Guatemala and Spain. The discovery of a document from the Archivo General de Indias, Seville, Spain, allowed the Historian E. Pérez to guide the investigation of the galleon Santiago wreck, assigned as escort of the Tierra Firme Fleet in the year of its loss (1658) in Chinchorro Bank.

Due to the research of historian E. Perez, we know the vicissitudes faced by this galleon from its departure from Spain to its tragic end in the false atoll; likewise, the geographical description of the site of the accident, provided by the witnesses of the event and by Captain Martín de Larrinaga, was obtained, setting it to the West of two small islands separated by a channel (Cayo Norte), located in the North of a greater island (Cayo Centro), place that matches with the location of 40 Cañones.

permitió al Hist. E. Pérez orientar la investigación sobre el naufragio del galeón Santiago, asignado como escolta de la Flota de Tierra Firme el año de su pérdida (1658) en Banco Chinchorro.

Derivado del trabajo del Hist. Pérez se conocen las vicisitudes de este galeón desde su partida de España hasta su trágico fin en el falso atolón, así mismo se obtuvo la descripción geográfica del sitio del accidente proporcionada por los testigos del suceso y por el capitán Martín de Larrinaga, situándolo al oeste de dos pequeñas islas separadas por un canal (Cayo Norte), las cuales se hallan al norte de una isla mayor (Cayo Centro), sitio que coincide con la ubicación del 40 Cañones.

Por otro lado, los referentes arqueológicos que permiten establecer hasta este momento una relación entre el 40 Cañones y el galeón Santiago se basan en que el 40 Cañones era un buque de madera impulsado a vela; conserva 36 piezas de artillería de al menos tres calibres diferentes, así como fragmentos de botijas y de cerámica de procedencia europea, municiones de mosquete, palanquetas, balas (expoliadas entre el 2008 y 2009) y un ancla tipo almirantazgo característica de los siglos 16. y 17.

El Ángel

Se ubica al sur de Banco Chinchorro, hundido entre 10 y 12 metros de profundidad. Algunos de los restos que



10. Shipwreck El Angel 2017 / Embarcación El Angel 2017. (Photo: O. Del Rio)



11. Shipwreck El Angel 2017 / Embarcación El Angel 2017. (Photo: O. Del Río)

On the other hand, the archaeological references that allow to establish, until now, a link between 40 Cañones and the Santiago galleon are based on the fact that 40 Cañones was a wooden sailing boat; it preserves 36 pieces of artillery from at least three different calibers, as well as fragments of olive jars and European pottery, musket ammunition, cannonballs (plundered between 2008 and 2009) and an Admiralty type anchor, characteristic of the sixteenth and seventeenth centuries.

El Ángel

It is located in the southern end of Chinchorro Bank, sunk between 10 and 12 meters deep. Some of the remains that are still preserved, such as ironwork and chainplates, indicate that the ship was also a sailboat. On the other hand, the reinforcements that protrude and that are better seen towards the stern section, near the starboard, as well as some found in the bow and on the inner lining, are made of iron, which indicates that, together with the planks found in the bow section, the structure of the wreck is made of wood and some reinforcements of iron were added to it like a breasthook and probable beams.

Few elements of the sailboat are preserved, such as the remains of the bottom of the ship (inner and outer skin (planks), frames and futtocks) buried in the seabed; the metallic sheathing (manufactured in Muntz); and, from bow to stern, an anchor of Admiralty type and circular metal objects (probably components of a windlass), logs of

aún se conservan como herrajes y cadenotes, indican que el sistema de propulsión de la embarcación era a vela. Por otro lado, los refuerzos que sobresalen del lecho y que se aprecian mejor hacia la sección de popa cerca de la aleta de estribor, así como algunos hallados en la proa y sobre el forro interno son de hierro, lo que indica, junto a los tabloncillos hallados en la sección de proa, que la estructura del pecio es de madera y se le añadieron algunos refuerzos de hierro como una buzarda y probables baos.

Se preservan pocos elementos del velero, sobresaliendo los restos del fondo del buque (forro interior, cuadernas, genoles y forro exterior) enterrados en el fondo marino, el recubrimiento metálico (manufacturado en Muntz) y, de proa a popa, un ancla del tipo almirantazgo y objetos metálicos circulares (probablemente componentes de un molinete), troncos de palo de tinte (cargamento), algunos ladrillos, dos tanques de hierro posiblemente para almacenamiento, así como refuerzos (colocados para dar soporte y fortaleza a las secciones de unión de componentes principales) y aparejos de hierro de jarcia fija como cadenotes dispersos en todo el contexto, entre otros elementos de hierro aislados que no han podido ser identificados por estar muy concrecionados.

Hacia popa las líneas del recubrimiento se entierran en el sedimento, por lo que se desconoce aún la eslora total del pecio. En esta última sección apenas sobresalen las láminas de Muntz que cubrían la madera y que se fijaban por un doble sistema de clavos de alguna aleación de cobre y al parecer, de hierro. También hacia la popa se



12. Shipwreck El Angel 2017 / Embarcación El Angel 2017. (Photo: O. Del Río)



13. Shipwreck El Angel 2017 / Embarcación El Angel 2017. (Photo: O. Del Rio)

dyewood (cargo), some bricks, two iron tanks possibly for storage, as well as reinforcements (placed to give support and strength to the cross-sections of main components) and iron rigs and chainplates scattered throughout the context, among other isolated iron elements that have not been identified because of the calcareous concretions.

The lines of the coating are buried in the sediment in the stern section, so the total length of the wreck is still unknown. In this last section, the Muntz sheathing that covered the wood and were fastened by a double system of nails made of some copper alloy and, apparently, iron, are barely visible. Also, towards the stern are two mounds of ballast stone, which were removed from their original position by treasure hunters.

The investigation of this wreck is still in process; until now we have a general sketch of the context and a detailed plan of the first 10 meters, from bow to stern, on the starboard side, a section that corresponds to the bilge or the lowest part of the cellar.

Broadly speaking, the archaeological work consists of releasing the remains of the ship in a controlled manner by using a dredger; once all the sediments are removed from the section that will be registered, their documentation is carried out using several techniques: drawing, photography, video and, recently, digital 3D modeling. Some artifacts have been recovered for analysis, assuring their long-term preservation.

What is known so far about El Ángel?

El Ángel was a wooden sailboat which structure was reinforced with iron pieces; its underbody was covered with Muntz sheathing and, at the time of the accident, it was carrying a cargo of logwood, which was stowed in the hold. The construction features of the ship, its anchor and chain, as well as the use of Muntz sheathing, allow to chronologically locate El Ángel construction date toward the first half of the 19th century. On the other hand, due

observan dos montículos de piedra de lastre conformado por piedras de río, las cuales fueron removidas de su posición original por buscadores de tesoros.

La investigación de este pecio sigue en proceso, hasta ahora se cuenta con un croquis general del contexto y un plano a detalle de los primeros 10 metros de la proa hacia la popa sobre la banda de estribor, sección que corresponde con la sentina o parte más baja de la bodega.

A grandes rasgos, el trabajo arqueológico consiste en liberar de forma controlada los restos del buque mediante el uso de una draga; una vez que retiran todos los sedimentos de la sección a registrar, se realiza su documentación mediante diversas técnicas: dibujo, fotografía, video y, recientemente, modelado 3D digital. Se han recuperado algunos artefactos considerados como referentes temporales, de los cuales se asegura su conservación a largo plazo.

¿Qué se sabe hasta ahora sobre El Ángel?

El Ángel era un velero construido en su mayor parte en madera, cuya estructura se reforzó con piezas de hierro; su obra viva estaba recubierta con láminas de Muntz y al momento del accidente transportaba un cargamento de palo de tinte, el cual estaba estibado en la bodega. Sus características constructivas, el tipo de ancla con cepo de metal y cadena con concreto, así como el uso de recubrimiento de Muntz, permiten ubicar temporalmente a El Ángel hacia la primera mitad del siglo 19. Por otro lado, derivado de la investigación histórica se encontró información sobre sucesos de naufragio sucedidos en Chinchorro para la época en cuestión, de los cuales resalta el caso del Jean como una referencia potencial.

El Jean era una embarcación tipo bergantín con casco forrado, de pequeño porte y dos cubiertas construido en los astilleros de Irvine, Escocia, en 1819 (Pérez, 2015). Se perdió en Triángulos Norte, nombre con el cual se conocía a Chinchorro en Reino Unido, en enero de 1837, mientras realizaba un viaje de Honduras Británicas a Mobile, Alabama. A partir de estos datos se están realizando búsquedas para obtener más información



14. Shipwreck El Angel 2017 / Embarcación El Angel 2017. (Photo: O. Del Rio)



15. Shipwreck El Ángel 2017 / Embarcación El Ángel 2017. (Photo: O. Del Río)

to historical research, we found some information about shipwreck events that occurred in Chinchorro Bank by that period, highlighting the case of the Jean as a potential reference.

The Jean was a small brigantine craft with lined hull and two decks, built in the shipyards of Irvine, Scotland, in 1819. It was lost in North Triangles, name with which Chinchorro was known in the United Kingdom, in 1837, while traveling from British Honduras to Mobile, Alabama. From these data, searches are being made to obtain more information and archaeological references about this vessel, in order to demonstrate or reject El Ángel identification hypothesis.

The contributions of different specialists involved in the project greatly enrich the interpretation of the contexts, from the identification of the material remains and their spatial and temporal association, to the study of the naval architecture and the documentary references on maritime disasters occurred in this area, in which references are sought to make correlations between archaeological contexts and historical data.



16. Shipwreck Emily Cheramie 2014 / Embarcación Emily Cheramie 2014. (Photo: O. Del Río)

de este buque, y contar con referentes que permitan demostrar o rechazar la hipótesis sobre la identificación de El Ángel.

Los aportes de los distintos especialistas involucrados en el proyecto enriquecen notablemente la interpretación de los contextos, desde la identificación de los restos materiales y su asociación espacial y temporal, hasta el estudio de la arquitectura naval y las referencias documentales sobre siniestros marítimos ocurridos en la zona de estudio, en las cuales se buscan referentes para efectuar correlaciones entre los contextos arqueológicos y los datos históricos.



17. Project Team, from left / Equipo del proyecto, empezando por la izquierda: Octavio del Río, Josue Guzmán, Alberto Soto, Octavio González, Michel Segura, Andrés Zuccolotto, "Doña Tana" and Laura Carrillo (Photo: R. Calderon)

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UNDERWATER ARCHAEOLOGY FIELD SCHOOL IN THE CZECH REPUBLIC

TERÉNNÍ ŠKOLA PODVODNÍ ARCHEOLOGIE V ČESKÉ REPUBLICE

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In February 2018 the idea of organizing the first Underwater Archeology Field School in the Czech Republic was born. Though underwater archeology does not have a long tradition in the Czech Republic, it gradually becomes aware of the academic community and the general public. With the development of diving technology and the sharing of scientific information across Europe, more and more archeology students (and also professional archeologists) are emerging with an interest in this specific research. Underwater archeology can not be studied in the Czech Republic, there are no full-semester courses, so we have decided to open up underwater archeology to (not only) Czech students via practical field school.



1. Offset documentation exercise on land / Cvičení offset dokumentace na zemi (Photo: B. Machová)

Students were able to acquire basic methods of documentation, processing and evaluation of underwater archeological situations in real freshwater conditions on Lake Barbora near Teplice (Northern Bohemia).

Underwater archeology Field School was organized by International Centre for Underwater Archaeology in Zadar (Luka Bekić, Mladen Pešić, Roko Surić and

V únoru 2018 se zrodila myšlenka zorganizovat první terénní školu podvodní archeologie v České republice. Ačkoliv podvodní archeologie nemá v České republice dlouhou tradici, začíná se postupně dostávat do povědomí akademické obce i široké veřejnosti. S vývojem potápěčské techniky a sdílením vědeckých informací napříč Evropou se začíná objevovat stále více studentů archeologie (a také profesionálních archeologů) se zájmem o toto specifické odvětví. Podvodní archeologii nelze v České republice studovat, neexistují ani žádné celosemestrální kurzy, proto jsme se rozhodli (nejen) českým studentům přiblížit metody podvodní archeologie prostřednictvím praktické terénní školy.

Studenti si v rámci terénní školy mohli osvojit základní metody dokumentace, zpracování a vyhodnocení archeologických situací pod vodou v reálných sladkovodních podmínkách na jezeře Barbora u Teplic (severní Čechy).

Terénní školu podvodní archeologie organizovalo Mezinárodní centrum za podvodní archeologii u Zadru (Luka Bekić, Mladen Pešić, Roko Surić a Maja Kaleb) a Archeologický ústav AV ČR, Praha, v. v. i. (Barbora Machová) v termínu 24. – 28. září 2018. Zúčastnilo se ho 5 studentů: Mikhail Bardashov (RU), Anders Budde (N), Filip Hájek (ČR), Jiří Chlevišťan (ČR) a Monika Konrádová (ČR). Školu navštívili také Miroslava Daňová z Trnavské univerzity (SK) a Tomáš Kiss (SK).

Cílem předkládaného článku je zpráva o proběhlém terénní škole a její zhodnocení. Na místo konání jsme dorazili v neděli večer. Zatímco severní Čechy nás přivítaly bouřkou a chladným počasím, výcvikové středisko Barbora patřící Svazu potápěčů ČR (CMAS) již mělo vyhřáté a připravené pokoje čekající na náš příjezd. Po zabydlení všech účastníků terénní školy jsme provedli krátký briefing a těšili se na ráno. První tři dny byly věnovány praktickým cvičením. V pondělí se studenti



2. Offset documentation in poor visibility in the water / Offset dokumentace ve slabé viditelnosti ve vodě (Photo: M. Kaleb)

Maja Kaleb) and the Institute of Archaeology of the CAS, Prague (Barbora Machová) on 24-28 September 2018. It was attended by 5 students: Mikhail Bardashov (RU), Anders Budde (N), Filip Hájek (CZ), Jiří Chlevištan (CZ) and Monika Konrádová (CZ). The field school also visited Miroslava Daňová from University in Trnava (SK) and Tomáš Kiss (SK).

The aim of the present article is to report about the completed field school and its evaluation. We arrived at the venue on Sunday evening. While Northern Bohemia welcomed us with a thunderstorm and cold weather, the Barbora Training Center belonging to the Association of Divers of the Czech Republic (CMAS) already had warm and prepared rooms waiting for our arrival. After all the participants were accommodated, we held a short briefing and looked forward to the morning. The first three days were devoted to practical exercises. On Monday, students learned how to document archaeological situations in 2D space using the offset method and trilateration method. The exercise took place first in the garden belonging to the center (Fig.1), then directly in the water, where three different places were installed for three pairs of students (one student accompanied by Maja Kaleb). Barbora Lake has a relatively muddy bottom, so students can feel the importance of knowing how to keep the buoyancy in the water. Otherwise, the students tested the documentation in very poor visibility, which was also a useful experience (Fig. 2).

Tuesday was marked by the teaching of photogrammetry. Students learned basic principles of 3D modeling and basic knowledge of work in Agisoft software. Emphasis was also put on explaining the camera's appropriate setting to underwater conditions. Students also learned how to make a series of photos needed to create the model on land and then repeat the exercises in water (Fig.

naučili, jak dokumentovat archeologické situace ve 2D prostoru metodou offset a metodou trilaterace. Cvičení probíhalo nejprve na zahradě patřící středisku (Obr. 1), poté přímo ve vodě, kde byla instalována tři různá místa pro tři dvojice studentů (jednoho studenta doprovázela Maja Kaleb). Jezero Barbora má poměrně kalivé dno, studenti tak mohli přímo pocítit, jak důležité je umět ve vodě dobře udržet vztlak. V opačném případě si studenti vyzkoušeli dokumentaci ve velmi špatné viditelnosti, což byla také užitečná zkušenost (Obr. 2).

Úterní den se nesl ve znamení výuky fotogrammetrie. Studenti se naučili základní principy tvorby 3D modelu a základní znalosti práce v programu Agisoft. Důraz byl také kladen na vysvětlení vhodného nastavení fotoaparátu do podmínek podvodního prostředí. Studenti se dále naučili, jak provést sérii fotografií potřebnou k tvorbě modelu na suchu a poté cvičení zopakovali ve vodě (Obr. 3). Pro tuto situaci jsme se rozhodli umístit objekt fotografického zájmu na výcvikové plato v hloubce 5 m. Nehrozila tedy snížená kvalita fotografií vlivem zakalené viditelnosti. Večer studenti fotografie upravili do požadované podoby a tvorba modelu mohla začít.

Ve středu byl kurz zaměřen na dokumentaci archeologických situací ve 3D prostoru. Ve větších hloubkách pod vodou nelze použít totální stanici, která s milimetrovou přesností zaměří výšku předmětu; studenti si tímto cvičením vyzkoušeli dokumentaci přesné polohy předmětu pomocí naměřených hloubek předmětu tím způsobem, že pásmem měřili délky vybraných signifikantních částí předmětu ke kontrolním a pomocným bodům. Předmět společně s kontrolními a pomocnými body jsme tentokrát umístili na dno jezera do hloubky asi 4 m. Studenti, poučení z prvního dne, již dbali na důkladné držení vztlaku a cvičení provedli výborně. O tom později také svědčil výsledek 3D dokumentace v software Site Recorder, ve kterém se všechna měření projevila jako správná.

