Yearbook of the International Centre for Underwater Archaeology in Zadar
Godišnjak Međunarodnog centra za podvodnu arheologiju u Zadru

Submerged Heritage
Potopljena baština

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Divers head back to Ližnjan port / Ronioci se vraćaju u luku Ližnjan (photo: M. Šimičić)

IMPRESSUM

SUBMERGED HERITAGE / POTOPLJENA BAŠTINA

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SADRŽAJ

News / Vijesti

DEGUWA Underwater Archaeology Conference Wraps Up

The annual conference of DEGUWA, the German Society for the Promotion of Underwater Archaeology, was held from the 20th to 23rd of March 2014. Participating and presenting lectures at the conference were some forty experts from over ten countries, with the conference pooling a total of some one

1. Predavanja su se održavala u dvorani Muzeja sojenica u Unteruhldingenu / Lectures were staged at the auditorium of the pile dwelling museum at Unteruhldingen (photo: L. Bekić)

hundred participants. Along with the lectures the programme included dives and experimental archaeology and organised visits to museums, find sites and a dendrochronological laboratory. The main part of the event took place in the German town of Unteruhldingen on the shore of Lake Constance (Bodensee) that is home to the Pfahlbaumuseum, an open-air museum of prehistoric pile dwellings. The conference was held under the patronage of UNESCO, which has declared the pile dwellings around the Alps a World Heritage Site.

Exploratory Trenching at St Nicholas church in Zadar

Archaeological exploratory trenching was conducted in July and October 2014 within the architectural complex of the former monastery and church of Sveti Nikola (St Nicholas) led by Luka Bekić, Šime Vrkić and Filipa Jurković Pešić. The trenches at eight different locations demonstrated that there are no significant traces of prehistoric and Roman settlements in this part of the complex, however, numerous graves and trac-

Završena konferencija podvodne arheologije u organizaciji DEGUWA-e

Godišnja konferencija njemačkog društva podvodne arheologije DEGUWA održana je od 20. - 23. ožujka 2014. Na konferenciji je s predavanjem sudjelovalo četrdesetak stručnjaka iz preko 10 različitih zemalja, a sveukupno se na skupu okupilo stotinjak zainteresiranih. Uz predavanja na

2. An excursion to Eschenz – the event participants also visited some of the archaeological sites in Switzerland / Izlet u Eschenz - sudionici skupa posjetili su i neka arheološka nalazišta u Švicarskoj (photo: L. Bekić)

programu je bio i ronilački zaron i eksperimentalna arheologija te organizirani posjeti muzejima, nalazištima i dendrokronološkom laboratoriju. Glavni dio događanja odvijao se u Unteruhldingu u Njemačkoj, gdje se na obali Bodenskog jezera nalazi muzej prapovijesnih sojenica, tzv. Pfahlbau museum. Konferencija je održana pod patronatom UNESCO-a, koji je niz sojeničkih naselja oko Alpa proglasio svjetskim kulturnim dobrom.

Arheološka sondiranja kod crkve Sv.Nikole u Zadru

Unutar arhitektonskog sklopa bivšeg samostana i crkve Sv. Nikole, u srpnju i listopadu 2014. g. su obavljena arheološka sondiranja koja su vodili Luka Bekić, Šime Vrkić i Filipa Jurković Pešić. Sonde na osam različitih mjesta su pokazala da na ovom dijelu sklopa nema značajnijih tragova prapovijesnog i antičkog naselja, ali su pronađeni brojni grobovi i

es of construction from the medieval and in particular post medieval periods were found. After having served for many centuries as a monastery and church, the complex passed, in the late 18th century, into military hands and served as a barracks and for an extended period as a military hospital. During World War II the complex suffered significant damage from bombardment, as did all of Zadar. The exploratory trenching was conducted for the purpose of drawing up documentation for the renovation of this valuable cultural property and the housing of various ICUA facilities in individual edifices.

Excavation of a grave at the belfry of Sveti Nikola church / Iskopavanje grobnice kod zvonika crkve Sv. Nikole (photo: Š. Vrkić)

UNESCO Regional Meeting and Von Petrikovits Library Opening

A Regional Meeting was staged at the International Centre for Underwater Archaeology in Zadar from September 30th to October 1st 2014 dedicated to the implementation of the UNESCO Convention on the Protection of the Underwater Cultural Heritage. The objectives of the meeting were to find methods to improve international cooperation among the countries of Southeast Europe with regard to the protection of underwater finds and sites. Taking part were the

3. Some of the graves in the courtyard of the Sveti Nikola monastery complex / Neki od grobova u dvorištu samostanskog sklopa Sv. Nikole (photo: Š. Vrkić)

tragovi gradnji iz srednjovjekovnog i posebice novovjekovnog razdoblja. Nakon što je ovaj sklop više stoljeća služio kao samostan i crkva, od kraja 18. st. prešao je u vojne ruke, pa je osim kao vojarna, duže vrijeme služio kao vojna bolnica. U 2. Svjetskom ratu, sklop je znatno stradao bombardiranjem, kao uostalom i cijeli Zadar. Arheološka sondiranja provedena su zbog izrade projektne dokumentacije za obnovu ovog vrijednog kulturnog dobra i smještanja raznih sadržaja MCPA u pojedine objekte.

UNESCO
United Nations Educational, Scientific and Cultural Organization
Venice Office
Regional Bureau for Science and Culture in Europe

Održan Regionalni sastanak UNESCO-a i otvorena knjižnica Von Petrikovits

30.9. i 1.10.2014. u Međunarodnom centru za podvodnu arheologiju u Zadru se održao Regionalni sastanak posvećen

4. The UNESCO-organised Regional Meeting on underwater archaeology at the ICUA lecture hall / Regionalni sastanak o podvodnoj arheologiji u organizaciji UNESCO-a odvijao se u učionici MCPA (photo: M. Šimičić)

5. The library was formally declared open by Deputy Minister of Culture of Croatia Berislav Šipuš and RGK Frankfurt director Eszter Banffy / Knjižnicu su svečano otvorili dominstar kulture RH Berislav Šipuš i ravnateljica RGK Frankfurt Eszter Banffy (photo: M. Šimičić)

representatives of the culture ministries of twelve countries and numerous experts who warned of the problems and spoke of opportunities in the field of underwater heritage. In the evening ICUA Zadar also officially opened the Harald Von Petrikovits Library that has been presented on permanent loan to ICUA Zadar and the University of Zadar by RGK Frankfurt, part of the German Archaeological Institute (DAI). Many gathered for the gala opening ceremony with Dr Eszter Banffy of RGK Frankfurt, assistant professor Dr Tomislav Fabijanić of the University of Zadar and Deputy Minister of Culture of Croatia Berislav Šipuš on hand to welcome the gathered.

IKUWA 5 World Congress held in Cartagena, Spain

The fifth world congress of underwater archaeologists, on the theme of "Heritage for Humanity", was held in Spain's Cartagena from October 15th to 19th. The IKUWA 5 congress was organised and hosted by the ARQVA National Museum of Un-

implementaciji konvencije o zaštiti podvodne kulturne baštine u organizaciji UNESCO-a. Ciljevi sastanka su bili pronaći moduse za poboljšanje međunarodne suradnje zemalja jugoistočne Europe, u pogledu zaštite podvodnih nalaza i nalazišta. Na njemu su sudjelovali predstavnici ministarstava kulture 12 zemalja ali i brojni stručnjaci koji su upozorili na probleme i mogućnosti u polju podvodne baštine. Ujedno je navečer u MCPA Zadar svečano otvorena knjižnica Harald Von Petrikovits, koja je kao trajna posudba darovana MCPA Zadar i Sveučilištu u Zadru od strane RGK Frankfurt, u sastavu Njemačkog arheološkog instituta (DAI). Otvorenju je nazočio velik broj zainteresiranih, a govore su održali prof. dr. Eszter Banffy iz RGK Frankfurt, doc.dr.Tomislav Fabijanić sa Sveučilišta u Zadru i prof. Berislav Šipuš, zamjenik ministrice kulture RH.

Svjetski kongres IKUWA 5 održan u Cartageni, Španjolska

Od 15. do 19. 10. 2014. u Cartageni je održan peti po redu svjetski kongres podvodnih arheologa pod imenom "Baština za čovječanstvo". Kongres IKUWA 5 je održan u organi-

6. IKUWA 5 lectures were held at the large auditorium of the Universidad Politecnica de Cartagena / Predavanja kongresa IKUWA 5 su održavana i u velikoj dvorani Politehničkog sveučilišta u Cartageni (photo: L. Bekić)

zaciji Nacionalnog muzeja podvodne arheologije ARQVA, a predavanja su održana u zgradi Politehničkog sveučilišta. Održano je preko 100 predavanja koje je pratilo nekoliko

7. Coffee and juice breaks in the stunning courtyard of the university / Stanke za kavu i sokove su se održavale u prekrasnom dvorištu sveučilišta (photo: L. Bekić)

derwater Archaeology and the lectures staged at the premises of the Universidad Politecnica de Cartagena. Over a hundred lectures were given for several hundred active participants and other interested persons. A large number of specialist posters were on display during the congress and visits were organized to local museums and restoration workshops. The congress was a complete success thanks to its excellent organization – the following IKUWA event is to be staged in Fremantle, Australia.

Danish Underwater Archaeologists Visit Zadar

A group of underwater archaeologists from Denmark visited ICUA Zadar from October 22nd to 24th 2014. The visiting Danish experts Morten Stenak, Torben Malm, Ingeborg Svennevig and Tina Damgaard-Sørensen gave a series of lectures presenting their achievements in the protection of cultural heritage and underwater archaeology. The lectures drew a large audience of underwater archaeologists and students of archaeology in particular. The following day the delegation visited Split, where a two-year cooperation agreement in the field of underwater archaeology was formally singed by ICUA Zadar and the Danish Agency for Culture in the presence of Her Majesty the Danish Queen Margrethe II.

stotina aktivnih sudionika i ostalih zainteresiranih. Tijekom kongresa izložen je veći broj stručnih postera, a organizirani su i posjeti domaćem muzeju i restauratorskoj radionici. Kongres je u potpunosti uspio zahvaljujući odličnoj organizaciji, a slijedeća IKUWA održati će se u Fremantlu, Australija.

Posjet danskih podvodnih arheologa Zadru

Skupina podvodnih arheologa iz Danske boravila je u posjetu MCPA Zadar od 22. - 24.10.2014.g. Tom prilikom su Morten Stenak, Torben Malm, Ingeborg Svennevig i Tina Damgaard-Sørensen održali niz predavanja kojima su predstavili svoja postignuća u zaštiti kulturne baštine i podvodne arheologije. Predavanja su privukla veći broj posjetioca, podvodnih arheologa i posebice studenata arheologije. Slijedeći dan delegacija je provela u Splitu, gdje je pred Njenim veličanstvom danskom kraljicom Margaretom II svečano potpisan dvogodišnji sporazum o međusobnoj suradnji na polju podvodne arheologije između MCPA Zadar i Danske agencije za kulturu.

8. The formal signing of the Croatian-Danish cooperation agreement at Split's Narodni Trg Svečano / Potpisivanje ugovora o hrvatsko-danskoj suradnji odvijalo se na Narodnom trgu u Splitu (photo: DK Kulturstyrelsen)

ICUA Post Medieval Glass Exhibition Opens at MAS

An exhibition on "Post Medieval Glass from the Waters of Istria and Dalmatia" was formally opened October 23rd 2014 at Zadar's Museum of Antique Glass (MAS). The exhibition is jointly organised by MAS and ICUA Zadar. The event also saw the promotion of a comprehensive exhibition catalogue by Luka Bekić. The exhibited artefacts are from the 16th to 20th century period and were found at

9. The post medieval glass exhibition was opened at Zadar's Museum of Antique Glass / Izložba o novovjekovnom staklu otvorena je u Muzeju antičkog stakla u Zadru (photo: M. Šimičić)

various coastal sites during the underwater archaeology campaigns of ICUA Zadar. Finds of this kind have not to date been published in specialist literature making this a pioneering undertaking.