3. Photogrammetry exercise on land / Cvičení fotogrammetrie na zemi (Photo: B. Machová)



3). For this situation, we decided to place a photographic interest on a training platform at a depth of 5 m. This did not compromise the reduced quality of the photographs due to poor visibility. In the evening, students edited the images and the modeling could begin.

On Wednesday, the course focused on documentation of archaeological situations in 3D space. At a greater depth of the underwater environment, a total station can not be used to measure the height of the subject with millimeter accuracy; the students tried to document the exact position of the subject using the measured depths of the subject by measuring the lengths of selected significant parts of the object to the control and auxiliary points. The subject, along with the control and auxiliary points, we placed this time at the bottom of the lake to a depth of about 4 m. Students, lessons learned from the first day, they had taken care of the buoyancy and practiced excellently. This was later testified by the result of the 3D documentation in the Site Recorder software, in which all measurements proved to be correct.

Thursday - á la dry day was the sunniest day of the week, so we set off for planned excursions and excursions. Our first stop was a hillfort from the Bronze Age and early Middle Ages on the hill called "Three Crosses" near Litoměřice. The hillfort is famous for its massive banks, its strategic location and also because more than 80

luxury finds from the Bronze Age (swords, axes,



4. Prehistoric and early medieval hillfort on the „Three Crosses“ hill and the Elber river / Pravěké a raně středověké hradiště na „Tříkřížovém“ vrchu a řeka Labe (Photo: M. Gojda)

Čtvrtek – á la suchý den byl nejslunnějším dnem celého týdne, vyrazili jsme tedy na plánované výlety a exkurze. Naší první zastávkou bylo hradiště z doby bronzové a raného středověku na vrchu zvaném „Tři kříže“ nedaleko Litoměřic. Hradiště je známé svými mohutnými valy, strategickou polohou a také proto, že uprostřed řeky Labe, přímo pod hradištěm, bylo v druhé polovině 20. století objeveno více, než 80 luxusních předmětů z mladší doby bronzové (meče, sekery, kovové nádoby atp.; Obr. 4). Z hradiště jsme tedy nemohli zamířit nikam jinam, než do Litoměřického muzea, kde je soubor předmětů z řeky Labe vystaven ve stálé expozici. O historii muzea a města Litoměřice nám na místě laskavě povyprávěl



ARCHEOLOGICKÝ ÚSTAV
AV ČR PRAHA



5. Participants in the historical centre of Prague / Účastníci v historickém centru Prahy (Photo by M. Bardashov)



6. Drawing an archaeological finds through a documentatation grid / Kresebná dokumentace archeologických nálezů pomocí dokumentační mřížky (Photo: M. Pešić)

metal vessels, etc.) were discovered in the middle of the 20th century in the middle of the Elbe river (Fig. 4). From the hillfort we could not go anywhere but to the Litoměřice Museum, where a collection of finds from the River Elbe is exposed in a permanent exhibition. The history of the museum and the town of Litoměřice was kindly presented by the local archaeologist Oldřich Kotyza. From Litoměřice we continued to Prague, to the Institute of Archaeology of the CAS, Prague, where Luka Bekić had a great lecture on “Examples of Roman ports and piers of Istria and Dalmatia”. The trip ended with an evening walk through the historical center of Prague (Fig. 5).

The last day we spent completing the 3D model and also processing and digitizing data from 3D documentation in Site Recorder software. Students could also try alternative methods of program processing (eg AutoCad). In the afternoon, students only waited for the last practical exercise in water to try out how to put together a grid or how to draw an archaeological find through a documentation grid (Fig. 6, 7). After the dive, we congratulated all students for the successful completion of the weekly field school and passed them the diplomas. In the evening we ended up with a great barbecue (Fig. 8).

We tried to use the remaining time during the field school as efficiently as possible. In the evening, lectures took place (eg “Rivers and lakes - source of information for underwater archeology in Slovakia” by Miroslav Daňová) or we made a trip to the historical center of Teplice.

Finally, I would like to say in my name that the content of the whole field school has been used to the maximum possible extent. Compared with the original plan, we

místní archeolog Oldřich Kotyza. Z Litoměřic jsme pokračovali do Prahy, na Archeologický ústav AV ČR, Praha, v. v. i., kde měl Luka Bekić skvělou přednášku na téma „Examples of Roman ports and piers of Istria and Dalmatia“. Výlet jsme zakončili podvečerní procházkou historickým centrem Prahy (Obr. 5).

Poslední den jsme věnovali dokončení 3D modelu a také zpracování a digitalizaci dat z 3D dokumentace v programu Site Recorder. Studenti si mohli vyzkoušet také alternativní metody programového zpracování (např. v AutoCad). Odpoledne studenty čekalo už jen poslední praktické cvičení ve vodě, kdy si vyzkoušeli, jak se sestavuje grid či jak se kresebně dokumentuje archeologický předmět pomocí dokumentační mřížky (Obr. 6, 7). Po ponoru jsme všem studentům pogratulovali k úspěšnému dokončení týdenní terénní školy a předali jim diplomy. Večer jsme zakončili báječným grilováním (Obr. 8).

7. Grid setting exercise / Cvičení sestavování gridu (Photo: B. Machová)



retreated only from the original idea of participating in real archaeological excavation, which at the same time took place at Nechranice Dam. I think that decision was quite right over time. Students needed to absorb their acquired experience and a precise work on relatively difficult archaeological research could be stressful for them. Notwithstanding the poor visibility in Nechranice Dam and thus limiting the possibilities of supervising tutors. The whole week we really enjoyed, and all participants were full of enthusiasm. We received positive feedback from students, which I very much appreciate. The field school itself was highly anticipated, indicating that even in the Czech Republic there is a passion for underwater archeology among students and young scientists who see the meaning in this field. It was very motivating to be able to introduce, together with the ICUA team, to five young archaeologists this fascinating world of underwater archeology. I believe that without undergoing similar training of basic methods of underwater archeology, underwater archaeological excavation can not be done responsibly. I am therefore very pleased that Luka Bekić and his team have just chosen the Czech Republic as a place to organize this very successful field school.

8. Group of the Field School participants, from left / Skupina účastníků Terénní školy, zleva: Filip Hájek, Barbora Machová, Monika Konrádová, Maja Kaleb, Jiří Chlevištan, Anders Budde, Luka Bekić, Mikhail Bardashov, Mladen Pešić and Roko Surić (Photo: R. Surić)

Zbýlý čas v průběhu terénní školy jsme se snažili využít co nejefektivněji. V podvečer probíhaly přednášky (např. „Rivers and lakes – source of information for underwater archaeology in Slovakia“ od Miroslavy Daňové) nebo jsme si udělali výlet do historického centra Teplic. Na závěr bych chtěla svým jménem říci, že náplň celé terénní školy byla využita do maximální možné míry. Oproti původnímu plánu jsme ustoupili pouze z původní myšlenky účastnit se reálného archeologického výzkumu, který ve stejný čas probíhal na Nechranické přehradě. S odstupem času toto rozhodnutí považuji za zcela správné. Studenti potřebovali svoje nabyté zkušenosti vstřebat a chtít po nich precizní práci na poměrně obtížném archeologickém výzkumu by mohlo být stresující. Nehledě na špatnou viditelnost v Nechranické přehradě a tím pádem limitující možnosti dohledu tutorů. Celý týden se nesl v duchu dobré nálady a velkého entuziasmu všech zúčastněných. Od studentů jsme obdrželi pozitivní zpětnou vazbu, čehož si velmi vážím. O kurz samotný byl nad očekávání vysoký zájem, což svědčí o tom, že i v ČR existuje nadšení pro podvodní archeologii z řad studentů a mladých vědců, kteří v tomto oboru vidí smysl. Bylo velice motivující mít možnost představit společně s týmem ICUA pěti mladým archeologům fascinující svět podvodní archeologie. Domnívám se, že bez absolvování podobného školení základních metod podvodní archeologie, nelze podvodní archeologický výzkum zodpovědně provést. Mám proto velkou radost, že si Luka Bekić a jeho tým vybral právě Českou republiku jako místo pro organizování této velmi úspěšné terénní školy.



INTERNATIONAL CONGRESS "FIRST WORLD WAR SUBMERGED HERITAGE"

MEĐUNARODNI KONGRES "POTOPLJENA BAŠTINA PRVOG SVJETSKOG RATA"

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1. Red poppies, a symbol of the end of the First World War / Crveni makovi - simbol kraja Prvog svjetskog rata (Photo: M. Kaleb)

As part of the NETWORLD project (Networking in Preserving the First World War Multicultural Heritage in the Danube Countries) the International Centre for Underwater Archaeology in Zadar has collaborated with Zadar County's INOVAcija institute for the development of competence, innovation and specialisation to stage an international conference on culture tourism focusing on the First World War. The Submerged Heritage of the First World War conference was held on the 12th of June 2018 at the former St Nicholas church building in the ICUA Zadar complex. The date of the event is symbolic and marks the 100th anniversary of the sinking of the SMS Szent István, a ship of the navy of the Austria-Hungary dual monarchy, in the waters off Premuda Island, and the 100th anniversary of the end of World War I. The conference gathered experts in history, culture tourism and underwater archaeology in Europe and discussed

U sklopu projekta NETWORLD (Networking in preserving the First World War multicultural heritage in the Danube countries), Međunarodni centar za podvodnu arheologiju Zadar, organizirao je u suradnji s ustanovom za razvoj kompetencija, inovacija i specijalizacije Zadarske županije INOVAcija, međunarodnu konferenciju o kulturnom turizmu s naglaskom na Prvi svjetski rat. Konferencija "Potopljena baština Prvog svjetskog rata" održala se 12. lipnja 2018. godine u prostoru bivše crkve sv. Nikola u sklopu MCPA Zadar, a datum održavanja simbolično je odabran povodom obilježavanja 100. obljetnice potonuća austrougarskog broda Szent István u podmorju otoka Premuda te obilježavanja 100. obljetnice završetka Prvog svjetskog rata. Konferencija je okupila stručnjake iz područja povijesti, kulturnog turizma i podvodne arheologije na prostoru Europe, a predstavljeni su povijesni pomorski događaji i flote Prvog svjetskog rata.

Događaj je otvorio domaćin, ravnatelj MCPA Zadar Luka Bekić, a uslijedile su uvodne riječi predstavnice Sveučilišta u Zadru, tajnice prorektorice za znanost i informacijsku infrastrukturu, Ivanke Stričević, te Ivana Šimunića, pročelnika Upravnog odjela za obrazovanje,

2. The participants take a break during the proceedings / Druženje sudionika tijekom stanke (Photo: M. Kaleb)





3. The One Hundred Years of Solitude Under the Sea exhibition / Izložba "Sto godina samoće pod morem"
(Photo: M. Kaleb)

historical maritime events and the fleets of the First World War.

ICUA Zadar director Luka Bekić opened the event on behalf of the hosts. Also on hand to welcome everyone was the secretary to Ivanka Stričević, the University of Zadar's deputy rector for science and information infrastructure, and Ivan Šimunić, the head of the Zadar County administrative department for education, culture and sports. The event participants were also greeted by Vesna Kozar, the head of the NETWORLD project, and by Krešimir Partl, the state secretary at the culture ministry, who wished the conference success in its proceedings.

A short documentary was screened ahead of the specialist segment of the conference on the sinking of the Tegetthoff-class battleship SMS Szent István, followed by a minute of silence honouring the people killed in the First World War. Outside the formal event proceedings the participants and visitors had an opportunity to visit the former St Nicholas church and view the One Hundred Years of Solitude Under the Sea poster exhibition, also related to the torpedo sinking of the battleship now lying in magical silence near Premuda Island at a depth of sixty-six metres.

A topical presentation opened the segment dedicated to the Szent István with the speakers, Igor Miholjek of the Croatian Conservation Institute and Dražen Gorički of the Dragorlux company, introducing us to the history of the ship—its construction, purpose and the circumstances of it sinking on the 10th of June 1918, and the investigations that followed the discovery of the wreck in 1974. Early diving expeditions were discussed as were the latest campaigns pooling the efforts of the Croatian Conservation

kulturu i šport Zadarske županije. Konferenciju je službeno pozdravila Vesna Kozar, voditeljica projekta NETWORLD, a puno uspjeha u radu konferencije zaželio je Krešimir Partl, državni tajnik Ministarstva kulture Republike Hrvatske.

Prije početka znanstvenog dijela skupa, svi okupljeni su imali priliku pogledati kratki dokumentarni film o potonuću bojnog broda klase Tegetthoff, SMS Szent István, nakon čega je minutom šutnje odana počast svim žrtvama Prvog svjetskog rata. Izvan formalnog programa, sudionici i posjetitelji su imali priliku u crkvi sv. Nikole pogledati izložbu plakata "Sto godina samoće pod morem", također vezanu za potonuće prvog ratnog broda kojeg su potopila torpeda i koji sada leži u magičnoj tišini na 66 metara dubine nedaleko od otoka Premuda.

Tematske prezentacije otvorila je sekcija vezana upravo za Szent István, a govornici, Igor Miholjek (Hrvatski restauratorski zavod) i Dražen Gorički (Dragorlux) uveli su nas u povijest broda; njegovu gradnju, svrhu i okolnosti potonuća dana 10. lipnja 1918. godine, ali i istraživanja koja su uslijedila po otkriću 1974. godine. Spomenuta su ranija istraživanja koja su organizirana u nekoliko službenih ronilačkih ekspedicija, ali je predstavljena i najnovija ekspedicija okupljena od strane djelatnika Hrvatskog konzervatorskog zavoda u suradnji s Specijalnom policijom, te tvrtkama Dragorlux, St. Lukas i Shark. Osim predavanja, okupljenima je prezentiran i promotivni film ekspedicije kako bi se dočaralo stanje očuvanosti samog broda, lokacija novopronađenih predmeta, te scena postavljanja memorijalne ploče u znak sjećanja na poginule, odnosno nestale članove posade nekadašnjeg ponosa austrougarske ratne mornarice.

Brodolome koji su sudjelovali u poznatoj Helgolandskoj bitci, prvoj pomorskoj bitci iz Prvog svjetskog rata koja se odvila u njemačkim teritorijalnim vodama Sjevernoga

4. Krešimir Partl welcomes the participants on behalf of the Ministry of Culture / Krešimir Partl pozdravlja sudionike u ime Ministarstva kulture RH
(Photo: M. Kaleb)





5. Florian Huber's lecture / Predavanje Floriana Hubera (Photo: Z. Vrgoč)

Institute, police special units and the Dragorlux, St Lukas and Shark companies. The lectures were accompanied by a promotional film about the expedition that offers a glimpse at the state of preservation of the ship, the locations of newly identified objects, and the scene of the installation of a memorial plaque honouring the deceased and missing in action crew of what was once the pride of the navy of the Austria-Hungary dual monarchy.

Dr Florian Huber of Submaris discussed the wrecks of the ships that took part in the famed First Battle of Helgoland Bight, the first naval battle of World War I, which took place in German territorial waters in the North Sea. Besides noting that most of these wrecks are under threat of deliberate and unintentional destruction, the lecture focused on the final documentation from the investigation of German submarine SM UC-71 which is credited with sinking 61 ships and was itself sunk in 1919 and now lies at the bottom of the North Sea off Helgoland Island.

The best known of the Adriatic wrecks, that of the passenger steamship Baron Gautsch, was presented in terms of its appreciation as a site of tourism. The wreck, often referred to as the "Croatian Titanic", sank on the 13th of August 1914 while passing through a friendly minefield, and has been a destination for divers from around the world for many years. Lying at an accessible depth, the wreck attracts sports and recreational divers. Filip Višić of the Diving Network spoke about everything else besides diving it has to offer to the numerous visitors.

Fabio Ruberti of IANTD Expeditions spoke of the unknown aspects of the sinking of the battleship Regina Margherita, the pride of the Italian royal navy. It returned from a war the Kingdom of Italy fought against Ottoman Turkey in 1911 and 1912 and was repurposed as a training ship. It left the Albanian port of Vlorë in December of 1916 and struck naval mines. The depths of the sea are now the

mora, predstavio je dr. Florian Huber (Submaris). Osim isticanja kako većini ovih brodoloma prijeti opasnost od namjernog i nenamjernog uništavanja, naglasak izlaganja bio je na predstavljanju završene dokumentacije s istraživanja njemačke podmornice S.M. UC 71 kojoj je pripisano potapanje čak 61 broda, a koja je i sama potopljena 1919. godine, te se danas nalazi na dnu Sjevernog mora uz otok Helgoland.

Kroz turističku valorizaciju predstavljen je najpoznatiji brodolomu na Jadranu, putnički parobrod Baron Gautsch. Hrvatski Titanik, kako ga mnogi od milja zovu, potonuo je 13. kolovoza 1914. godine uslijed prolaska kroz prijateljsko minsko polje, a već godinama ga posjećuju ronionci iz cijelog svijeta. Na pristupačnoj dubini, olupina privlači sportske i rekreativne ronioce, a da ronjenje nije sve što se može ponuditi brojnim posjetiteljima izložio je Filip Višić (Diving Network).

Fabio Ruberti (IANTD Expeditions) predstavio je misterij vezan uz potonuće broda Regina Margherita, ponosa talijanske kraljevske ratne mornarice. Po povratku iz Talijansko-turskog rata (1911-1912), u službi broda za vježbu, u prosincu 1916. godine napušta albansku luku Vlora i nailazi na morske mine. Zajedno s brodom, morske dubine postale su vječno počivalište za više od 600 duša. Nakon objave potonuća 1917. godine, suparničke strane su se nadmetale za preuzimanje zasluga, a prava istina otkriva se posljednjih 13 godina, odnosno od 2005. godine kada je olupina otkrivena.

Parobrode Albanien i Euterpe koji se danas nalaze u podmorju nedaleko otoka Paga, predstavio je Vedran Dorušić (Foka d.o.o.). Osim što ih je oboje naručila austrougarska kompanija Österreichische Lloyd i pripadaju istoj vrsti, parobrodi su doživjeli i sličnu sudbinu. Naime, potopljene su od strane torpeda s talijanskih podmornica, a upravo ih je talijanska ekspedicija krajem prošlog stoljeća i otkrila. Od tada se izvršilo nekoliko uvida na lokacije od strane tehničkih ronionca osposobljenih za ronjenje na dubinama preko 60 metara. Naglašena je već postojeća zaštita, pa je tako ronjenje na olupinama moguće samo preko ovlaštenog ronilačkog centra, a bilo je govora i o velikom turističkom potencijalu u budućnosti.

Osim brojnih olupina, po završetku Prvog svjetskog rata, u povijesno nasljeđe su nam ostavljena i brojna pisana djela. Jedno od njih je Priručnik za pomorce s posebnim naglaskom na carsku i kraljevsku Mornaricu (Handbuch des Seewesens mit besonderer Berücksichtigung für die k.u.k. Kriegsmarine) koje je predstavio Franjo Zeljak. Priručnik je napisao Friedrich von Arvay 1918. godine tijekom svoje službe na bojnom brodu Szent István. Osim navedenog predstavljene su i zanimljive konstruktivne pogreške prilikom gradnje radnih brodova vrste

eternal resting place of the ship and the over 600 people that died when the ship went down. The sinking was announced in 1917 and the opposing sides vied among each other in claiming credit for the sinking and it was only in the past thirteen years, since 2005, that the actual reason that the ship went down was revealed when the wreck was discovered.

The steamships *Albanien* and *Euterpe*, now lying on the seabed off Pag Island, were presented by Vedran Dorušić of the Foka d.o.o. company. Besides the fact that both ships were commissioned by the Österreichische Lloyd company in Austria-Hungary and that they are of the same type, they also saw a similar fate. Both, namely, were sunk by torpedoes launched from Italian submarines. It was also an Italian expedition late in the last century that discovered their whereabouts. Several examinations have been undertaken since then by technical divers equipped to dive at depths in excess of sixty metres. The existing protective regime was noted with dives to the wreck possible only by way of authorised diving centres and the discussion noted the significant future tourism potential.

Besides the many wrecks, the historical legacy of the First World War also includes numerous written works. One of these is a handbook for sailors, in particular of the imperial and royal navy (*Handbuch des Seewesens mit besonderer Berücksichtigung für die k.u.k. Kriegsmarine*) presented at the event by Franjo Zeljak. Friedrich von Arvay penned the handbook in 1918 during his time in service aboard the *Szent István*. The discussion also included some of the interesting construction errors made during the building of the Dreadnought class of ships for the navy of Austria-Hungary.

Radoslav Simeonov spoke of some interesting details of the First World War period in Bulgaria. The role of the nascent Bulgarian navy saw a major shift from the moment the Black Sea region of Dobrudja became a battleground. Its chief mission became the defence of Bulgarian harbours and the border from the Russian navy. In spite of their limited means, and with the aid of their German allies, they successfully pushed back against the Russian forces. A representative of the Bulgarian defence ministry provided a detailed description of Bulgarian military forces and technology up to the close of the First World War.

Italian IANTD instructor Edoardo Pavia lectured on the topic of the sinking of the ship HMHS *Britannic* near the Greek island of Kea. The sister to the world famed *Titanic* and the less known *Olympic*, she was built as a passenger ship but was repurposed at the height of the First World War as a hospital ship for the transport of the wounded (HMHS is short for His Majesty's Hospital Ship). After a number of expeditions financed by National Geographic,



6. Fabio Ruberti offers a fascinating presentation / Slušatelji sa zanimanjem prate predavanje Fabija Rubertija (Photo: K. Ivković)

Dreadnought za potrebe austrougarske ratne mornarice. Zanimljive detalje iz razdoblja 1. svjetskog rata u Bugarskoj prezentirao je Radoslav Simeonov. Od trenutka kada je i crnomorska regija Dobrudža postala bojište, značenje tek uspostavljenih bugarskih pomorskih snaga se znatno promijenilo. Njihov glavni zadatak postaje obrana Bugarskih luka i granice od Ruske mornarice, a unatoč limitiranim sredstvima, uz pomoć svojih saveznika Nijemaca, uspješno su odagnali ruske snage. Djelatnik Ministarstva obrane Republike Bugarske zatim je detaljno opisao razvoj bugarskih vojnih snaga i tehnologije do završetka 1. svjetskog rata.

Talijanski IANTD instruktor Edoardo Pavia održao je predavanje na temu potonuća broda HMHS *Britannic* nedaleko otoka Kea u Grčkoj. Sestrinski brod svjetski poznatog *Titanica* i manje poznatog *Olympica*, izgrađen kao putnički brod, u jeku Prvog svjetskog rata dobiva novu funkciju pa biva prenamijenjen u bolnički brod za prijevoz ranjenika (prefiks HMHS - His/Her Majesty's Hospital Ship). Nakon nekoliko ekspedicija financiranih od strane National Geographica, Pavia sa svojim timom istražuje okolnosti potonuća, a rezultate istraživanja imali su priliku čuti svi posjetitelji međunarodne konferencije u Zadru.

Hrvatski povjesničar i podvodni fotograf, Danijel Frka, izložio je pregledno predavanje o podmornicama iz 1. svjetskog rata čije se posljednje počivalište nalazi u dubinama Jadranskog mora. Brodovi koji se mogu kretati na površini mora, ali i pod njom, po prvi su puta predstavljene čovječanstvu u Prvom svjetskom ratu i predstavljale su iznimno opasno i učinkovito oružje u pomorskom ratovanju. Tijekom četverogodišnjih ratnih aktivnosti na Jadranu, potopljen je impresivan broj podmornica svih suprotstavljenih strana, a Frka je tijekom svog predavanja sažeto izložio uzroke i posljedice

SUBMERGED HERITAGE OF THE FIRST WORLD WAR

THE CONFERENCE ON 12TH JUNE 2018 AT ST. NICHOLAS CHURCH WITHIN THE INTERNATIONAL CENTRE FOR UNDERWATER ARCHAEOLOGY IN ZADAR.



INOVAcija



POTOPLJENA BAŠTINA PRVOG SVJETSKOG RATA

KONFERENCIJA 12. LIPNJA 2018., U PROSTORU CRKVE SV. NIKOLE U SKLOPU MEĐUNARODNOG CENTRA ZA PODVODNU ARHEOLOGIJU U ZADRU.

Pavia and his team investigated the circumstances of the sinking, and presented the findings to the international conference participants in Zadar.

Croatian historian and underwater photographer Danijel Frka presented an overview of World War I submarines that found their final resting place on the bottom of the Adriatic. Ships that could navigate the sea surface and beneath it were first seen during World War I and were a very dangerous and effective weapon in naval warfare. An impressive number of submarines were downed in the Adriatic on all the opposing sides during the four years of war, and Frka offered a concise overview of the causes and consequences of the sinking of these ships.

Jurica Vučetić, the head of the service for the economy and for property rights relations of the state administration office in Zadar County and a war history enthusiast, spoke of the SMS Zenta, a light cruiser of the navy of the Austria-Hungary dual monarchy. The story of the Zenta, a ship just short of a hundred metres in length, began with her construction in Pula in 1898. After navigating in Asia and South America she was deployed in 1914 for what turned out to be her final mission—to bomb the town of Bar in Montenegro. During the mission the Zenta was trapped and sunk by combined French and British naval forces and is remembered in European history as the first naval ship of Austria-Hungary to be sunk in World War I. The wreck was discovered in 2001. It now lies almost untouched and covered with fishing nets at a depth of 73 metres in the waters off Bar.

Antonija Jozić of the International Centre for Underwater

potonuća.

Priču o lakoj krstarici austrougarske ratne mornarice i vodećem brodu svoje klase - SMS Zenta prezentirao je Jurica Vučetić, voditelj Službe za gospodarstvo i imovinsko-pravne odnose Ureda državne uprave RH u Zadarskoj županiji, te veliki zaljubljenik u ratnu povijest. Priča o gotovo stometarskom brodu Zenta započinje njegovom gradnjom u Puli, 1898. godine. Nakon krstarenja po Aziji i Južnoj Americi, poslan je 1914. godine na, kako se ispostavilo, posljednju misiju - bombardiranje grada Bara u Crnoj Gori. Tijekom misije, Zenta je zarobljen i potopljen od strane Francuskih i Britanskih pomorskih snaga i tako ostao zapamćen u Europskoj povijesti kao

7. Antonija Jozić of host organisation ICUA Zadar lectures on the work of conservation-restoration professionals / Predstavnica domaćina, MCPA Zadar, Antonija Jozić održala je predavanje iz konzervatorsko-restauratorske struke (Photo: M. Kaleb)





**8. The participants at the former St Nicholas church /
Zajednička fotografija ispred crkve sv. Nikole
(Photo: I. Škoro)**

Archaeology in Zadar offered a unique approach to the presentation of insights into the World War I period. Her presentation focused on the conservation and restoration of underwater finds from the Albanien and Szent István wrecks. Artefacts were recovered during expeditions to these wrecks from the ship's equipment and that of the sailors who worked on them. These artefacts were subjected to treatments adhering to the principles of the restoration-conservation profession that significantly retarded their natural degradation.

The closing lecture at the conference was given by Jurica Bezak of the Croatian Conservation Institute on the topic of the wreck of the Italian warship Cesare Rossarol. The sinking of this scout cruiser in 1918 was caused by naval mine the ship hit while manoeuvring on the route from Pula to Rijeka. It now lies at a depth of fifty metres in the waters of Ližnjan and is one of the most visited wrecks in the Adriatic Sea.

The close of the lecture segment of the conference saw the participants and visitors visit the underwater archaeology gallery, where they had an opportunity to see showcase finds from excavations conducted by ICUA Zadar. There was also a tour of all our restoration and conservation workshops.

The lecturers offered a presentation of their research and projects of equal interest to both specialists and the broader public, and described examples of good and bad practices in the presentation of underwater cultural heritage. For us at ICUA Zadar it was an honour to organise and host this event in the European Year of Cultural Heritage and in this way mark the 100th anniversary of the sinking of the SMS Szent István and of the end of the First World War.

prvi austrougarski brod potopljen u Prvom svjetskom ratu. Olupina je otkrivena 2001. godine, a i danas se gotovo netaknuta i prekrivena ribarskim mrežama nalazi na dubini od 73 metra u podmorju grada Bara.

Jedinstveni pristup u prezentaciji saznanja iz razdoblja Prvog svjetskog rata ponudila je Antonija Jozić (MCPA Zadar) koja je na konferenciji održala predavanje o konzervaciji i restauraciji podvodnih nalaza s brodoloma Albanien i Szent István. Tijekom ekspedicija na navedenim olupinama prikupljeni su predmeti koji pripadaju opremi broda i mornarima koji su na njima služili. Na njima su provedeni postupci po načelima restauratorsko-konzervatorske struke koji su znatno usporili prirodno degradiranje predmeta.

Posljednje predavanje na konferenciji održao je Jurica Bezak (Hrvatski restauratorski zavod) na temu olupine talijanskog ratnog broda Cesare Rossarol. Potonuće izviđačke krstarice na 1918. godine uzrokovala je podmorska mina na koju je brod naletio tijekom manevriranja na ruti od Pule do Rijeke. Danas leži na 50 metara dubina u podmorju Ližnjana i jedna je od najposjećenijih olupina na Jadranu.

Po završetku predavačkog dijela konferencije, svim sudionicima i posjetiteljima je otvorena Galerija podvodne arheologije gdje su mogli vidjeti reprezentativne nalaze s istraživanja MCPA Zadar, a organiziran je i obilazak svih radionica za restauriranje i konzerviranje u sklopu MCPA Zadar.

Predavači su na znanstveni, ali i popularni način predstavili svoja istraživanja i projekte, te opisali primjere dobre i loše prakse u prezentaciji podvodne kulturne baštine. Kao djelatnicima MCPA Zadar, bila nam je čast biti domaćinom i organizirati ovaj događaj u Europskoj godini kulturne baštine i na ovaj način obilježiti 100-tu godišnjicu potonuća broda SMS Szent István te stotu obljetnicu završetka Prvog svjetskog rata.

FIRST POLISH-CROATIAN ARCHAEOLOGICAL CULTURAL HERITAGE COLLABORATION

ZAČETAK POLJSKO-HRVATSKE SURADNJE NA POLJU ARHEOLOŠKE KULTURNE BAŠTINE

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1. The formal exchange of the cooperation agreement / Svečani trenutak predaje ugovora o suradnji (Photo: M. Kaleb)

In 2018 the International Centre for Underwater Archaeology in Zadar began its collaboration with the Museum of the First Piasts (Muzeum Pierwszych Piastów) at Lednica in Poland. The core mission of this major institution is to showcase medieval cultural heritage on and around Poland's Lake Lednica.

International collaboration in the field of underwater archaeology is one of the core segments of the work of the International Centre for Underwater Archaeology (ICUA) in Zadar and the initiative to establish this collaboration was thus met with great enthusiasm at ICUA. This international contact is the result of the fruitful culture activity of the team at the Croatian embassy in Warsaw under the leadership of the ambassador, HE Andrea Bekić. Following a round of correspondence

Međunarodni centar za podvodnu arheologiju u Zadru započeo je u 2018. g. suradnju s Muzejom prvih Piasta (Muzeum Pierwszych Piastów) na Lednici u Poljskoj. Glavna zadaća te velike ustanove je prezentacija ranosrednjovjekovne kulturne baštine na i oko područja jezera Lednica u Poljskoj.

Međunarodna suradnja na polju podvodne arheologije jedan je od najvažnijih segmenata Međunarodnog centra za podvodnu arheologiju u Zadru (MCPA Zadar) i upravo je zato inicijativa za suradnju u zadarskom centru prihvaćena s entuzijazmom. Uspostava međusobnih kontakata plod je bogate kulturne djelatnosti ekipe hrvatskog Veleposlanstva u Varšavi, pod vodstvom veleposlanice, njezine ekscelencije Andreje Bekić. Nakon prvih pismenih kontakata između dvije ustanove,

2. A presentation of the work of ICUA Zadar / Predavanje o MCPA Zadar (Photo: M. Kaleb)





3. The team from Zadar with their Polish hosts; from left to right: / Zadarski tim s poljskim domaćinima; s lijeva na desno: Andrzej Pydyn, Janusz Górecki, Roko Surić, Andrzej M. Wyrwa, Maja Kaleb, Luka Bekić, Jerzy Jacek Domicz, Andrzej Łozowski, Danuta Nowacka (Photo: B. Prabucki)

between the two institutions, an official visit was staged of ICUA staffers to the museum at Lednica. The visit took place from the 15th to 19th of July 2018.

At the heart of the visit was the formal signing of an inter-institutional agreement establishing scientific cooperation between the Polish museum of the First Piasts and ICUA Zadar. The agreement was signed by museum director Andrzej M. Wyrwa and ICUA director Luka Bekić. On hand for the signing ceremony were Croatian honorary consul in Poznań Jerzy Jacek Domicz and Andrzej Łozowski, the municipal mayor of Łubowo. It is worth

5. A presentation of the key ICUA projects for our Polish colleagues / predstavljanje najvažnijih projekata MCPA poljskim kolegama (Photo: R. Surić)



dogovoren je i službeni posjet djelatnika MCPA Zadar muzeju na Lednici. Posjet je realiziran u razdoblju od 15. do 19. srpnja 2018. g.

Osnovna svrha posjeta bila je službeno i formalno potpisivanje međuinstitucionalnog ugovora u kojem se dogovara znanstvena suradnja između poljskog Muzeja Prvih Piasta na Lednici i MCPA Zadar. Ugovor su potpisali ravnatelj muzeja prof. dr. sc. Andrzej M. Wyrwa i ravnatelj centra doc. dr. sc. Luka Bekić, a svečanom potpisivanju prisustvovali su i počasni konzul Republike Hrvatske u Poznanju Jerzy Jacek Domicz te načelnik općine Łubowo Andrzej Łozowski. Valja napomenuti kako je Općina Łubowo već je duže vrijeme u pobratimskom statusu s našim gradom Ninom, pa će ova nova suradnja pridonijeti novim vezama.

Znanstvena suradnja će se bazirati na istraživanju ranosrednjovjekovnih vladarskih središta, s hrvatske strane Nina i okolice,



4. The tour / Obilazak (Photo: R. Surić)



6. The visit to the archaeological museum in Poznań / Posjet Arheološkom muzeju u Poznanu (Photo: M. Kaleb)

noting that the Municipality of Łubowo has for some time now been twinned with the Croatia town of Nin and this new collaboration is sure to pave the way to new contacts.