Clearing Around the Ruins of the Sveti Nikola Complex and the Design of a New ICUA Wing

A number of campaigns to clear the area of overgrowth, partition walls, cinder blocks, large refuse and other refuse were undertaken from spring to autumn for the purpose of creating as-built architectural drawings and drafting a conceptual design of the Sveti Nikola complex in Zadar. Many truckloads of refuse were removed and only now is the entire space of this cultural property visible, situated on the very tip of the Zadar peninsula. Architect Ante Uglešić and the Forvm architectural studio he leads have drawn up a conceptual design for the content of every individual edifice in the frame of the Sveti Nikola complex. The key element is the future adaptation of the church building that will

10. The official poster of the exhibition organised by ICUA and MAS Zadar / Službeni plakat izložbe u organizaciji MCPA i MAS Zadar (author: J. Belevski)

Otvorena izložba MCPA o novovjekovnom staklu u MAS Zadar

Dana 23.10.2014. u Muzeju antičkog stakla u Zadru svečano je otvorena izložba pod nazivom Novovjekovno staklo iz podmorja Istre i Dalmacije, koju su zajednički organizirali MAS i MCPA Zadar. Ujedno je predstavljen i opsežni katalog izložbe autora Luke Bekića. Izloženi predmeti potječu iz razdoblja od 16. do 20. st., a pronađeni su na različitim priobalnim nalazištima tijekom podvodnih akcija MCPA Zadar. Ovakvi nalazi dosada nisu bili objavljeni u stručnoj literaturi pa je riječ o pionirskom pothvatu.

Čišćenje ruševina sklopa Sv. Nikole i projektiranje novog krila centra

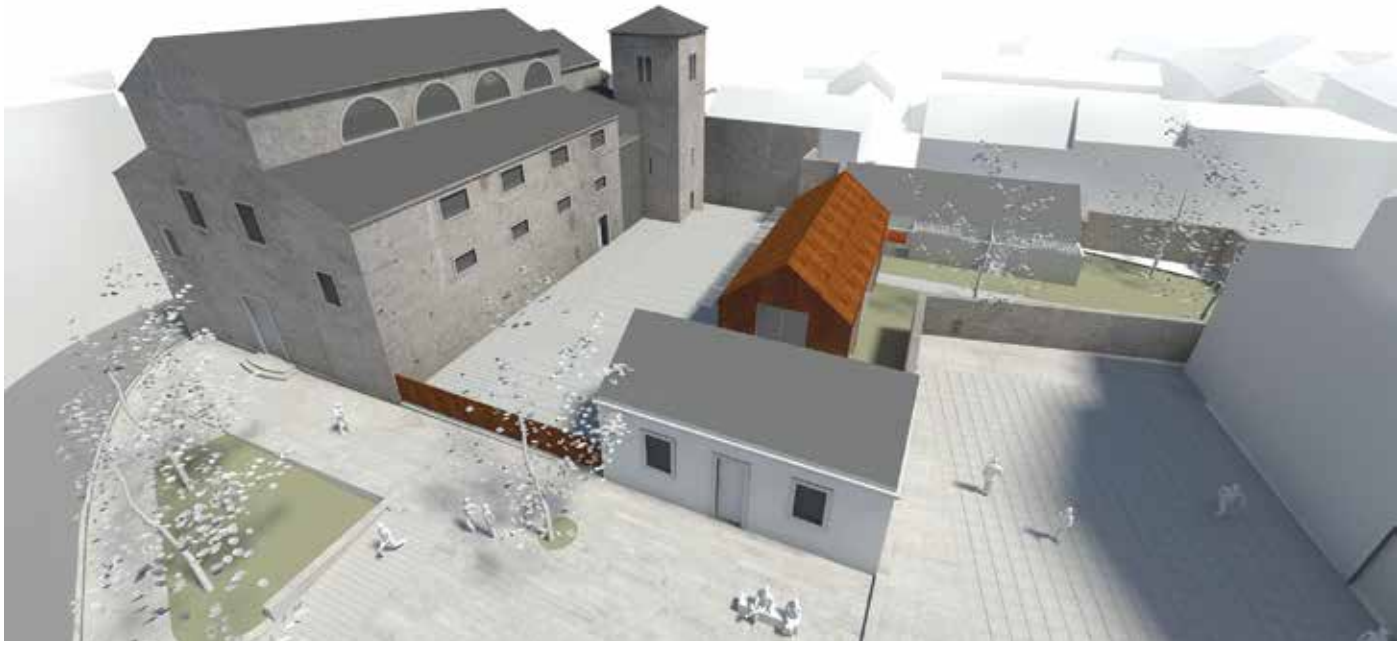
Zbog izrade nacrtnog snimka postojećeg stanja i izrade idejnog rješenja arhitektonskog sklopa Sv. Nikole u Zadru, od proljeća do jeseni provedeno je nekoliko akcija čišćenja ovog prostora od divljeg raslinja, pregradnih zidova od betonskih blokova, krupnog otpada i raznog

11. Clearing and removal of decades of accumulated refuse from the Sveti Nikola complex / Čišćenje i odvoz desetljećima gomilanog otpada iz sklopa Sv.Nikole (photo: F. Jurković Pešić)

house the ICUA museum and gallery exhibition of underwater archaeology and maritime history.

drugog smeća. Odvezen je velik broj kamiona otpada i tek sada je vidljiv cjelokupni prostor ovog kulturnog dobra, smještenog na samom vrhu zadarskog poluotoka. Arhitekt Ante Uglešić i njegov arhitektonski studio Forvm iz Zadra je izradio idejni projekt, kojim je osmišljen sadržaj za svaki pojedini objekt u sklopu Sv.Nikole. Najvažnije je buduće uređenje zgrade crkve, u kojoj će naći mjesto muzejsko-galerijski postav podvodne arheologije i povijesti pomorstva MCPA Zadar.