The research cooperation will be based on the investigation of the seats of power of early medieval rulers—in Croatia this is Nin and its environs, and in Poland the area of Ostrów Lednicki (Lednicki Island). Besides being key political hubs of early medieval states, it is thought that Croatian and Polish rulers were baptized into the Roman Catholic Church at these sites. There are also

a s poljske područja Ostrowa Lednickog. Osim što se radi o važnim političkim središtima ranosrednjovjekovnih država, pretpostavlja se da su se na tim mjestima pokrstili hrvatski i poljski vladari, a postoje i brojne druge paralele koje valja detaljno istražiti. Dva otoka pružaju pregršt zanimljivih povijesnih priča koje će se u ovoj suradnji nastojati rasvijetliti. Bitan segment suradnje biti će i popularizacija kulturne baštine kojom se ta dva prostora mogu podići.

Zadarski tim podvodnih arheologa u ovoj posjeti sačinjavali su ravnatelj MCPA doc. dr. sc. Luka Bekić, Roko Surić iz Odjela prezentacije podvodne baštine MCPA i Maja Kaleb iz Odjela edukacije i dokumentacije MCPA. Po potpisivanju ugovora održana je prezentacija, u kojoj se poljskim kolegama u kratkim crtama predstavio MCPA Zadar. Nakon formalnog dijela u upravnoj zgradi muzejskog sklopa, domaćini su zadarski tim proveli kroz muzejske odjele. Tako su imali priliku vidjeti stari muzejski postav s dvije drvene ladve (monoksila), privremene izložbe i restauratorsko - konzervatorske radionice muzeja. Posebno je zanimljiv muzej na otvorenom, na Ostrowu Lednickom, gdje se mogu vidjeti konzervirani ostaci zidane crkve i palače te ostaci masivnih zemljanih bedema.

7. Preparations for the dive in Lake Lednica / Pripreme za zaron u jezero Lednicu (Photo: L. Bekić)



many other parallels that deserve deeper study. The two islands offer an abundance of fascinating history that this collaboration will aim to shed more light on. An important part of this collaboration will be the popularization of the cultural heritage these two places boast.

The team of ICUA Zadar underwater archaeologists on this visit consisted of ICUA director Luka Bekić, Roko Surić from our underwater heritage presentation department, and Maja Kaleb from our education and documentation department. The signing of the agreement was followed by a brief presentation of the work of ICUA for our Polish colleagues. After the formal part of the event at the museum's administrative building the Polish hosts guided the ICUA team through the museum departments. They had an opportunity to view the museum exhibition of two wooden boats (monoxylons), the temporary exhibits and the museum's restoration-conservation workshop. Of particular interest is the open-air museum on Lednicki Island where the team had an opportunity to see the conserved remains of the walled church and palace and the remains of the massive earthwork ramparts.

The Museum of the First Piasts at Lednica also manages a reserve with Piast dynasty fortifications in Giecz and the Wielkopolska ethnographic park. The core thread of the museum's work is to showcase the early medieval



8. Finds from the excavations in the lake / Pregled nalaza s iskopavanja u jezeru (Photo: R. Surić)

Muzej Prvih Piasta na Lednici upravlja i arheološkim rezervatom s fortifikacijom iz razdoblja Piasta u Gieczu te Wielkopolskim etnografskim parkom. Osnovna nit vodilja muzeja je prikaz ranosrednjovjekovnog razvoja Poljske države, koji je odvijao upravo u naselju koje je bilo smješteno na otoku usred jezera, pod imenom Ostrow Lednicki. U tom utvrđenom ranosrednjovjekovnom naselju poljski kralj Mieško 1. Sagradio je kršćansku crkvu te je tim činom poveo cijelu Poljsku i poljake u obitelj kršćanskih nacija. Njegovo slavno djelovanje s otoka Ostrow Lednicki i uspješno vladanje nastavio je i sin Boleslav Hrabri. Ledničko jezero smješteno je u srcu područja koje je činilo jezgru najranije poljske srednjovjekovne države, a u relativnoj blizini jezera nalaze se i druga važna naselja te države: Poznań, Gniezno i Giecz.

Za vrijeme posjeta samom Ledničkom otoku, hrvatski stručnjaci imali su priliku zaroniti na tri nalazišta u jezeru Lednica, na kojima im je poljski kolega dr. sc. Andrzej Pydyn, voditelj Instituta podvodne arheologije na Sveučilištu Nikola Kopernik u Torunu, pokazao ostatke drvenih mostova koji su otočiće spajali s obalom jezera. S obzirom na to da su se u trenutku posjeta vršila podvodna arheološka iskopavanja, iskorišten je trenutak da se obiđe lokalitet, te da poljski kolega pokaže svojim gostima, kojim tehnikama iskopavanja i dokumentiranja se služe na takvim istraživanjima. Ovaj obilazak poslužio je za obostranu razmjenu iskustva i ideja u vezi istraživanjem takvih podvodnih nalazišta. U kućici na otoku, koju poljski kolege koriste kao arheološku bazu održano je predavanje u kojem je predstavljen MCPA Zadar, a druženje na Ledničkom otoku iskorišteno je i za planiranje konkretnih koraka u budućoj suradnji na poljskim i hrvatskim nalazištima.

Treći dan posjeta hrvatski je tim proveo u glavnom gradu Poljske, Varšavi, tijekom kojeg je posjećen Poljski državni



9. A diver next to the wooden piles of the medieval bridge / Ronilac pored drvenih pilona srednjovjekovnog mosta (Photo: L. Bekić)



10. Preparations for the viewing of the archaeological trenches beneath the platform / Pripreme za pregleđ arheološke sonde ispod platforme
(Photo: L. Bekić)

development of Poland that took place at the settlement located on Lednicki Island in Lednica Lake. At this fortified early medieval settlement Mieszko I of Poland erected a Christian church and, by doing so, moved the whole of Poland and the Polish nation into the fold of Christian nations. His glorious work on Lednicki Island and successful reign was continued by his son Bolesław I the Brave. Lake Lednica is located in the centre of the region that constituted the heartland of the earliest Polish medieval state. Close to this lake are the other key settlements of this state: Poznań, Gniezno and Giecz.

During the visit to Lednicki Island the visiting Croatian experts had an opportunity to dive at three sites in Lake Lednica at which their Polish colleague Andrzej Pydyn, the head of the underwater archaeology institute at Nicolaus Copernicus University in Toruń, showed them the remains of the wooden bridges that connected the islets to the shores of the lake. As underwater archaeological excavations were ongoing during the visit it was an opportunity to tour the site and for the Polish host to show his guests the excavation and documentation techniques being applied at these excavations. The tour was also an opportunity to exchange experiences and ideas related to the excavation of underwater sites of this

arheološki muzej. Domaćini, zamjenik ravnatelja dr. sc. Wojciech Borkowski te muzejski savjetnik Witold Migal primili su hrvatski tim na službeni sastanak. Raprava se na sastanku odvijala o projektima iz područja podvodne arheologije u koje je bio uključen varšavski muzej, kao i hrvatskim iskustvima iz sličnih projekata, a obišao se i stalni postav muzeja. Posjet ovom važnom muzeju iskorišten je i za razmjenu publikacija, pa su knjižnica Državnog arheološkog muzeja Poljske i Knjižnica MCPA Zadar bogatije svaka za stotinjak novih izdanja.

Za vrijeme posjeta Varšavi održan je i sastanak u

11. The meeting at the State Archaeological Museum in Warsaw / Sastanak u Poljskom državnom arheološkom muzeju u Varšavi (Photo: Z. Korzeniewska)



kind. A presentation of the work of ICUA was staged at the house on the island used by the Polish colleagues as their archaeological base of operations. The time spent on Lednicki Island was also used to plan concrete steps in our future collaboration at Polish and Croatian sites.

The third day of the visit saw the Croatian team in the Polish capital Warsaw and included a visit to the Polish State Archaeological Museum. The hosts, deputy director Wojciech Borkowski and museum advisor Witold Migal, received the Croatian team for an official meeting. The discussion focused on projects in the field of underwater archaeology in which this museum has taken an active role and Croatian experiences from similar endeavours, followed by a tour of the museum's permanent exhibition. The visit to this important museum was also an opportunity to exchange publications and the libraries of the State Archaeological Museum in Warsaw and of ICUA Zadar are both now richer for a hundred new editions.

The time in Warsaw was also an opportunity for a meeting at the Croatian embassy in Poland where the ICUA underwater archaeologists were warmly received by the ambassador, HE Andrea Bekić. At the embassy meeting the team from Zadar informed the ambassador of the outcome of the visit and what potential further steps lie ahead in this collaborative effort. The ambassador expressed the embassy's readiness to provide further assistance in developing cooperation in the field of underwater cultural heritage between the two countries.

The archaeologists from Zadar also had the opportunity to experience the great warmth of the Polish people and their links with Croatia, who were particularly gracious in congratulating us at every corner for the *najlepszu drużynę piłkarsku*, that is to say the best team at the recent football World Cup. We can only hope that this first step will be fruitful and that our collaboration in the years to come will see optimal development to the benefit of specialists, our cultural heritage and the friendship shared by Croatia and Poland.



12. An exchange of duplicates with the library of the State Archaeological Museum in Warsaw / Razmjena dubleta s knjižnicom državnog arheološkog muzeja u Varšavi (Photo: Z. Korzeniewska)

Veleposlanstvu Republike Hrvatske u Poljskoj u kojem je podvodne arheologe MCPA srdačno primila njena ekscelencija veleposlanica dr. sc. Andrea Bekić. U Veleposlanstvu su zadarski stručnjaci izvijestili veleposlanicu o tome kako je prošao dotadašnji dio posjeta, te koji su potencijalni budući koraci u samoj suradnji. Na primanju je istaknuta spremnost Veleposlanstva na daljnju pomoć u razvitku suradnje na polju podvodne kulturne baštine u ovim dvjema državama.

Zadarski arheolozi imali su priliku doživjeti veliku srdačnost i povezanost poljskog naroda s hrvatskim, a posebno je simpatično bilo primanje čestitki koje su Poljaci na svakom koraku upućivali hrvatskim gostima za „*najlepszu drużynę piłkarsku*“ odnosno najbolju nogometnu reprezentaciju na netom završenom svjetskom prvenstvu u nogometu. Ostaje samo za poželjeti kako će ovaj prvi korak uroditi plodom te da će se suradnja kroz godine koje dolaze razviti u pravom smislu, od čega bi dobrobit imali stručnjaci, kulturna baština i prijateljstvo ovih dviju država.

13. ICUA archaeologists with HE Andrea Bekić, ambassador at the Croatian embassy in Warsaw / Arheolozi MCPA s veleposlanicom, njenom ekscelencijom Andrejom Bekić u hrvatskom Veleposlanstvu u Varšavi (Photo: D. Bekić)

INTERNATIONAL CONFERENCE ON UNDERWATER CULTURAL HERITAGE IN EUROPE TODAY

MEĐUNARODNA KONFERENCIJA „PODVODNA KULTURNA BAŠTINA U EUROPI DANAS”

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In collaboration with the Croatian Ministry of Culture the International Centre for Underwater Archaeology in Zadar, a UNESCO Category II centre, staged an international conference on Underwater Cultural Heritage in Europe Today. The event, held on the 25th and 26th of October 2018, is part of our celebration of the European Year of Cultural Heritage. The conference is supported by the Central European Initiative—a forum for culture and research that Croatia is presiding over as of January of this year, the UNESCO Regional Bureau for Science and Culture in Europe, Antenna Office in Sarajevo, the European Commission Representation in Croatia and the Europe Direct Zadar Information Centre.

The event was staged under the high patronage of UNESCO Director-General Audrey Azoulay and is part of the official programme of the Croatian presidency of the Committee of Ministers of the Council of Europe and presented as such in Strasbourg on the 30th of May.



1. The ICUA's director Luka Bekić welcome address at the St Nicholas church / Pozdravni govor ravnateljice Luke Bekića u crkvi sv. Nikole (Photo: K. Ivković)

U okviru Europske godine kulturne baštine Međunarodni centar za podvodnu arheologiju u Zadru, UNESCO-ov centar II. kategorije, u suradnji s Ministarstvom kulture organizirao je od 25. do 26. listopada 2018. međunarodnu konferenciju pod nazivom „Podvodna kulturna baština u Europi danas”. Međunarodna konferencija sufinancirana je sredstvima Srednjoeuropske inicijative (CEI), kulturne i znanstvene međunarodne organizacije kojom Republika Hrvatska predsjedava od siječnja 2018. godine, sredstvima osiguranim od strane UNESCO-vog Regionalnog Ureda u Sarajevu, Predstavništva Europske komisije u Hrvatskoj i Informacijskog Centra Europe Direct Zadar.

Manifestacija je organizirana pod visokim pokroviteljstvom glavne ravnateljice UNESCO-a gđe. Audrey Azoulay, dio je službenog programa predsjedanja Republike Hrvatske Odborom ministara Vijeća Europe i kao takva predstavljena u Strasbourgu 30. svibnja 2018. godine.





2. The lecture of Mladen Pešić at the former St Nicholas church building / Predavanje Mladena Pešića u bivšoj crkvi sv. Nikole (Photo: M. Kaleb)

By organising the Underwater Cultural Heritage in Europe Today conference the ICUA Zadar joins numerous Croatian and European institutions in celebrating the European Year of Cultural Heritage in 2018 and putting cultural heritage in the focus. Almost half (453) of all sites included on the UNESCO World Heritage List are located in Europe, while the eighty-nine inscribed examples of intangible heritage in the EU make up a quarter of UNESCO's Representative list of intangible cultural heritage. The decision to declare the European Year of Cultural Heritage was made by the European Parliament and the Council of the European Union on the 17th of May 2017. The decision was aimed at encouraging people to investigate Europe's rich and diverse cultural heritage, to protect its unique value and to consider the role of cultural heritage in our everyday lives.

The first day of the two-day event was staged on Thursday the 25th of October at the former St Nicholas church. At the Conference international experts from twelve European countries exchanged their experiences and showcased their achievements in the protection and preservation of underwater cultural heritage. The participants were welcomed by ICUA Zadar director Luka Bekić and by the deputy head of the archaeology department at the University of Zadar Dario Vujević.

Bearing in mind that cultural heritage has been recognised as an important factor in national identification and constitutes a long term resource in sustainable development this forum was an opportunity to hear fascinating presentations on our diverse underwater heritage, its preservation, protection, appreciation, presentation and popularisation, and the possibilities open to us with our present technology in facilitating and accessing underwater cultural heritage.



Organiziranjem konferencije „Podvodna kulturna baština u Europi danas” MCPA Zadar pridružio se brojnim hrvatskim i europskim institucijama u obilježavanju Europske godine kulturne baštine 2018. stavljajući kulturnu baštinu u središte pozornosti. Gotovo polovina svih lokaliteta (453) uvrštenih na Popis svjetske baštine UNESCO-a nalazi se u Europi, dok 89 upisa nematerijalne baštine EU-a čini četvrtinu Reprezentativnog popisa nematerijalne kulturne baštine UNESCO-a. Odluku o proglašenju Europske godine kulturne baštine donijeli su Europski parlament i Vijeće Europske unije 17. svibnja 2017. g. Namjera je bila potaknuti ljude na istraživanje bogate i raznovrsne kulturne baštine Europe, štititi

3. The ICUA underwater archaeology gallery / MCPA Galerija podvodne arheologije (Photo: M. Kaleb)





4. International meeting at the Rector's palace / Međunarodni sastanak u Kneževoj palači (Photo: K. Ivković)

The conference lecturers and their presentations:

- Mr Mladen Pešić, ICUA Zadar, Croatia's Rich Underwater Heritage in Old and New Research Projects
- Ms Barbora Machová, Institute of Archaeology of the CAS, Czech Republic, First Steps in Underwater Cultural Heritage Protection in the Czech Republic
- Mr Andrzej Pydyn, Nicolaus Copernicus University in Toruń, Poland, Underwater Archaeological Heritage of Poland - Current Research and Future Development
- Mr Cyril Dworsky, National Management, UNESCO Prehistoric Pile Dwellings Around the Alps (Kuratorium Pfahlbauten, UNESCO-Welterbe Prähistorische Pfahlbauten um die Alpen), Austria, Underwater Cultural Heritage as a New Mission in Austria
- Mr Roman Scholz, German Archaeological Institute (DAI), Germany, Submerged - Perspectives and Limits of Underwater Archaeology in Germany
- Mr Miran Erič, Institute for the Protection of Cultural Heritage of Slovenia, Underwater Cultural Heritage in Slovenia and Future Protection Perspectives
- Ms Peta Knott, Nautical Archaeology Society (NAS), United Kingdom, The Sea Knows no Boundaries: Public Access to Underwater Cultural Heritage Throughout Europe
- Ms Liisa Randmaa, Estonian Maritime Museum, Estonia, Maritime Archaeology in a Museum Setting
- Ms Annie Dumont, Department for Underwater Archaeological Research (DRASSM), Ministry of Culture and Communication of the French Republic, Ms Marion Foucher, University of Burgundy in Dijon, France, Underwater Cultural Heritage of French Rivers
- Mr Massimo Capulli, University of Udine, Department of Humanities and Cultural Heritage, Italy, Underwater Archaeology in Italy: Training and Research
- Mr Attila J. Tóth, Árpád Museum, Ráckeve, Hungary, News and Actual State of Underwater Archaeological Research in Hungary
- Mr Dimitris Kourkoumelis, Ephorate of Underwater

njezinu jedinstvenu vrijednost te promišljati o mjestu koje kulturna baština zauzima u našim životima.

Prvi dan dvodnevne manifestacije održan je u četvrtak 25. listopada 2018. u crkvi sv. Nikole. Na stručnoj konferenciji međunarodni stručnjaci iz dvanaest europskih zemalja razmijenili su iskustva te predstavili dostignuća u zaštiti i očuvanju podvodne kulturne baštine. Pozdravne govore održali su ravnatelj MCPA Zadar dr.sc. Luka Bekić i zamjenik pročelnika Odjela za arheologiju izv.prof.dr.sc. Dario Vujević.

Uzimajući u obzir činjenicu da je kulturna baština prepoznata kao važan faktor nacionalne identifikacije i predstavlja dugoročan resurs za održivi razvoj, bila je ovo prigoda poslušati zanimljiva izlaganja o bogatoj podvodnoj baštini, o njenom očuvanju, zaštiti, valorizaciji, prezentaciji i popularizaciji kao i o mogućnostima današnje tehnologije koja olakšava otkrivanje i pristup podvodnoj kulturnoj baštini.

Na konferenciji su sudjelovali predavači sa sljedećim prezentacijama:

- g. Mladen Pešić, MCPA Zadar, „Hrvatska bogata podvodna baština u starim i novim istraživačkim projektima”;
- gđa. Barbora Machová, Arheološki institut (Institute of Archaeology of the CAS), Češka Republika „Počeci zaštite podvodne kulturne baštine u Češkoj Republici”;
- g. Andrzej Pydyn, Sveučilište Nicolaus Copernicus u Toruńu, Republika Poljska, „Podvodna arheološka baština Poljske – današnja istraživanja i budući razvoj”;
- g. Cyril Dworsky, Upravni odbor UNESCO-vih prapovijesnih naseobina sojenica (Kuratorium Pfahlbauten, UNESCO-Welterbe Prähistorische Pfahlbauten um die Alpen), Austrija, „Podvodna kulturna baština kao nova misija Austrije”;
- g. Roman Scholz, Njemački arheološki institut (DAI), Njemačka, „Potopljeno – mogućnosti i granice podvodne arheologije u Njemačkoj”;
- g. Miran Erič, Institut za zaštitu kulturne baštine Slovenije, „Podvodna kulturna baština u Sloveniji i mogućnosti buduće zaštite”;
- gđa. Peta Knot, Nautičko arheološko društvo (Nautical Archaeology Society – NAS), Velika Britanija, „More ne poznaje granice: javni pristup podvodnoj kulturnoj baštini Europe”
- gđa. Liisa Randmaa, Pomorski muzej Estonije (Estonian Maritime Museum), Estonija, „Pomorska arheologija u muzejskom okruženju”;
- gđa. Anni Dumont, Odjel za podvodna i podmorska arheološka istraživanja (DRASSM), Ministarstvo kulture i komunikacija Francuske Republike, gđa. Marion Foucher, Sveučilište Burgundy u Dijonu, Francuska,

Antiquities,
Ministry of Culture
and Sports of the
Hellenic Republic,
Protecting the
Underwater
Cultural Heritage
in Greece – An
Obligation or a
Necessity?

- Ms Iwona Pomian, Central Maritime Museum in Gdansk, Ms Agnieszka Olech, Ministry of Culture and National Heritage, Poland; Underwater Archaeological Sites in Poland;

- Ms Barbara Davidde, Superior Institute for Conservation and Restoration, Ministry of Cultural Heritage and Activities and Tourism, Italy, Preservation and Conservation of Underwater Cultural Heritage in Italy: An Overview

- Ms Brigita Petek, Ministry of Culture, Directorate for Cultural Heritage, Slovenia, Underwater Heritage – Legal Protection in Practice

- Ms Rita Auriemma, University of Salento, Italy, The Faro Convention and the Sustainable Valorisation of the Underwater Heritage: Case Studies and Projects in the Adriatic and Ionian Sea

- Ms Andrea Cukrov, Cultural Property Documentation and Registration Service, Directorate for the Protection of Cultural Heritage, Mr Saša Denegri, Conservation Department in Split for the area of the Split-Dalmatia County, Ministry of Culture, Croatia, System of Protection and Supervision of Underwater Cultural Heritage by Inter-Sector Cooperation Between State Administration Bodies

At the close of the lecture sessions the conference participants were provided a tour of the ICUA underwater archaeology gallery and our workshops and other facilities.

On day two of the event, Friday the 26th of October, Mr Hrvoje Manenica, the assistant to culture minister Nina Obuljen Koržinek, opened an International Meeting at the concert hall of the Rector's palace. Welcome addresses were delivered by Mr Branko Baričević, the head of the European Commission Representation in Croatia, Mr Mario Horvatić, the assistant to the foreign and European affairs minister for multilateral and global affairs, and Jagoda Surać, the deputy mayor of Zadar.



5. Ulrike Guerin speaks at the Rector's palace / Ulrike Guerin govori u Kneževoj palači (Photo: M. Kaleb)

„Podvodna kulturna baština francuskih rijeka”;

- g. Massimo Capulli, Odjel za humanističke znanosti i kulturnu baštinu, Sveučilište u Udinama (University of Udine, Department of Humanities and Cultural Heritage), Italija, „Podvodna arheologija u Italiji: obuka i istraživanje”;

- g. Attila J. Tóth, Muzej Árpád, Ráckeve, Mađarska, „Novosti i stanje podvodnih arheoloških istraživanja u Mađarskoj”;

- g. Dimitris Kourkoumelis, Odjel za podvodne starine (Ephorate for underwater antiquities), Ministarstvo kulture i sporta Hellenke Republike, „Zaštita podvodne kulturne baštine u Grčkoj - obveza ili nužnost?”;

- gđa. Iwona Pomian, Nacionalni pomorski muzej u Gdansku, gđa. Agnieszka Olech, Ministarstvo kulture i nacionalne baštine Republika Poljska; prezentacija „Podvodna arheološka nalazišta u Poljskoj”;

- gđa. Barbara Davidde, Visoki institut za konzervaciju i restauraciju, Ministarstvo kulturne baštine i turizma Talijanske Republike, Italija, „Zaštita i konzervacija podvodne kulturne baštine u Italiji – pregled”;

- gđa. Brigita Petek, Sektor za nepokretnu baštinu, Ministarstvo kulture, Republika Slovenija, „Podvodna baština – pravna zaštita u praksi”;

- gđa. Rita Auriemma, Sveučilište Salento, Italija, „Faro konvencija: prema održivijoj valorizaciji podvodne baštine. Studije slučaja i projekti na Jadranskom i Jonskom moru”;

- gđa. Andrea Cukrov, Služba za dokumentaciju i registar kulturnih dobara, Uprava za zaštitu kulturne baštine, g. Saša Denegri, Konzervatorski odjel iz Splita za područje Splitsko-dalmatinske županije, Ministarstvo kulture, „Sustav zaštite i nadzora podvodne kulturne baštine te međusektorska suradnja između tijela državne uprave”.

The meeting focused on the implementation of the 2001 UNESCO Convention on the protection of underwater cultural heritage. Croatia was the third country in the world to ratify the Convention, reaffirming the importance it assigns to the protection of underwater cultural heritage.

Mr Siniša Šešum, the head of the UNESCO Antenna Office in Sarajevo, spoke of the importance of the ICUA Zadar as a UNESCO Category II centre for Croatia and Southeast Europe as a whole. He noted that UNESCO Director-General Audrey Azoulay approved UNESCO auspices for this event because of the importance of promoting the broadest possible ratification and implementation of the 2001 Convention and the congruence of the aims of the conference in Zadar with the objectives of the European Year of Cultural Heritage. UNESCO recognised the high level of development of underwater archaeology and worked with Croatia to achieve an agreement to found ICUA Zadar as the first institution of its kind in Croatia under the auspices of UNESCO.

Ms Urlike Guérin of the UNESCO headquarters in Paris reiterated the importance of the Convention adopted in Paris in 2001 as the first multiparty international agreement that offers a systematic and comprehensive approach to the protection of underwater cultural heritage and called on UN Member States to sign and ratify the Convention, with the current number of State Parties to the Convention numbering sixty.

She also spoke of the UN 2030 Agenda for Sustainable Development adopted at the General Assembly in New York in September of 2015. The international community for the first time ever recognised the role of cultural heritage and creative industries as the drivers of sustainable development. The Agenda 2030 puts forward seventeen sustainable development goals, of which goal number fourteen, Conserve and sustainably use of oceans, has been identified as critical to the protection of underwater cultural heritage.

6. The visit to antiquities museum in Nin / Posjet Muzeju ninskih starina (Photo: R. Surić)



Po završetku predavanja sudionicima konferencije organizirano je razgledavanje MCPA Galerije podvodne arheologije te posjet radionicama i prostorijama Centra.

Drugog dana u petak 26. listopada 2018. izaslanik ministriculture dr. sc. Nine Obuljen Koržinek pomoćnik ministriculture dr. sc. Hrvoje Manenica otvorio je međunarodni sastanak u koncertnoj dvorani Kneževa palače. Sudionicima se obratio voditelj Predstavništva Europske komisije u Hrvatskoj dr.sc. Branko Baričević, pomoćnik ministriculture za multilateralu i globalna pitanja Ministarstva vanjskih i europskih poslova g. Mario Horvatić te zamjenica gradonačelnika Zadra dipl. iur. Jagoda Surać. Sastanak je bio posvećen pitanjima provedbe UNESCO-ve Konvencije iz 2001. godine o zaštiti podvodne kulturne baštine. Republika Hrvatska ratificirala je Konvenciju kao treća država u svijetu, potvrđujući time značaj koji pridaje zaštiti podvodne kulturne baštine.

O važnosti MCPA Zadar kao UNESCO-ovog centra II. kategorije ne samo u Hrvatskoj nego i jugoistočnoj Europi, govorio je voditelj Regionalnog ureda UNESCO-a u Sarajevu g. Siniša Šešum. Istaknuo je kako je glavna ravnateljica UNESCO-a gđa. Audrey Azoulay odobrila pokroviteljstvo UNESCO-a upravo zbog važnosti promicanja najšire moguće ratifikacije i provedbe Konvencije iz 2001. godine te poklapanja zadaća Zadarske konferencije s ciljevima Europske godine kulturne baštine. Podvodna arheologija je vrlo dobro razvijena što je UNESCO prepoznao te je na temelju dvostranog ugovora između Republike Hrvatske i UNESCO-a osnovan MCPA Zadar kao prva ustanova takve vrste u Hrvatskoj pod pokroviteljstvom UNESCO-a.

Predstavnica Središnjeg ureda UNESCO-a u Parizu gđa. Urlike Guérin, ponovila je važnost Konvencije usvojene u Parizu 2001., prvog mnogostranog međunarodnog ugovora koji se sustavno i sveobuhvatno bavi zaštitom podvodnih kulturnih dobara te pozvala zemlje članice UN-a na potpisivanje i ratificiranje predmetne Konvencije (broj država stranaka koje su pristupile Konvenciji dosegnuo je broj 60).

Osvrnula se i na UN-ov Program održivog razvoja 2030. tzv. Agendu 2030. usvojenu na UN-ovoj Općoj skupštini u New Yorku u rujnu 2015. Međunarodna zajednica po prvi puta je prepoznala ulogu kulturne baštine i kreativnih industrija kao pokretače održivog razvoja. Agenda 2030. sadrži 17 ciljeva održivog razvoja, a upravo je Cilj 14. Očuvanje vodenog svijeta prepoznat kao najvažniji za zaštitu podvodne kulturne baštine.

Sudionicima konferencije MCPA Zadar predstavljen je dokumentarni film pod nazivom „Očuvanje potopljene baštine” redateljica Marina Fulgosija. U filmu je prikazana



7. The participants at “Five Wells Square” (Trg pet bunara) in Zadar / Zajednička fotografija, Trg pet bunara Zadar (Photo: K. Ivković)

Director Marin Fulgosi's documentary film “Preserving Submerged Heritage” was screened for the participants of the ICUA Zadar conference. The documentary showcases the tradition of studying our maritime legacy in Croatia, the progress that has been made in recent years in conducting a quality system of surveys, investigation and protection of underwater archaeological sites, and the activities and departments at ICUA.

Saturday the 27th of October saw an organised visit to the town of Nin and a tour of its antiquities museum. Ms Anita Jelić and Ms Marina Šimičić provided expert guidance in presenting the re-conservation of the early Croatian Condura Croatica boats. These boat were discovered in the lagoon near Nin in 1966 and are a part of the original tradition of Croatian shipbuilding.

Croatia has a tradition spanning over 160 years in its institutional care for cultural heritage. This two-day international conference achieves a critical segment of the ICUA's core mission to disseminate available specialist data between Croatian archaeologists and experts from abroad. The event also reaffirmed our commitment to encourage diverse aspects of archaeological investigation, the comprehensive valorization of archaeological monumental heritage, and the adequate incorporation of archaeology into the society as a whole. The ICUA Zadar will continue in its mission to nurture the systematic and quality development of the archaeological profession both at the national level and in its European neighbourhood.

tradicija proučavanja pomorskog nasljeđa u Republici Hrvatskoj, napredak koji je postignut posljednjih godina u provođenju kvalitetnog sustava rekognosciranja, istraživanja i zaštite podvodnih arheoloških nalazišta, djelatnostima te odjelima Centra.

U subotu 27. listopada 2018. organiziran je posjet Ninu te obilazak Muzeja ninskih starina. Uz stručno vodstvo gđe. Anite Jelić i gđe. Marine Šimičić predstavljen je projekt rekonstrukcije staro hrvatskih brodova Condura Croatica. Riječ je o tipu broda koji je pronađen u ninskoj laguni 1966. godine i koji predstavlja originalnu tradiciju hrvatske brodogradnje.

Briga za kulturnu baštinu u Republici Hrvatskoj institucionalno traje više od 160 godina. Organiziranjem dvodnevne međunarodne konferencije ostvarena je i osnovna zadaća Centra, a to je prijenos dostupnih stručnih i znanstvenih informacija između hrvatskih arheologa i stručnjaka iz inozemstva. Jednako tako, potvrđena je želja za poticanjem različitih arheoloških istraživanja, za sveobuhvatnim valoriziranjem arheološkog spomeničkog nasljeđa kao i adekvatnom inkorporiranju arheologije u društvo u cjelini. Misija MCPA Zadar i nadalje će biti briga o sustavnom i kvalitetnom razvoju arheološke struke kako na nacionalnoj razini tako i u kontekstu europskog okruženja.

THE EARLY CROATIAN BOATS FROM NIN - RE-CONSERVATION PART 2

STAROHRVATSKI BRODOVI IZ NINA - REKONZERVIRANJE 2. DIO

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The conservation and restoration department at the International Centre for Underwater Archaeology is now in the third year of work in the process of re-conserving two early Croatian wooden boats from Nin, the Condura Croatica boats dated to the late eleventh century. The condura boats were discovered in the 1960s in Nin Cove and were investigated and extracted from the marine environment. This was followed by a conservation and restoration procedure carried out at the Archaeological Museum in Zadar. Since the late 1980s they have been on display at the Museum on Nin Antiquities. With the highly vulnerable wooden structure exposed to the unfavourable microclimatic conditions in which the boats were housed, it was just a few years later that the museum staff began noticing the degradation of the wood and to warn the competent authorities of the necessity of undertaking urgent interventions to protect the boats and retard the degradation process. Samples of the wood were taken in 2010 and sent for analysis, with the results showing that iron sulphate, pyrite, was forming within the wooden structure of the boats. The long-term exposure of the boat structure to these unfavourable microclimatic conditions, in combination with the large quantities of polyethylene glycol (PEG) used in its conservation, had led to accelerated oxidation. The oxidation of pyrite produces hydrous iron sulphates (melanterite, rozenite) visible as large quantities of powder formed on the boat structures, and sulphuric acid that penetrates into the structure of the wood and acidifies the wood, which in the end leads to the accelerated chemical and physical degradation of the wood.

The first phase of the re-conservation of the Nin boats has been ongoing since 2016 thanks to funding provided by the culture ministry. 2016 saw the processing and analysis of documentation on the previously conducted archaeological and conservation-restoration work, the documenting of the current condition and a new analysis



1. Documenting the Nin 2 boat prior to the launch of this year's works / Dokumentiranje broda Nin 2 prije početka ovogodišnjih radova (Photo: A. Jelić)

Odjel konzerviranja i restauriranja Međunarodnog centra za podvodnu arheologiju već treću godinu zaredom provodi proces rekonzerviranja dva starohrvatska drvena broda iz Nina, brodica nazvanih kondurama i datiranim u kraj 11. st. Kondure su 1960.-ih godina otkrivene u podmorju Ninskog zaljeva, na njima su provedena arheološka istraživanja te su izvađene iz mora. U tim je godinama uslijedio postupak konzerviranja i restauriranja brodica u Arheološkom muzeju u Zadru, a od kraja 1980.-ih godina kondure su izložene u dvorani Muzeja ninskih starina. S obzirom na osjetljivost drvene građe te nepovoljne mikroklimatske uvjete u kojima su brodice smještene, već nakon nekoliko godina djelatnici Muzeja zamijetili su degradacijske promjene na drvenoj građi te se počelo upozoravati nadležne službe na nužnost što hitnije intervencije u smislu zaštite i usporavanja procesa degradacije. 2010. godine uzeti su uzorci drvene građe i poslani na analize čiji su rezultati pokazali da je unutar strukture drveta brodske konstrukcije došlo do formiranja željezovog sulfida odnosno pirita, a višegodišnje izlaganje brodskih konstrukcija prethodno spomenutim nepovoljnim mikroklimatskim uvjetima u kombinaciji s



2. Documenting the Nin 1 boat prior to the launch of this year's works - the pyrite oxidation product (white powder) is visible / Dokumentiranje broda Nin 1 prije početka ovogodišnjih radova, vidljivi i produkti oksidacije pirita (bijeli prah) (Photo: A. Jelić)

of the wood and the powder being produced, which confirming the above cited causal factors of degradation and excluded the possibility of the formation of new factors. Based on the results obtained from the analysis a plan was formulated for future conservation-restoration work that foresaw work in phases from January of 2017 to December of 2021, with an option to extend work into 2023 in the event of unforeseen developments.