12 a,b. Two tabled concepts for the future ICUA museum section in the frame of the Sveti Nikola complex as envisaged by architect A. Uglešić / Dvije moguće vizure budućeg muzejskog dijela MCPA u sklopu Sv. Nikole, prema zamisli arhitekta A. Uglešića (author: Forvm d.o.o.)



Launch of Systematic Research of the Piruzi Rocks Shipwreck, Rovinj

Početak sustavnih istraživanja brodoloma kod hridi Piruzi, Rovinj

Luka Bekić ● lbekic@icua.hr

Nakon završenog petogodišnjeg projekta (2008.-2013.) pod nazivom "Luka Veštar", na području rovinjštine osmišljen je novi projekt podvodne arheologije pod nazivom "Rovinjski brodolomi". Iako se zna da grad Rovinj baštini značajnu pomorsku tradiciju dugo u povijest, većina najranijih podataka o tome još je skrivena u obliku neistraženih podvodnih arheoloških nalazišta. Većina tih nalazišta su temeljito opljačkana, a nalazi su raspršeni. Stoga se ovim projektom, iz preostalih tragova brodoloma na morskom dnu, nastoji doznati čim više o najranijoj tradiciji pomorstva ovog grada.

Podmorskim istraživanjima koje posljednjih godina Međunarodni centar za podvodnu arheologiju u Zadru (MCPA) provodi u rovinjskom akvatoriju ustanovljeno je postojanje najmanje tri antička brodoloma, a postoji mogućnost da ih je bilo i više. Ovaj je akvatorij oduvijek bio opasan za navigaciju zbog brojnih hridi, ali je bogatstvo na obali mamilo brodare na intenzivnu plovidbu.

Cilj ovog projekta je istražiti ostatke tri najstarija brodoloma rimskih trgovačkih brodova za koje se zna na području Rovinja, a koji su se potopili kod hridi Piruzi, otočića Sv. Ivan i Sestrice, te konačno pronaći i četvrti misteriozni brodolom sa teretom globularnih amfora kod rta Guštinja. Ovogodišnje podvodno istraživanje ostataka kasnoantičkog brodoloma kod hridi Piruzi početak je trogodišnjeg projekta.

Planira se da će istraživanje ovih triju nalazišta trajati tri puta tri godine, a nakon svakog završenog nalazišta, rezultati istraživanja objaviti će se u dvojezičnoj monografiji, te će se organizirati izložba nalaza. Ovim projektom nastaviti će se višegodišnja suradnja MCPA Zadar, Zavičajnog muzeja Grada Rovinja i Bavarskog društva za podvodnu arheologiju (Bayerischen Gesellschaft für Unterwasserarchäologie).

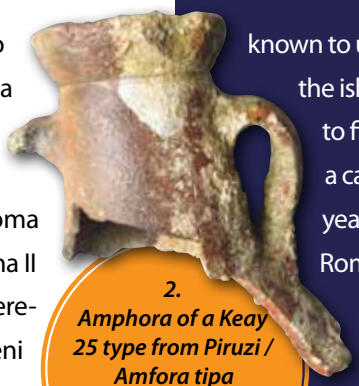
Ronioci MCPA Zadar već su 2011. g. u okviru programa rekognosciranja podmorja Istre pregledali i podmorje otoka Veliki

1. Laying out the grid over the shipwreck postition / Postavljanje mrežista na položaj brodoloma (photo: M. Prell)

Following the close of the five-year Veštar Harbour project (Luka Veštar, 2008–2013) a new underwater archaeology project, Shipwrecks of Rovinj (Rovinjski brodolomi) has been initiated in the Rovinj area. Although it is well known that the city of Rovinj has a legacy of maritime tradition with a long history, most of the earliest data on the subject remains shrouded in uninvestigated underwater archaeological sites. Most of these sites have been thoroughly looted and the finds dispersed. This project aims to learn as much as possible about the earliest maritime traditions in this city from the remaining traces of shipwrecks on the seabed.

The underwater research conducted in the waters of Rovinj in recent years by the International Centre for Underwater Archaeology in Zadar (ICUA) established the existence of at least three Roman period shipwrecks, and there may be more. The many underwater rocks have always made maritime navigation in these waters a risky proposition, but it was the wealth of these shores that enticed mariners to undertake intensive navigation. The objective of this project is to research the remains of the three oldest shipwrecks of Roman merchant vessels that are

i Mali Piruzi. Tom su prilikom provjereni navodi o postojanju opljačkanog kasnoantičkog brodoloma između ovih dvaju otoka. Prema toj informaciji, arheolog Štefan Mlakar je početkom 70-tih godina prošlog stoljeća otkrio tragove brodoloma koji je prevozio kasnoantičke amfore tipa Africana II (Vrsalović 1979; Starac 2006, 101). Pregledom terena 2011. g. između ova dva otoka nisu pronađeni arheološki nalazi, ali je na jugozapadnoj strani otoka Veliki Piruzi, na dubini od oko 6 m, pronađena veća koncentracija polomljenih dijelova sjevernoafričkih amfora među kojima je bio i jedan tipološki odrediv komad, grlo Keay 25B amfore. Ovim pregledom konačno je utvrđeno kako se lokacija kasnoantičkog brodoloma nalazi na jugozapadnoj strani otoka Veliki Piruzi pa je na toj lokaciji i započelo ovogodišnje istraživanje.