The following year, 2017, saw the start of preliminary cleaning of the condura boats and the removal of excess impregnation substance. This phase of conservation-restoration work was successfully carried out on both boats. The preliminary cleaning included the removal of all visible dirt, i.e. accumulated surface impurities such as particles of dust, sand and impurities created by insects (cobwebs, eggs) and the formed powder (white, yellow and grey), i.e. the visible product of the oxidation of pyrite (melantherite, rozenite) whereupon we undertook the removal of the impregnation substance polyethylene glycol from the surface of the boat structure, used in the previous conservation-restoration procedure as the

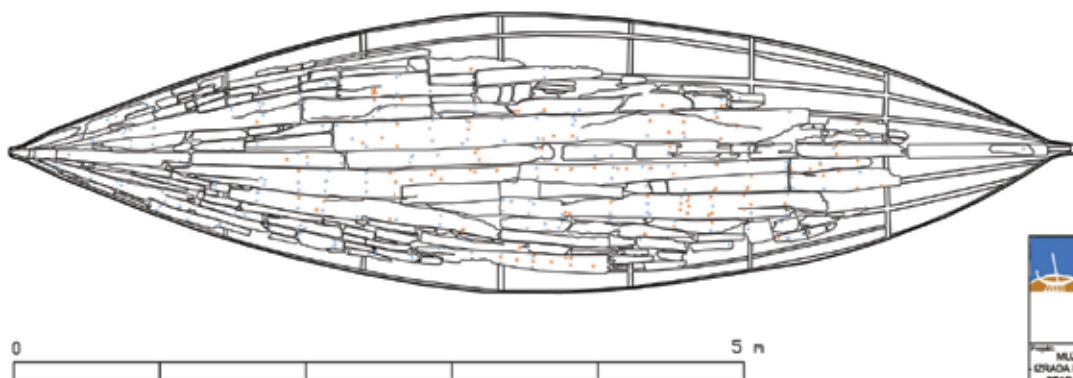
velikim količinama korištenog polietilen glikola izazvalo je njegovu ubranu oksidaciju. Oksidacijom pirita nastali su hidrolizirani željezovi sulfati (melantherit, rozenit) tada vidljivi u obliku velike količine formiranog praha na brodskim konstrukcijama te sulfatna kiselina koja prodire u strukturu drveta i zakiseljava drvenu građu što u konačnici dovodi do ubranog kemijskog i fizičkog razaranja drvene građe.

Od 2016. godine zahvaljujući financijskim sredstvima Ministarstva kulture započela je prva faza rekonzerviranja ninskih brodica. U toj je godini izvršena obrada i analiza dokumentacije o ranije provedenim arheološkim i konzervatorsko-restauratorskim radovima, dokumentirano je postojeće stanje te je provedena nova analiza drva i formiranog praha čime su potvrđeni prethodno određeni uzročnici propadanja, a isključena mogućnost formiranja novih. Na osnovu dobivenih rezultata analiza izrađen je plan budućih konzervatorsko-restauratorskih radova kojim je planirano izvođenje radova po fazama u terminu od siječnja 2017. do prosinca 2021. godine uz mogućnost produljenja radova do 2023. godine u slučaju nepredviđenih okolnosti.

U sljedećoj, 2017. godini, započelo je preliminarno čišćenje kondura i uklanjanje viška impregnacijskog sredstva. Ta faza konzervatorsko-restauratorskih radova uspješno je provedena na oba broda. Preliminarno čišćenje podrazumijevalo je uklanjanje svih vidljivih nečistoća, tj. nakupljenih površinskih nečistoća kao što su čestice prašine, pijeska te nečistoća nastalih uslijed djelovanja kukaca (paučina, jajašca) i formiranog praha (bijelog, žutog, sivog) odnosno vidljivog produkta oksidacije pirita (melantherit, rozenit) nakon čega se pristupilo uklanjanju impregnacijskog sredstva polietilen glikola s površine brodske konstrukcije, a korištenog u ranijem konzervatorsko-restauratorskom postupku kao površinska zaštita.

Uklanjanjem polietilen glikola s površine brodske

3. Plan view of the Nin 2 boat / Tlocrt broda Nin 2 (By: M. Ćurković Madiraca)



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	MUZEJ NINSKIH STARINA IZDAVA NAČRTNE DOKUMENTACIJE STAROHRVATSKIH BRODOVA (CONDURA CROATICA)
Datum: 14.11.2018.	Stranica: 125

surface protection.

The removal of the polyethylene glycol from the surface of the boats revealed details of the structure of the boats, i.e. the method in which the wooden structure was constructed and the appearance of the frames and planking, and the positions of iron elements and wooden pegs, metal ties used to bind wooden sections and the method used to fill in gaps. The newly discovered details were documented in drawings in 2016, which was also the start of work in 2018 with drawn documentation made of both vessels—the plan views and side views.

Given that there was a significant hazard of the boats coming apart into their constituent elements they were secured with polypropylene netting on the outside, between the planking and the metal cradle that held them, once drawn documentation had been completed. This year's re-conservation phase included the cleaning and removal of acidic sections of the wood and other products of the oxidation of pyrite. The prior analysis established that the wood was acidic in places at which there had once been iron elements, i.e. the nails used to join the planking to the frames. These places are visible on the planking as circular openings (holes) with a diameter of about one centimetre, and as wide and deep fissures in the frames.

The identification of acidic parts of the wood was effected with demineralised water and universal litmus paper. The universal litmus paper was placed against a few drops of demineralised water applied to the wooden surface around the round openings and within the fissures, with the paper turning from dark yellow to red in the presence of acid as verification of the acidification of the wood. This procedure was used to test every visible round opening in the planking and each of the fissures in the frames. A small number of the round openings in the planking did not show acidification, which was the result of the use of wooden pegs for joining in the previous conservation-restoration procedure and the taking of samples for wood type analysis in 2008. The same procedure determined that acid had penetrated into the structure of the wood with a radius of about one centimetre around most acidic round openings. All the fissures in the frames showed acidity, although the extent of acid penetration into the structure of the wood could not be determined before the



4. Mechanical cleaning of the wood / Mehaničko čišćenje drvene građe (Photo: Z. Vrgoč)

konstrukcije otkrili su se detalji poput same konstrukcije broda, odnosno način slaganja drvene građe te izgled rebara i oplata broda, zatim položaj željeznih elemenata i drvenih klinova, metalne poveznice kojima su se međusobno povezivali drveni dijelovi u cjelinu kao i način zapunjavanja šupljina. Novootkriveni detalji dokumentirani su na nacrtu dokumentaciju iz 2016. godine čime su ujedno i započeli radovi u 2018. godini. Nacrtu su dokumentirana oba broda, tlocrti i bokovi.

Kako postoji velika mogućnost raspadanja brodova na sastavne dijelove, po završetku nacrtne dokumentacije brodovi su osigurani postavljanjem polipropilenske mrežice s vanjske strane, između oplata broda i rešetke. Ovogodišnja rekonzervatorska faza uključivala je čišćenje i uklanjanje kiselih dijelova drvene građe i drugih produkata oksidacije pirita. Prethodnim analizama ustanovljeno je da je drvena građa kisela na mjestima gdje su nekad bili željezni elementi odnosno čavli, korišteni za spajanje oplata i rebara brodova. Na oplati brodova ta su mjesta bila vidljiva kao kružni otvori ili rupe promjera od oko 1 cm, a na rebrima kao široke i duboke

5. Achieving a neutral level at one of the many acidic round openings / Postizanje neutralnosti na primjeru jednog od mnogih kiselih kružnih otvora (Photo: A. Jelić)





6. Creating drawn documentation of the frames / *Nacrtno dokumentiranje rebara (Photo: A. Jelić)*

cleaning of the frames began.

In order to properly carry out the phase of detailed cleaning and removal of acidic sections, each part of the boat's structure was taken apart, both the planking and the frames, and each subjected to separate testing for wood acidification and cleaning. Cleaning and removal of acidic sections was done mechanically using hand-held chisels with semi-circular profile and scalpels of various sizes working through to the uninfected, neutral wood. During the removal of the acidic sections of wood we conducted periodic testing to see if the cleaning had removed all the affected acidic wood. When neutrality was achieved a small section of unaffected wood was also removed in order to ensure the success of the procedure. On the whole about one centimetre of wood was removed around each of the round openings affected by the acidification. After cleaning the initial acidic round openings of about one centimetre became neutral round openings with a diameter of about three centimetres. This procedure was used to clean out some 260 acidic round openings in the planking of the Nin 2 boat and around eighty on the planking of the Nin 1 boat, on which work is still in progress. The cleaning and removal of acidic sections of the frames was done with a power chisel and scalpels. Periodic testing of the procedure was done in the same manner as with the planking, with the final neutral fissures being larger and of irregular form. All 24 frames of the Nin 2 boat were cleaned, with cleaning of the frames of the Nin 1 boat still to be completed. The detailed cleaning phase was completed with the cleaning of the surface of each wooden element with ethyl alcohol to remove undesirable glossiness and oily surface texture to restore a more natural wood appearance.

Given that every part of the boat's structure was cleaned individually we concurrently removed metal ties and the mixture of polyethylene glycol, hemp, sand and sawdust used to fill in gaps in the previous conservation-restoration procedure—the conservation-restoration plan anticipates the replacement of this filler with other suitable material

pukotine.

Lokalizacija kiselih dijelova drvene građe vršila se uz pomoć demineralizirane vode i univerzalnog lakmus papira. Na par kapljica demineralizirane vode nanese na površinu drveta oko kružnih otvora i unutar pukotina prislanjao se univerzalni lakmus papir koji u slučaju prisutnosti kiseline mijenjao tamnožutu boju u crvenu, kao dokaz zakiseljenosti drvene građe. Ovim postupkom provjeravao se svaki vidljivi kružni otvor oplata i svaka pukotina rebara. Manji dio kružnih otvora oplata nije pokazivao zakiseljenost, a posljedica su upotrebe drvenih klinova za spajanje u prethodnom konzervatorsko-restauratorskom postupku i uzimanja uzoraka za provođenje analize vrste drveta provedene 2008. godine. Istim postupkom ustanovljeno je prodiranje kiseline u strukturu drveta u radijusu od približno 1 cm oko većine kiselih kružnih otvora. Svaka pukotina rebara pokazuje kiselost, a stvarno prodiranje kiseline u samu strukturu drveta nije bilo moguće odrediti prije samog početka čišćenja rebara.

Kako bi se pravilno provela faza detaljnog čišćenja i uklanjanja kiselih dijelova, odvajao se svaki dio brodske konstrukcije kako oplata tako i rebara te posebno provjeravao zakiseljenost drvene građe i vršilo čišćenje. Čišćenje i uklanjanje kiselih dijelova oplata vršilo se mehanički uz pomoć ručnih dlijeta polukružnog profila i skalpela različitih veličina do nezaraženog, neutralnog dijela drvene građe. Tijekom uklanjanja kiselih dijelova drvene građe povremeno je provjeravano dolazi li se čišćenjem do nezaraženog, neutralnog dijela drveta. Po postizanju neutralnosti uklonjen je i mali dio neutralne drvene građe kako bi bili sigurni u ishod postupka. Većinom se oko svakog kiselog kružnog otvora oplata uklonio približno 1 cm drvene građe. Nakon čišćenja prvotni kisel kružni otvor promjera od oko 1 cm u konačnici postaje neutralni kružni otvor promjera od oko 3 cm. Navedenim postupkom očišćeno je oko 260 kiselih kružnih otvora na oplati broda Nin 2 te osamdesetak na oplati broda Nin 1, na kojem su radovi još u tijeku. Čišćenje i uklanjanje

7. The Nin 2 planking after cleaning / *Oplata broda Nin 2 nakon čišćenja (Photo: A. Jelić)*





**8. A section of the Nin 1 planking after cleaning /
Dio oplate broda Nin 1 nakon čišćenja
(Photo: A. Jelić)**

(araldite, balsite, balsa wood). This procedure made it impossible to simply restore small parts of the boat structure to their actual positions and they were therefore temporarily fixed to a thin substrate of polystyrene (Styrofoam) using thin malleable stainless steel wire and in this manner placed back in their original position in the boat's structure. Thicker polystyrene was used as support within the planking and frames in order for the planking and frames of the boat to retain their proper form prior to the phase that will see the parts of the boat structure re-joined, which is planned for next year. Top view and side view drawn documentation was made of the frames on a 1:1 scale on transparent polypropylene substrate in order to have the best possible documentation. They were additionally protected and fixed in place by wrapping them in transparent wrapping foil and as such temporarily returned to the boat planking.

In the coming years we plan to carry out the remaining phases of the conservation-restoration plan, including joining all the parts of the boat structure, integrating the gaps created in the cleaning process, the continued removal of acidic parts of the wood, and toning the integrations on both boats.

Carrying out the conservation-restoration work to completion is only one segment of the overall protection of this unique cultural property. The expected results of the conservation-restoration work are the improvement of the boat structure and the renewed visual identity of the boats, while for the highest possible level of retardation of the wood degradation process the key thing is to create suitable and stable microclimatic conditions. Establishing stable microclimatic conditions will minimise the speed of the pyrite oxidation process and thereby achieve the greatest possible retardation of wood degradation in the Nin boats. A complete overhaul of the exhibition space is, therefore, absolutely essential, otherwise the same issues will crop up in the very near future.

kiselih dijelova rebara vršilo se upotrebom električnog dlijeta i skalpela. Provjeravanje postupka vršilo se na isti način kao kod oplata, a u konačnici su neutralne pukotine nepravilnog oblika i većih dimenzija. Očišćena su sva rebra odnosno njih 24 s broda Nin 2 dok čišćenje rebara s broda Nin 1 tek slijedi. Sama faza detaljnog čišćenja završena je čišćenjem površine svakog elementa drvene građe etilnim alkoholom čime je uklonjen neželjeni sjaj i masna površinska tekstura, a drvu vraćen prirodni izgled.

Budući da se pojedinačno čistio svaki dio brodske konstrukcije, paralelno se vršilo i uklanjanje metalnih poveznica i smjese polietilen glikola, kudelje, pijeska i piljevine korištene za popunjavanje šupljina u prijašnjem konzervatorsko-restauratorskom postupku, a čija je zamjena nekim od odgovarajućih materijala (araldit, balsit, balsa drvo) predviđena konzervatorsko-restauratorskim planom. Ovaj postupak doveo je do nemogućnosti jednostavnog vraćanja manjih dijelova brodske konstrukcije na stvarne pozicije te su isti privremeno fiksirani na tanku podlogu od polistirola (stiropora) pomoću tanke savitljive inox žice i na taj način vraćeni u izvorni položaj unutar brodske konstrukcije. Također, deblji dijelovi polistirola korišteni su i kao podupirači unutar oplata, ali i unutar rebara kako bi i oplata i rebra broda zadržali pravilnu formu do faze međusobnog spajanja dijelova brodske konstrukcije u cjelinu koja je planirana za sljedeću godinu. Radi bolje dokumentacije rebara, ista su i nacrtano dokumentirana, tlocrt i bokocrt, u realnoj veličini na prozirnoj polipropilenskoj podlozi, dodatno zaštićena i fiksirana u cjelinu zamatanjem s prijanjajućom prozirnom folijom te kao takva privremeno vraćena na oplata brodova.

U godinama koje slijede planirano je provesti i ostale faze konzervatorsko-restauratorskog plana poput međusobnog spajanja dijelova brodske konstrukcije u cjelinu, integriranje šupljina nastalih pri čišćenju i uklanjanju kiselih dijelova drvene građe te toniranje integracija na oba broda.

Provođenje konzervatorsko-restauratorskih radova do kraja samo je jedan od segmenta u očuvanju i zaštiti ovog jedinstvenog kulturnog dobra. Očekivani rezultati konzervatorsko-restauratorskih radova su poboljšanje brodske konstrukcije i novi vizualni identitet brodova dok je za maksimalno usporavanje procesa degradacije drvene građe ključna uspostava odgovarajućih i stabilnih mikroklimatskih uvjeta. Uspostavom stabilnih mikroklimatskih uvjeta minimalizirat će se brzina reakcije oksidacije pirita, a time i maksimalno usporiti proces degradacije drvene građe ninskih brodova. Stoga je potpuna sanacija izložbenog prostora neophodna, u protivnom s istim problemima suočit ćemo se vrlo brzo u skoroj budućnosti.