2. Amphora of a Keay 25 type from Piruzi / Amfora tipa Keay 25 s Piruza (photo: L. Bekić)

Na zaravnatom proširenju među visokim stijenama na morskom dnu uz otok Veliki Piruzi pričvršćeni su klinovi s brojčanim oznakama (točke) koje su činile uglove kvadranata dimenzija 4 x 4 metara (kvadranti A-H). Vodenom pumpom i "mamutima" se iskapao kvadrant po kvadrant, a kako je koji kvadrant završen, prelazilo se na slijedeći. Sa iskapanjem se

known to us in the Rovinj area that sank at the Piruzi rocks, the islet of Sveti Ivan and the two Sestrica islands, and to finally find the mysterious fourth shipwreck with a cargo of globular amphorae off Cape Guštinja. This year's underwater research of the remains of a late Roman shipwreck off the Piruzi rocks marks the launch of a three-year project.

Plans foresee a research effort at these three sites spanning a period of three times three years, and upon the completion of research at each of the sites the results will be published in a bilingual monograph accompanied by the organisation of an exhibition of the finds. This project will build on the multiannual collaboration of ICUA Zadar, the City of Rovinj Heritage Museum and the Bavarian Society for Underwater Archaeology (Bayerischen Gesellschaft für Unterwasserarchäologie).

Back in 2011 ICUA divers investigated the waters off the islets Veliki Piruzi and Mali Piruzi in the frame of a programme that saw the archaeological survey of the waters of Istria County. It was an opportunity to look into allegations concerning the presence of a looted late Roman shipwreck between these

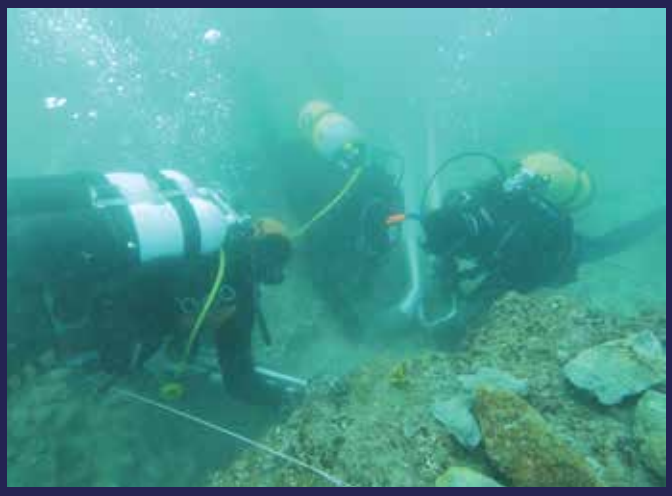
3. Šimičić and Starčić connecting a water pump for excavation / Šimičić i Starčić spajaju vodenu pumpu za iskopavanje (photo: L. Bekić)

4. Heinzlmeier and other divers on the boat during the change of diving pairs / Heinzlmeier i drugi ronioci na brodu prilikom smjene parova (photo: M. Šimičić)

započelo s jugozapadne, dublje strane, prema sjeveroistoku (otoku). Kada je jedan kvadrant iskopan do kraja, zatrpavan je kamenom i pijeskom iz novozapočetog kvadranta. Pumpa za iskapanje mamutima nalazila se na brodu usidrenom iznad nalazišta. Za brod i logističku bazu za istraživače poslužio je ronilački centar Old diver u Veštru.

6. Excavation in quadrantu / Iskopavanje u kvadrantu (photo: M. Prell)

two islets. According to the information, archaeologist Štefan Mlakar had in the early 1970s discovered traces of the wreck of a ship that had transported late Roman amphorae of the Africana II type (Vrsalović 1979; Starac 2006, 101). No archaeological finds were discovered during the 2011 survey of the terrain between these two islets, but a large concentration of shattered parts of North African amphorae were found to the southwest side of Veliki Piruzi at a depth of about six metres, among which there was one typologically identifiable sherd – the neck of a Keay 25B amphora. This survey finally confirmed that the location of the late Roman shipwreck is to the southwest side of the islet of Veliki Piruzi and it was at this location that this year's research began.



5. Joining forces to excavate a quadrant / Iskopavanje kvadranta zajedničkim snagama (photo: M. Pešić)

Spikes were affixed on a flat expanse between high rocks on the seabed alongside Veliki Piruzi with numerical designators (points) to form the corners of a four by four metre grid (quadrants A-H). Water pump and two dredges were used to excavate quadrant by quadrant, and as a given quadrant was completed we moved on to the next one. The excavations were started on the southwest, deeper side and moved to the northeast (the islet). Once a quadrant had been fully excavated it was then backfilled with stone and sand from a new quadrant. The water pump was housed on a boat anchored above the site. The Old Diver diving centre in Veštar provided the logistics base and boat for the researchers.

All finds discovered in the trenches were collected during the research (total collection). The finds were then sorted, counted and weighed. This data was then entered in tables prepared for the purpose. A total of 291 potsherds were extracted from the sea in the frame of this year's research effort with a total weight of 41.84 kilograms. Of all the finds the majority were sherds of amphorae, 274 pieces, with a total weight of 28.51 kilograms,

7. Dno lonca / The base of a pot (photo: M. Prell)

8. Finds are counted, measured and packed / Nalazi se broje, mjere i pakiraju (photo: M. Prell)

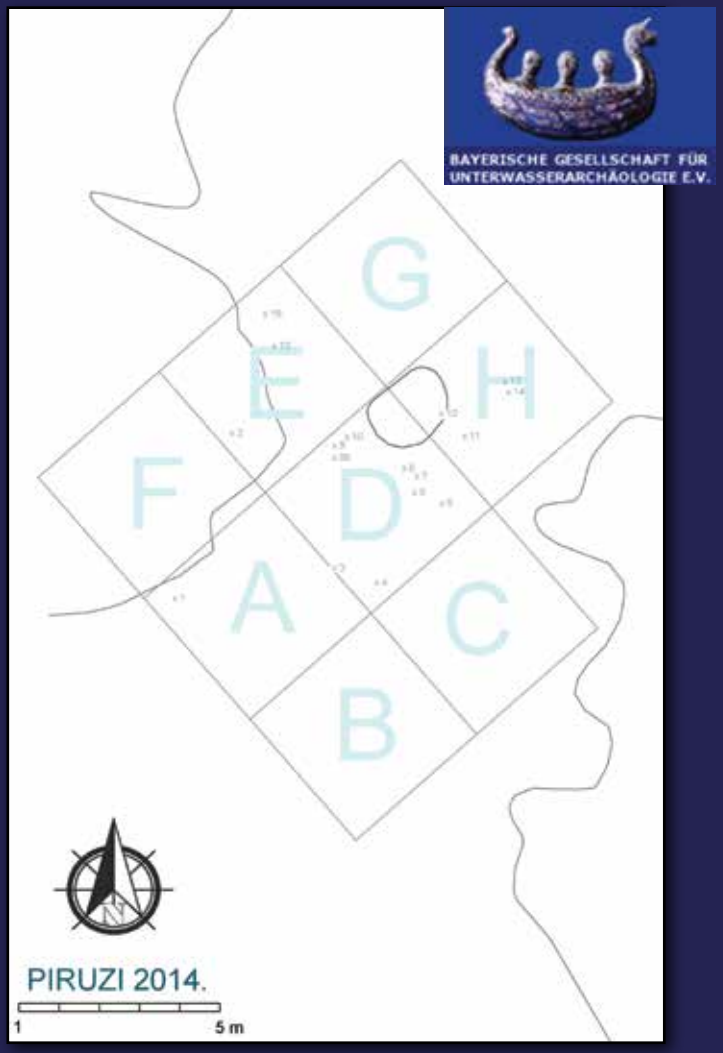
Prilikom istraživanja prikupljani su svi arheološki nalazi (total collection) pronađeni u sondama. Nalazi su zatim sortirani, prebrojani i izvagani. Ovi podaci uneseni su u unaprijed pripremljene tablice. U sklopu ovogodišnjih istraživanja ukupno je iz mora izvađen 291 ulomak keramike ukupne težine 41,84 kilogram. Od ukupnog broja najčešći su ulomci amfora, njih 274 komada, ukupne težine 28,51 kg, a pojedinačno je najteži donji dio pitosa od 5,35 kg.

Za tipološki odredive nalaze (posebne nalaze, PN) zabilježen je točan položaj unutar kvadranta. Pod morem je svaki posebni nalaz fotografiran zajedno sa brojem kojim je označen i na taj način ih je izdvojeno ukupno 16. Ovakvim načinom obrade nalaza dobiveni su podaci o prostornoj koncentraciji različitih tipova posuđa. Istraživanjem cijelog nalazišta dobiti će se vjerna slika rasprostiranja predmeta s uništenog broda.

Ulomci keramike uglavnom su dijelovi kasnoantičkih amfora afričkih tipova. U ovogodišnjim istraživanjima izdvojeno je 3 vrška dna, 9 ulomaka ručki i 5 dijelova oboda amfora. Pronađeni su i pojedinačni ulomci keramičkog posuđa, dva dna sa stopicama zasad nepoznatih posuda i još nekoliko neodredivih ulomaka. Pronađeno je i 8 komada oblog balastnog kamenja veličine od 5 - 25 cm i jedan ulomak pitosa koji teži preko 5 kg. Za daljnju analizu uzeti su samo tipološki odredivi nalazi, dok je ostatak nalaza vraćen u podmorje na isto mjesto odakle je izvađen.

while the heaviest single find was a part of the lower section of a pithos weighing in at 5.35 kilograms.

9. Drawing of part of the site with quadrants and special finds indicated / Nacrt dijela nalazišta s ucrtanim kvadrantima i posebnim nalazima (authors: M. Prell, M. Šimičić)



Ove godine, u prvoj kampanji iskopavanja, istražena je površina od oko 128 četvornih metara površine. Svi arheološki nalazi sada su u radionici Odjela za restauriranje podvodnih arheoloških nalaza MCPA Zadar, a nakon njihove desalinizacije biti će dostupni za temeljito proučavanje. Terenska istraživanja ovog opljačkanog nalazišta nastaviti će se slijedeće godine, a pokušati će se ući u trag amforama koje su sa ovog mjesta izvađene prije četrdesetak godina.

Tijekom terenskih istraživanja u sklopu projekta "Rovinjski brodolomi", u uvali Veštar je proveden i trodnevni tečaj podvodne arheologije prema programima britanskog Nautical Archaeological Society (NAS) i to NAS Uvod u priobalnu i podvodnu arheologiju i tečaj NAS 1. stupanj priobalne i podvodne arheologije. Tečajevi su se sastojali od teoretskih predavanja u ronilačkom klubu Old Diver u kampu Veštar kod Rovinja, a

10. NAS lecture at the diving club / NAS predavanja u ronilačkom klubu (photo: M. Prell)

praktične podvodne vježbe su se održavale u blizini ostataka novovjekovnog mola 2 u uvali Veštar. Tečajeve je uspješno završilo troje polaznika iz Slovenije i Hrvatske. Provođenje NAS tečajeva u organizaciji MCPA na ovom arheološki bogatom i zanimljivom mjestu nastaviti će se i iduće godine.

Paralelno s ovim podvodnim istraživanjima, u uvali Veštar je provedeno i kraće kopneno arheološko istraživanje, na položaju ruševine novovjekovne kamene građevine na obali u blizini potopljenog novjekovnog mola 3. Mol 3 je istraživan ranijih godina, u sklopu projekta podvodnih arheoloških istraživanja luke Veštar, u kampanjama 2012. i 2013. g. Arheološki keramički nalazi pronađeni u rovovima i sondama prilikom istraživanja ovog mola pripadaju razdoblju 17. i 18. st. Zgrada na obali je vrlo zanimljiva jer postoje brojne indicije da je povezana sa korištenjem mola 3.