THREE IRON ANCHORS CONSERVED AND RESTORED AT ICUA ZADAR

KONZERVIRANJE I RESTAURIRANJE TRIJU ŽELJEZNIH SIDARA U MCPA ZADAR

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Over the past few years the conservation and restoration department at the International Centre for Underwater Archaeology in Zadar has provided conservation and restoration treatment for three large iron anchors. Two anchors were recovered forty years ago during the investigation of the shipwreck off Gnalić Island, while the third anchor is in the holdings of the Croatian Academy of Sciences and Arts in Zadar for which we do not have data on its date or the location at which it was found. All three anchors were exhibited in the open in inadequate conditions, which accelerated their deterioration. Destructive corrosive processes are evident on the anchors, and are assisted by the presence of oxygen, humidity and salts in the air, and have led to significant damage to the bodies of the anchors, to the degradation of the iron material and the decomposition of the iron core.

Joining the ICUA specialists in working on these anchors were Jean Bernard Memet and Philippe de Viviés, restorers with France's A-Corros Expertise and specialists in the field of electrolysis procedures involving metal archaeological artefacts, to whom we are grateful for their assistance and very useful advice.

One of the most important post-medieval shipwrecks in the Mediterranean was discovered in the 1960s off Gnalić Island near Biograd. The vessel that sank here was transporting a cargo of artisan and craft products manufactured in the late sixteenth century in workshops from the Mediterranean to northern Europe. Given the wealth and diversity of the finds this wreck is often referred to as a "mirror of renaissance Europe" (Radić Rossi et al. 2013, 65). Among the many recovered finds are two large iron anchors extracted from the sea and exhibited in the open without prior conservation—one at the front of the building of the Biograd na Moru heritage museum and the other on an elevation on the square facing the building of the National Museum in Zadar.



1. Anchor no. 1 at the façade of the building of the heritage museum in Biograd na Moru / Sidro br. 1 na pročelju zgrade Zavičajnog muzeja Biograd na Moru (Photo: A. Jozić)

Odjel konzerviranja i restauriranja Međunarodnog centra za podvodnu arheologiju u Zadru u posljednjih je nekoliko godina provodio konzervatorsko-restauratorske radove na tri velika željezna sidra. Dva su sidra izvađena prilikom istraživanja brodoloma kod otočića Gnalić prije četrdesetak godina dok je treće sidro dio fundusa Hrvatske akademije znanosti i umjetnosti iz Zadra te nisu

The anchors experienced rapid deterioration in these conditions and were a danger to the visitors that climbed on them to take photographs. In order to prevent the further degradation of this valuable cultural property both anchors required urgent conservation and restoration treatment.

Work was launched on both iron anchors using funding provided through the culture ministry. They were transported to the workshop of the ICUA Zadar conservation and restoration department where, in controlled conditions, the conservation and restoration process was initiated.

Step one involved preliminary cleaning and testing of the level of degradation on the surface of the anchors. Visible on the surface were corrosion processes caused, for the most part, by the presence of chloride ions. The plan was to have the treatment process focus first on removing these ions applying the electrolytic reduction method.

The basic electrolytic reduction method involves forming

3. Preparing anchor no. 2 for the electrolytic reduction procedure / Priprema sidra br. 2 za postupak elektrolitičke redukcije

(Photo: M. Ćurković Madiraca)



2. Anchor no. 2 on an elevation on the square facing the National Museum in Zadar / Sidro br. 2 na platou ispred zgrade Narodnog muzeja u Zadru
(Photo: A. Jozić)

poznati podaci o dataciji i lokalitetu njegova pronalaska. Sva su tri sidra bila izložena na otvorenom prostoru i u neadekvatnim uvjetima što je uzrokovalo njihovo još ubrzanije propadanje. Na sidrima su vidljivi destruktivni korozijski procesi koji su potpomognuti prisutnošću kisika, vlage i soli u zraku doveli do većih oštećenja na tijelima sidara te do degradacije željeznog materijala i raspadanja željezne jezgre.



Uz djelatnike MCPA, u radovima na sidrima sudjelovali su i Jean Bernard Memet te Philippe de Vivies, francuski restauratori i stručnjaci na području elektrolitičkih postupaka na metalnim arheološkim predmetima iz institucije A-Corros Expertise kojima se i ovim putem zahvaljujemo na pomoći i korisnim savjetima.

1960.-ih godina u blizini otočića Gnalić nedaleko Biograda otkriven je jedan od najznačajnijih novojekovnih brodoloma na Mediteranu. Potonuli brod prevozio je raznovrstan teret umjetničkih i obrtničkih proizvoda izrađenih krajem 16. st. u radionicama od Sredozemlja do sjevera Europe. S obzirom na bogatstvo i raznovrsnost nalaza, brodolom se često titulira "ogledalom renesansne Europe" (Radić Rossi et al. 2013, 65). Među mnogobrojnim nalazima pronađena su i dva velika željezna sidra koja su izvađena iz mora i nekonzervirana izložena na otvorenom prostoru, jedno na



4. Measuring the corrosion potential of anchor no. 2 / Mjerenje korozivnog potencijala sidra br. 2 (Photo: A. Jelić)

an electrolytic cell between two metals immersed in an electrolyte. The corroded metal object serves as the cathode, with stainless steel serving as the anode. The most frequently used electrolyte is a mildly alkaline aqueous solution. The electric charge coming from an external source initiates a redox reaction within the cell and, in the ensuing electrolysis process, will cause reduction at the cathode and oxidation at the anode. The removal of chloride using the electrolytic reduction method yields good results when working with large metal objects with a preserved metal core because there is, in the course of the electrolytic reduction, along with diffusion, also an electromotive force at play that directs the chloride ions towards the anode—that is to say it actively extracts chloride ions from the cathode, i.e. the corroded metal object that is saturated with these ions (Kralik 2016, 289).

Besides removing chloride in the case of archaeological iron artefacts, this method also successfully reduces most corrosion products to stable magnetite, which contributes to the consolidation and stabilisation of the corrosion layers. This also facilitates mechanical cleaning; reducing associated risks, and facilitates the identification of corrosion as the process makes the original surface more stable and compact.

As our anchors met all the prerequisites for the success of this method the decision to move forward in its application

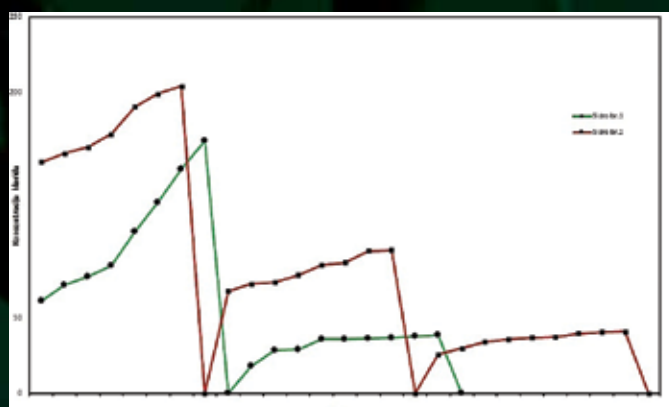
pročelju zgrade Zavičajnog muzeja Biograd na Moru, a drugo na platou ispred zgrade Narodnog muzeja u Zadru.

U takvim su uvjetima sidra rapidno propadala, a predstavljala su i opasnost za posjetitelje koji su se po njima penjali i fotografirali. Kako bi se spriječila daljnja degradacija ovog vrijednog kulturnog blaga, bilo je hitno potrebno provesti konzervatorsko-restauratorske radove na oba sidra.

Zahvaljujući financijskim sredstvima Ministarstva kulture, pokrenuti su radovi na oba željezna sidra. Sidra su prevezena u radionicu Odjela konzerviranja i restauriranja MCPA Zadar gdje je u kontroliranim uvjetima započeo proces konzerviranja i restauriranja. Najprije se pristupilo preliminarnom čišćenju te je ispitan stupanj degradacije površine sidara. Na površinama sidara bili su vidljivi korozivski procesi uzrokovani u najvećoj mjeri prisutnošću kloridnih iona te je predviđeno da će radovi ponajprije biti usmjereni na uklanjanje istih i to metodom elektrolitičke redukcije.

Osnova metode elektrolitičke redukcije sastoji se u formiranju elektrolitskog članka između dva metala uronjena u elektrolit. Korodirani metalni predmet služi kao katoda, dok je anoda od nehrđajućeg čelika. Najčešće korišten elektrolit je blago lužnata vodena otopina. Električni naboj koji dolazi iz vanjskog izvora pokreće redoks reakcije unutar članka te će se u procesu uspostavljene elektrolize na katodi vršiti redukcija, a na anodi oksidacija. Uklanjanje klorida metodom elektrolitičke redukcije daje dobre rezultate kad se radi o metalnim predmetima velikih dimenzija s očuvanom metalnom jezgrom budući da je za vrijeme elektrolitičke redukcije uz difuziju prisutna i elektromotorna sila koja kloridne ione usmjerava prema anodi, tj. aktivno izvlači kloridne ione iz katode, odnosno korodiranog metalnog predmeta koji je njima zasićen (Kralik 2016, 289).

5. Changes in the chloride concentration during electrolytic reduction / Promjena koncentracije klorida tijekom elektrolitičke redukcije (By: A. Jozić)





6. Work on anchor no. 1 following electrolytic reduction / Radovi na sidru br. 1 nakon elektrolitičke redukcije (Photo: Z. Vrgoč)

was the logical choice. Two basins were fabricated to size for the desalination of the anchors. Once the basins had been made, all large corrosion deposits on the surfaces of the anchors were removed in order to free up space for the electrical contact between the anchors and the source of electrical power, and the anchors were laid into the insulated basins. The electrolytic reduction process was conducted in the same manner for both anchors.

Stainless steel screws were fixed at five evenly distributed contact points in the metal core and connected by insulated wires to the negative pole of the power source. Stainless steel netting was then wrapped around the entire surface of the anchors and also connected with insulated wire to the positive pole of the power source. During this phase a multimeter was used to measure resistance to ensure that there was no electrical contact between the anode (the stainless steel netting) and the cathode (the anchor). A 5 per cent solution of sodium hydroxide was then added to the basins to serve as the electrolyte.

The corrosion potential of the anchor was measured with a voltmeter and a reference electrode and a sample of the solution was taken to measure the chloride concentration

Osim uklanjanja klorida u slučaju arheoloških željeznih predmeta, ovom se metodom također u stabilni magnetit uspješno reducira većina produkata korozije, što pridonosi konsolidaciji i stabilizaciji slojeva korozije. Također se pospješuje i sigurnije obavlja mehaničko čišćenje predmeta i olakšava njihovo otkrivanje budući da sam proces čini izvornu površinu stabilnijom i kompaktnijom.

Kako su naša sidra zadovoljavala sve preduvjete uspješnosti navedene metode, odluka o provođenju iste nametnula se kao logičan odabir. U tu su svrhu za postupak odsoljavanja sidara po mjerama izrađena dva

7. Anchor no. 2 following the conservation-restoration intervention / Sidro br. 2 nakon konzervatorsko restauratorskih radova (Photo: A. Jozić)





8. Iron anchor from the Croatian Academy of Sciences and Arts in Zadar before the intervention / Željezno sidro iz fundusa Hrvatske akademije znanosti i umjetnosti u Zadru prije radova (Photo: K. Ivković)

prior to the activation of the electric circuit. A saturated calomel electrode was used as the reference electrode, with the first sample of the solution serving as an initial point of reference in monitoring the leaching out of chloride. Once these parameters were established the power was turned on, beginning the process of stabilising the anchors by electrolytic reduction.

From earlier electrolytic procedures on various archaeological artefacts we have data on the required potential values for wrought and cast iron based on various reference electrodes. Our anchors are made of wrought iron and the potential value (based on a saturated calomel electrode) required for the electrolytic reduction stabilisation procedure is from -0.79V do -0.99V ($\approx$ -800mV to -1000mV).

Daily monitoring was required to keep the anchor potential constantly within the cited range, checking both the potential of the artefact and the voltage and current, given their proportional relationship. If the potential of the artefact increases, the current must be reduced and, conversely, if the potential drops, the current must be increased.

bazena. Nakon izrade bazena uklonjene su sve masivnije korozijske naslage s površine sidara s ciljem oslobađanja prostora za električni kontakt sidra s izvorom struje te su sidra položena u izolirane bazene. Proces elektrolitičke redukcije oba sidra proveden je na isti način.

Na pet ravnomjerno raspoređenih kontaktnih mjesta u metalnu jezgru sidra uglavljeni su inox vijci koji su pomoću izoliranih žica spojeni na negativan pol izvora struje. Oko čitave površine sidra potom je omotana inox mreža koja je također pomoću izolirane žice spojena na pozitivan pol izvora struje. U tijeku ove faze pomoću multimetra za mjerenje otpora provjeravano je da nema električnog kontakta između same anode (inox mreža) i katode (sidro). U bazen je zatim kao elektrolit dodana 5%-tna otopina natrijevog hidroksida.

Prije uključanja struje izmjeren je korozijski potencijal sidra pomoću voltmetra i referentne elektrode te je uzet prvi uzorak otopine u kojem je izmjerena koncentracija klorida. Kao referentna elektroda korištena je zasićena kalomel elektroda, a prvi uzorak otopine poslužio je kao polazišna točka za praćenje izlučivanja klorida. Nakon provjere navedenih parametara uključena je struja i započeo je proces stabilizacije sidara elektrolitičkom redukcijom.

Iz ranije provedenih elektrolitičkih postupaka na različitim arheološkim predmetima, poznati su podaci o potrebnim vrijednostima potencijala za kovano i lijevano željezo prema različitim referentnim elektrodama. Naša sidra izrađena su od kovanog željeza i vrijednosti potencijala (prema zasićenoj kalomel elektrodi) potrebne za postupak stabilizacije elektrolitičkom redukcijom iznose od -0,79V do -0,99V ($\approx$ -800mV do -1000mV).

Kako bi potencijal sidra konstantno bio unutar navedenih vrijednosti, bilo je potrebno svakodnevno praćenje, kako

9. A detail of an anchor fluke prior to the intervention / Detalj lopatice sidra prije radova (Photo: K. Ivković)



The potential of the anchor was measured at all five contact points at which the stainless steel screws had been affixed (using the reference electrode and a voltmeter). Samples of the electrolyte were also taken every seven days in order to measure the concentration of leached chlorides. Given that both anchors were brought on land and dried out many years prior to this desalination, the majority of corrosive deposits with the concentration of chlorides that are first leached out have already flaked off, and this electrolytic reduction process aimed to draw out the chlorides that remained trapped in akaganéite. Given that thus “encrusted” chlorides are much more difficult to leach out and leach out at a slower rate, the electrolyte solution had to be replaced during the electrolytic reduction process. When chloride measurements in the electrolyte samples no longer indicated an increase in the concentration, the electrolytic reduction process is completed and the anchors were neutralized with demineralised water. When neutralisation was completed the basins were taken apart and the anchors dried. Drying was followed by the mechanical cleaning of the anchors using a combination of manual, electric and pneumatic tools.

Once mechanical cleaning of the anchors had been completed we applied corrosion inhibitors and the appropriate final protection, adapted to the outdoor presentation of the anchors. One of the anchors was restored to the square facing the building of the National Museum in Zadar, where it awaits more fortunate circumstances that will see it presented in a more suitable manner and one appropriate to its significance. The conservation and restoration procedure at the ICUA workshops has recently been completed on the other anchor and it awaits transport to its home museum in Biograd na Moru.

The conservation and restoration of the iron anchor from the holdings of the Croatian Academy of Sciences and Arts in Zadar began in July of 2018. The iron anchor, another five anchors of various sizes, and an iron ship's cannon, are kept in the area behind the building of the Croatian Academy of Sciences and Arts' Institute for Historical Sciences in Zadar. In spite of the fact that the anchor was unprotected and exposed to the elements the original surface of the anchor is well preserved, which significantly expedited the conservation and restoration process.

The iron anchor from the academy holdings is of the admiralty pattern, with a length of 3.32 metres without the stock, located near the top. One arm is 1.3 metres long, while the other arm is damaged and thus shorter, measuring 1.17 metres. Both arms have damaged fukes, on the lower part of which we see the highest



10. Abrasive blasting / Pjeskarenje (Photo: A. Jozić)

potencijala predmeta, tako i napona te jakosti struje budući da su iste proporcionalno povezane. Ukoliko potencijal predmeta poraste, potrebno je smanjiti struju i obrnuto ukoliko potencijal pada, struja se mora povećati.

Potencijal sidra mjerio se u svih pet kontaktnih mjesta gdje su postavljeni inox vijci (pomoću referentne elektrode i voltmetra). Uz to se svakih sedam dana uzimao uzorak elektrolita u kojem se mjerila koncentracija izlučenih klorida. Budući da su oba sidra izvađena i osušena dugi niz godina prije desalinizacije, većina korozivskih naslaga s koncentracijom klorida koja se prva izlučuje već je otpala te se ovim postupkom elektrolitičke redukcije nastojalo izvući kloride koji su ostali zarobljeni u akaganitu. S obzirom da se ovako “inkrustirani” kloridi mnogo teže i sporije izlučuju, u tijeku postupka elektrolitičke redukcije bilo je potrebno izvršiti izmjene otopine elektrolita. Kada mjerenje klorida u uzorcima elektrolita više nije bilježilo porast koncentracije, završen je proces elektrolitičke redukcije te su sidra neutralizirana demineraliziranom

level of corrosion. The circumference of the anchor is 48 centimetres at the bottom, with the narrowest part measuring 38 centimetres. The entire surface of the anchor was corroded and at places we could make out cracking of the corrosion layer in the form of flakes of various sizes, which would spall off when touched. Preliminary cleaning established a well-preserved original surface without signs of active corrosion. As a result, and due to the limited funding available, no desalination was undertaken and the conservation-restoration work was directed primarily at mechanical cleaning and protection.