The exact position within the quadrant was recorded for typologically identifiable finds (special finds, SF). Each special find was photographed underwater together with the number with which it was tagged – sixteen in total were thus isolated. This method of processing finds yielded data on the spatial concentration of various vessel types. Examination of the entire site will provide us with a true representation of the distribution of artefacts from the sunken vessel.

The potsherds are for the most part from late Roman amphorae of the African types. In this year's research we isolated three foot tips, nine fragments of handles and five sections of amphorae rims. We also found individual sherds of ceramic ware, two bases with small feet from for now unidentified vessels and a number of other unidentifiable sherds. Also found were eight pieces of rounded ballast stones with dimensions ranging from five to twenty-five centimetres and one sherd from a pithos weighing over five kilograms. Only typologically identifiable finds were taken for further analysis, while the remaining finds were returned to the seabed to the same place where they were found.

This year, in the first excavation campaign, an area of some 128 square metres was investigated. All the archaeological finds are now at the workshop of the underwater archaeological finds restoration department of ICUA Zadar and they will be available for detailed examination after desalinisation is completed. The field investigation of this looted site will continue in the

11. NAS underwater hands-on training / NAS praktične vježbe pod morem (photo: M. Pešić)

coming year and an effort will be made to find out where the amphorae taken from this site some forty years ago wound up.

A three-day underwater archaeology course following the guidelines of the programme of the British Nautical Archaeological Society (NAS) was conducted during in the field research

12. Participants of the investigation of Piruzi in 2014: Upper row, left to right / Gornji red s lijeva: Mario Bloier, Mladen Pešić, Marko Srečec, Roko Surić; Second row, left to right / drugi red s lijeva: Daniel Neubauer, Marcus Prell, Max Fiederling, Michael Heinzlmeier, Nenad Starčić, Marina Šimičić; Squatting / čuči: Luka Bekić

Kameni objekt je zarastao u raslinje i nalazi se oko 40 m zapadno po obalnoj liniji od mola 3. Sačuvani su zidovi do visine od 3,35 m. Cilj istraživanja je bio odrediti smjerove pružanja i debljinu zidova ove kamene novovjekovne građevine. Kako bi se došlo do ostataka građevine uklonilo se raslinje i slojevi građevinske šute odnosno urušenja kamenih zidova. Iskopana je sonda dimenzije 1x1 metar u južnom dijelu građevine uz istočni zid. Ova je građevina trapezastog oblika približno 35-40 m2; dužina sjevernog zida iznosi 5,20, istočnog 7,10, južnog 5,40 m, a zapadnog 7,50 m.

Prilikom istraživanja očišćen je sjeverozapadni profil. Iz stratigrafske situacije koja je tu zabilježena može se zaključiti slijedeće. Kamena zgrada sagrađena na zemljanoj obali koja je korištena još u rimsko doba kao hodna ili poljoprivredna površina. Na početku u zgradi nije bilo čvrstog poda, već samo nabijena zemlja. Tragovi korištenja zgrade zabilježeni su tako u sloju gareži. Ostatak lule je odlično sačuvan i njegovo stanje nam svjedoči da je riječ o primarnom položaju tog nalaza, tj. da je lula polomljena i odbačena unutar zgrade i tu ostala. Životinjske kosti i ugljen su također tragovi boravka i korištenja ove zgrade. Prvotno korištenje možemo dakle postaviti

in the frame of the Shipwrecks of Rovinj project, namely the NAS Introduction to Foreshore and Underwater Archaeology and the NAS 1st Level Foreshore and Underwater Archaeology courses. The courses consisted of lectures on theory at the Old Diver diving club at Camp Veštar near Rovinj, while hands-on underwater training was staged near the remains of the post medieval mole 2 at Veštar Cove. Three participants from Slovenia and Croatia successfully completed the courses. ICUA will continue to organise NAS courses at this archaeologically rich and fascinating site in the coming year.

Parallel to this underwater research a brief land archaeological research effort was also made at Veštar Cove at the site of the ruins of a post medieval stone edifice on the coast in the vicinity of the sunken post medieval mole 3. Mole 3 has been investigated in previous years in the frame of the underwater archaeological research project at Veštar Cove during campaigns in 2012 and 2013. The archaeological ceramic finds discovered in the trial trenches and trenches during the research of this mole are from the 17th to 18th century period. The edifice on shore is interesting as there are numerous indications that it is related to the utilisation of mole 3.

The stone structure is overgrown with vegetation and is located to the west about forty metres along the shoreline from mole 3. Walls are preserved to a height of 3.35 metres. The objective of the investigation was to determine the orientation and thickness

13. Surić and Matošević document the remains of the onshore edifice / Surić i Matošević dokumentiraju ostatke obalne zgrade (photo: L. Bekić)

u vrijeme 18./19. st. kako se datira lula. Slijedeći sloj kamene podloge i vapnene podnice govori da je zgrada obnovljena i dodan joj je čvrsti pod. To se moglo dogoditi u kasno 19. ili početkom 20. st, što se može naslutiti po tipu žbukane podnice sa sitnim kamenčićima. Nakon nekog vremena prostorija je ponovno obnovljena, na način da je preko žbukane podnice zaliven tanji betonski sloj, a vrlo vjerojatno je u isto doba izrađeno je betonsko gazište-prag na ulazu. Ta zadnja faza adaptacije mogla je biti izvedena najranije u neko doba sredinom 20. st.