The preliminary work phase saw the photographing and documenting of the existing condition of the iron anchor. Work continued with detailed measurement of the iron anchor and the protection of the floor and wall face against which the anchor rests. Prior to mechanical cleaning the anchor was given a detailed wash with large quantities of denatured ethyl alcohol (96%). Zones were established for mechanical cleaning in light of the size and upright position of the anchor. The peeling flakes of the corrosion layer were removed with handheld tools whenever possible. This was followed by mechanical cleaning with power tools mounted with rotating metal brushes of various sizes and shapes. Removal of most of the corrosion layer was followed by abrasive blasting of the anchor until the original surface was achieved. The abrasive used was 90 µm corundum (aluminium oxide) and quartz sand with 0.035 to 0.063 millimetre grains. Stubborn corrosion deposits that could not be removed by blasting were removed using an ultrasonic pin and an ultrasonic chisel. Mechanical cleaning was followed by coating the anchor in a hot solution of tannin acid powder in demineralised water, ethanol and phosphoric acid. Distilled or demineralised water is used in this solution because tap water may contain chloride ions and other dissolved salts that encourage iron corrosion. Ethanol is used as a wetting agent that enhances the flow of the solution into porous corrosion layers and into all fissures on the iron surface, while phosphoric acid lowers the pH value of the solution and reacts with iron ions to form ferric phosphate, which protects iron (from: www.canada.ca). The frangible cracks on the anchor were filled with a two-component epoxy resin to which an appropriate pigment was added. The final phase of the conservation-restoration work on the iron anchor saw the application of a final protective coating adapted to the outdoor exhibition conditions. All materials used in the conservation and restoration of the iron anchor are reversible. The conservation work adhered to all rules of the profession and the process of the deterioration of the iron anchor has been retarded.



11. Applying the protective coatings / Nanošenje zaštitnih premaza (Photo: Z. Vrgoč)

vodom. Nakon završene neutralizacije uslijedilo je rastavljanje bazena i sušenje sidara. Nakon sušenja, pristupilo se mehaničkom čišćenju sidara kombiniranom upotrebom ručnog, električnog i pneumatskog alata.

Po završetku mehaničkog čišćenja sidra, uslijedilo je nanošenje inhibitora korozije i odgovarajuće završne zaštite prilagođene prezentaciji sidara u vanjskim uvjetima. Jedno je sidro tako vraćeno na plato ispred zgrade Narodnog muzeja u Zadru gdje čeka neku sretniju priliku kako bi se prezentiralo na odgovarajući i onaj način koji zaslužuje. Na drugom je sidru netom završen konzervacijsko-restauracijski postupak te u radionicama MCPA čeka svoj prijevoz u domicilni muzej u Biogradu na Moru.

Konzerviranje i restauriranje željeznog sidra iz fundusa HAZU Zadar započelo je u srpnju 2018. godine. Željezno sidro smješteno je s ostalih pet sidara različitih dimenzija i željeznim brodskim topom iza zgrade Zavoda. Unatoč činjenici što je sidro bilo nezaštićeno i izloženo na otvorenom prostoru, izvorna površina sidra dobro je očuvana što je uvelike olakšalo proces konzerviranja i restauriranja.

Željezno sidro iz fundusa HAZU je admiralskog tipa, dužine oko 3,32 m bez prečke koja se nalazi pri vrhu. Dužina jednog kraka iznosi 1,3 m dok je drugi krak bio oštećen i puknut te zbog toga kraći i dug 1,17 m. Oba



12. An iron anchor following the conservation-restoration intervention / Željezno sidro poslije konzervatorsko-restauratorskih radova
(Photo: K. Ivković)

Bibliography / Literatura:

Kralik, J. 2016 - Komparativno istraživanje primjene pulsirajuće struje u konzerviranju željeznih artefakata, Portal 7, 2016, 289.

Radić Rossi, I. et al. 2013 - Brodolom kod Gnalića – ogledalo renesansne Europe, u: Filep et al. (ur.) Gnalić Blago potonulog broda iz 16. stoljeća, Izbor iz zbirke „Teret potopljenog broda iz 16. stoljeća“ Zavičajnog muzeja Biograd na Moru Zagreb, 2013.

<https://www.canada.ca/en/conservation-institute/services/conservation-preservation-publications/canadian-conservation-institute-notes/tannic-acid-rusted-iron-artifacts.html> (17.11.2016)

kraka imaju lopate koje su bile oštećene i ispod kojih je bio vidljiv najveći stupanj korodiranosti. Obujam sidra, pri dnu iznosi 48 cm dok je najuži dio obujma 38 cm. Sidro je bilo korodirano cijelom površinom te su na nekim dijelovima površine bila vidljiva napuknuća korozijskog sloja u obliku ljuski različitih dimenzija, koje su se pri dodiru trusile s površine sidra. Preliminarnim čišćenjem utvrđena je dobro očuvana izvorna površina bez znakova aktivne korozije. Iz tih se razloga kao i zbog ograničenih financijskih sredstava nije proveo postupak desalinizacije te su konzervatorsko-restauratorski radovi bili prvenstveno usmjereni na mehaničko čišćenje i zaštitu.

U preliminarnoj fazi rada fotografirano je i dokumentirano zatečeno stanje željeznog sidra. Radovi su nastavljeni detaljnim mjerenjem željeznog sidra te zaštitom poda i fasade na koju je sidro naslonjeno. Sidro je prije početka mehaničkog čišćenja detaljno isprano u velikim količinama denaturiranog etilnog alkohola (96%). S obzirom na veličinu sidra i njegov uspravan položaj, određene su zone po kojima će se odvijati mehaničko čišćenje. Ljuske korozijskog sloja koje su se trusile uklonjene su ručnim alatom koliko god je bilo moguće. Potom je uslijedilo mehaničko čišćenje upotrebom električnog uređaja s metalnim rotirajućim četkama različitih veličina i oblika. Nakon što je uklonjen veći dio korozijskog sloja, uslijedilo je pjeskarenje površine sidra do izvorne površine. Abrazivno sredstvo koje je korišteno za pjeskarenje jest korund (aluminijev oksid) od 90 µm te kvarcni pijesak sa zncima debljine 0,035 - 0,063 mm. Tvrdokorne naslage korozije koje nije bilo moguće ukloniti pjeskarenjem, uklonjene su upotrebom ultrazvučne igle i ultrazvučnog dlijeta. Nakon mehaničkog čišćenja, sidro je premazano vrućom otopinom praha tanina u demineraliziranoj vodi, etanolu i fosfornoj kiselini. U spomenutoj se otopini koristi destilirana ili demineralizirana voda s obzirom da vodovodna voda može sadržavati kloridne ione i druge otopljene soli koje potiču koroziju željeza. Etanol se koristi kao sredstvo za vlaženje koje povećava protok otopine u porozne korozijske slojeve i u sve pukotine na površini željeza dok fosforna kiselina smanjuje pH otopine te reagira s ionima željeza da bi se formirao željezni fosfat koji štiti željezo (preuzeto iz: <http://www.canada.ca/en/>). Pukotine na sidru koje su bile lomljive zapunjene su dvokomponentnim epoksidnim ljepilom uz dodavanje odgovarajućeg pigmenta. U završnoj fazi konzervatorsko-restauratorskih radova na željeznom sidru nanoseni su završni zaštitni premazi prilagođeni uvjetima izlaganja sidra na otvorenom prostoru. Svi materijali koji su korišteni za konzerviranje i restauriranje željeznog sidra su reverzibilni. Provedenim konzervatorskim radovima poštivana su sva pravila struke te je proces propadanja željeznog sidra usporen.

OUR SIDE OF THE ICUA COURSE

POGLED S NAŠE STRANE NA TEČAJ MCPA ZADAR

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Ella Samut-Tagliaferro
(Photo: R. Surić)



Kees Post
(Photo: R. Surić)

Let's get introduced...

Ella (30) graduated as an archaeologist and has worked in the cultural heritage sector in the Maltese Islands for the last 8 years. She has worked as a freelance archaeologist, has formed part of the Fragsus ERC Archaeological Project team, and has worked with the Superintendence of Cultural Heritage in Malta. Her interests include cultural heritage, photography, and travel.

Kees (51) graduated in law. After working as a lawyer in a shipping company, he now works as a judge in The Netherlands. He likes sailing, diving and maritime history.

Why did you choose to do the course with ICUA Zadar?

Ella: I got to know about the ICUA Zadar through the UNESCO website a few years back. Over the years, the centre has provided consistent professional training and courses for underwater archaeology. Knowing this, and having heard about how beautiful Croatia is, there was no other option but to do the course with ICUA.

Kees: I followed an online course in Underwater Archaeology



2. Location of the courses - Bale, bay Colone / Mjesto održavanja tečajeve - Bale, uvala Kolone
(Photo: E. Samut-Tagliaferro)

Upoznajmo se...

Ella (30) diplomirani je arheolog i radila je u polju kulturne baštine na Malteškim otocima zadnjih 8 godina. Radila je honorarno kao arheolog, bila dio ekipe arheološkog projekta Fragsus ERC, te je radila sa Konzervatorskom službom kulturne baštine Malte. Zanima se za kulturnu baštinu, fotografiju i putovanja.

Kees (51) je diplomirani pravnik. Po završetku odvjetničke karijere u brodarskoj kompaniji, radi kao sudac u Nizozemskoj. Voli ploviti, roniti i pomorsku povijest.

Zašto ste se odlučili za MCPA Zadar tečaj?

Ella: Saznala sam za MCPA Zadar preko web stranice UNESCO-a prije nekoliko godina. Tijekom posljednjih godina, Centar je pružao dosljedno stručno usavršavanje i tečajeve podvodne arheologije. Znajući to i čuvši kako je Hrvatska prekrasna, nije bilo druge opcije nego odraditi tečaj s MCPA.

Kees: Pratio sam online Tečaj podvodne arheologije koji je organiziralo Pomorsko arheološko društvo (NAS). Kako je MCPA Zadar obrazovni partner NAS-u, pronašao

3. Students attend a lecture by ICUA instructor Mladen Pešić / Studenti na predavanju MCPA instruktora Mladena Pešića

(Photo: M. Kaleb)





4. Practice at the sea / Vježbe pod morem (Photo: M. Pešić)

with the Nautical Archaeological Society (NAS). ICUA Zadar is a training partner of the NAS, and I found ICUA's website to be very professional. Having sailed in Croatia, I was well aware of Croatia's maritime tradition and clear waters for practical training. So ICUA was a logical choice.

Which courses did you follow at ICUA Zadar?

Ella: We both did the NAS Introduction to Maritime Archaeology and the NAS Part-I course on Underwater Archaeology. After that, I did the Underwater Photogrammetry Course. The courses were held at the Old Diver dive centre at the Mon Perin campsite, right outside of Bale, between the towns of Rovinj and Pula.

So what did you learn?

Kees: The theoretical lectures gave us an overview of the field, from locating a site through project safety, survey methods, dealing with finds, to post-field activity. During our dives, we trained in recording a site and mapping it in the Site Recorder program.

Ella: The photogrammetry course was divided into two parts: theory and practice. We learnt about the principles of photogrammetry, equipment and software to use, and how to use them. We then put all this into practice – diving at an underwater site, taking images underwater, and 3D model making back at the Old Diver dive centre.

What was your favourite part of the course?

Ella: The processing of the photographs we took during fieldwork. It's a lengthy process but then you get to see the results of all the work – a 3D model of an ancient feature!

Kees: The diving assignments felt like playing in a National Geographic movie. And after the courses, I participated in an underwater excavation near Velika Sestrica island. For me as a sailor, it was exciting to investigate the last voyage of this ancient sailing ship. It felt like underwater detective

samslužbenu stranicu koja je djelovala vrlo profesionalno. Plovio sam već po Hrvatskoj, pa mi je bila poznata hrvatska pomorska baština i čisto more za praktični dio tečaja. MCPA Zadar je bio logičan izbor.

Koje tečajeve ste pratili s MCPA?

Ella: Oboje smo pohađali NAS-ov Uvod u priobalnu i podvodnu arheologiju, te NAS-ov I stupanj priobalne i podvodne arheologije. Po završetku NAS tečajeva, ja sam nastavila s tečajem podvodne fotogrametrije. Tečajevi su se održavali u kampu Mon Perin nedaleko od Bala, između Rovinja i Pule.

Što ste naučili?

Kees: Teorijska predavanja su nam omogućila cjelokupan pregled ovog polja, od pronalaska nalazišta, preko sigurnosti provođenja projekta, metoda pretraživanja, skrbi za nalaze, pa do post-istraživačkih aktivnosti. Tijekom praktičnog dijela, ronjenja, vježbali smo bilježenje podataka o nalazištu za potrebe kartiranja u programu Site Recorder.

Ella: Tečaj podvodne fotogrametrije bio je podijeljen u dva dijela: teorija i praksa. Naučili smo osnovne principe fotogrametrije, upoznali se s opremom i programom Agisoft Photoscan, te kako ih upotrebljavati. U praktičnom dijelu tečaja primijenili smo sve naučeno - ronjenje na podvodnom nalazištu, fotografiranje pod morem, te izradu 3D modela po povratku u ronilački centar The Old Diver.

5. Ella, moments after recovering an artefact / Ella, nekoliko trenutaka nakon otkrića artefakta (Photo: R. Surić)





6. Kees, excavating with the waterdredger / Kees, iskopavanje s vodenom mamut sisaljkom
(Photo: M. Pešić)

work.

And the worst part?

Ella: Moments after I began documenting a part of an ancient feature, the camera battery died – this meant we had to stop the dive, get back to the shore, head back to the dive centre, and then start the fieldwork all over again. To make things tough, the wind picked up and it began to rain – one of the prevalent rainstorms seemed to be forming. Luckily, when we got to shore we found out that a colleague had spare equipment. We got back into the water with the spare equipment and managed to complete the documentation. It was good practice, as these things happen when you are out on the field...

Kees: The worst part was definitely flying back home, leaving behind hundreds of wrecks that are waiting to be researched.

Would you be back again?

Kees: Gladly! It was a rich trip, with the ICUA-staff so willing to share knowledge. I have caught this virus now, so I will use the fall and winter to read and study. And I hope to do the NAS Part-II course with ICUA in 2019.

Ella: Definitely! I will visit Croatia again to continue to explore the historic towns, beautiful nature, and renowned diving sites! Hopefully I will also get the chance to further my training and possibly join the ICUA team for some fieldwork.

7. Instructor Luka Bekić shows to Ella and Kees finds from excavation / Instruktor Luka Bekić prezentira Elli and Keesu nalaze s iskopavanja (Photo: R. Surić)

Koji dio tečaja vam je bio najdraži?

Ella: Procesuiranje fotografija koje smo snimili tijekom terenskog rada. To je dugotrajan proces, ali na kraju imate priliku vidjeti rezultat svog rada - 3D model drevne strukture!

Kees: Tijekom ronilačkih zaduženja osjećao sam se kao u nekoj ulozi u filmu National Geographic-a. Naime, nakon tečaja, sudjelovao sam u podvodnom arheološkom iskopavanju brodoloma kraj otoka Velika Sestrica. Za mene, kao moreplovca, bilo je uzbudljivo istraživati posljednje putovanje ovog antičkog jedrenjaka. Sve je podsjećalo na podvodni detektivski posao.

A koji dio je bio najgori?

Ella: Nekoliko trenutaka nakon što sam počela dokumentirati drevnu strukturu, baterija na kameri je - umrla. To je značilo da moramo prekinuti ronjenje, otići natrag na obalu, pa do ronilačkog centra i započeti s terenskim radom ispočetka. Da bi stvari bile još teže, digao se vjetar i počela je kiša - činilo se kao da se sprema kišna oluja. Srećom, kad smo došli na obalu saznali smo da jedan od kolega ima rezervnu opremu. Vratili smo se u more s kompletiranom opremom i uspjeli završiti dokumentiranje. Bila je to dobra vježba jer se ovakve stvari često događaju tijekom terenskih istraživanja...

Kees: Najgori dio definitivno je bio povratak kući zrakoplovom, ostavljajući iza sebe stotine brodoloma koji čekaju da budu istraženi.

Biste li se opet vratili?

Kees: Rado! Bilo je to bogato putovanje s ekipom MCPA Zadar, koja je tako voljna dijeliti znanje. Sada sam zaražen ovim virusom pa ću iskoristiti jesen i zimu za čitanje i učenje. Nadam se da ću nastaviti tečaj NAS-a, II stupanj, s ekipom MCPA Zadar u 2019. godini.

Ella: Definitivno! Ponovno ću posjetiti Hrvatsku kako bih nastavila istraživati povijesne gradove, prekrasnu prirodu i poznate ronilačke lokacije! Nadam se da ću dobiti priliku dodatno se usavršavati i eventualno priključiti se ekipi MCPA u nekim terenskim radovima.





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