Prema svemu sudeći, moguće je da se tijekom korištenja mola 3, tijekom 17./18. st. pojavila potreba za izgradnjom kamene zgrade za smještaj osoba koje su bile povezane s korištenjem mola 3. To su mogli biti ljudi koji su radili na utovaru i ovjeravanju količina drva ali i ostale robe koja je ukrcavana i iskrcavana u luci Veštar. Iz pisanih izvora zna se kako je luka Veštar korištena za utovar drva koje se slalo za mletački Arsenal svake godine, a pretpostavljamo kako je upravo za to služio mol 3, pa i ova zgrada. Tradicija utovara drva i korištenja ove zgrade potrajala je kroz doba Austro - Ugarske, o čemu nam svjedoče i mještani. Kasnije je zgrada propadala i nije čudno kako se počela koristiti kao štala.

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of the walls of this post medieval structure. Vegetation and layers of construction debris, i.e. the collapsed segments of the walls, were removed in order to get to the remains of the building. A one by one metre trench was excavated along the south section of the structure along the eastern wall. The building is trapezoidal in shape and covers approximately thirty-five to forty square metres. The northern wall is 5.20 metres in length, the eastern 7.10, the southern 5.40 and the western 7.50.

The northwest profile was cleaned during the investigation. The following can be concluded from the stratigraphic situation recorded here: the stone edifice was built on an earthen shore that was used in Roman times as a pedestrian or agricultural surface. There was no firm flooring in the building initially, only rammed earth. A layer of soot indicates that the building was in use. The remains of a smoking pipe are in an excellent state of preservation and its condition indicates that this is the primary location of this find, i.e. that the smoking pipe was broken and discarded within the building and remained there. Faunal bones and charcoal are also traces of habitation and the utilisation of this building. We can then set the initial use to the period of the 18th and 19th centuries to when the smoking pipe is dated. The next layer of stone substrate and lime flooring indicates that the building was renovated and that a firm flooring was added. This may have occurred in the late 19th or early 20th century, which can be deduced from the type of plaster flooring with fine pebbles. After a time the room was again renovated by the pouring of a thin concrete layer over the plaster flooring and it is very likely that a concrete tread/threshold was installed at the entrance at this time. This final adaptation phase could have been effected at the earliest some time in the mid 20th century.

By all indications it is possible that during the utilisation of mole 3 during the 17th and 18th centuries a need emerged for the construction of a stone building for the accommodation of persons related to the utilisation of mole 3. These may have been people who worked on the loading and verification of quantities of wood and other goods that were on- and offloaded at Veštar harbour. From written sources we know that Veštar was used for the loading of wood delivered to the Arsenal in Venice every year and we presume that mole 3, and this building, served precisely this purpose. The tradition of the loading of wood and the utilisation of this edifice lasted through the Austro-Hungarian period to which local inhabitants also testify. Later the building deteriorated and it is no wonder that it was subsequently used as a stable.

R/V Hercules Research Along the Coast of Konavle and Župa Bay in 2014

Istraživanja R/V Herculesa u konavoskom i župskom primorju 2014. g.

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The American science and exploration ship R/V Hercules navigating the territorial waters of Croatia has once again launched a search for cultural heritage hidden in the depths of the Adriatic. The effort continues cooperation between the Croatian Ministry of Culture, the International Centre for Underwater Archaeology in Zadar and the USA-based RPM Nautical Foundation, now in its third year (Royal, Bekić 2012; Bekić, Šimičić 2013). This year's research has seen the greatest success to date.

Multiannual preparatory work investigating the seabed has this year finally yielded the discovery by robotic descent of an untouched Roman period shipwreck from the 1st century BCE. The shipwreck is located off Cape Pelegrin near Kupari – the remains of almost a hundred

1. R/V Hercules at Gruž harbour / Hercules u luci Gruž (photo: M. Šimičić)

amphorae in rows are visible on the seabed. By all accounts there are likely a further several hundred amphorae in deeper layers and beneath them, conserved by silt, may be the wooden remains of the ship. Another shipwreck was found off Cape Sveti Petar near Kupari at which we can observe some forty intact amphorae, although we are not sure how many have been preserved in deeper layers. Along with these two research "gems",

Američki znanstveno - istraživački brod Hercules je doplovivši u hrvatske teritorijalne vode, ponovno krenuo u potragu za kulturnom baštinom skrivenom u dubinama jadranskog podmorja. Radi se o nastavku suradnje Ministarstva kulture RH, Međunarodnog centra za podvodnu arheologiju u Zadru (MCPA) i američke zaklade RPM Nautical koja se odvija već treću godinu za redom (Royal, Bekić 2012; Bekić, Šimičić 2013). U ovogodišnjim istraživanjima postigli su se do sada najveći uspjesi.

Višegodišnjim pripremnim radovima na pregledu podmorja, ove godine je konačno spuštanjem robota otkriven netaknuti antički brodolom iz 1. st. pr. Kr. Brodolom se nalazi u blizini rta Pelegrin kod Kupara, a na njemu su na morskom dnu vidljivi ostaci gotovo stotinjak amfora u redovima. Po svemu sudeći, amfora u dubljim slojevima vjerojatno ima još nekoliko stotina, a ispod njih, konzervirani muljem, možda počivaju i drveni ostaci broda. Također, kod rta Sv. Petar kod Kupara pronađen je još jedan brodolom na kojem je primijećeno oko četrdesetak cijelih amfora, ali nije sigurno koliko ih je sačuvano u dubljim slojevima. Uz ta dva "bisera" istraživanja, ove godine pronađeno je i nekoliko brodoloma iz drugih razdoblja. Ti uspjesi konačno su potvrdili veliki potencijal ovih istraživanja, koja su dosada, zbog neizbježnih tehničkih problema visoko sofisticirane i opreme koja se upotrebljava, često završavali u "slijepoj ulici".

Podvodno arheološko istraživanje podmorja Konavla i Župe Dubrovačke provedeno je pod stručnim vodstvom arheologa dr. Luke Bekića iz MCPA i dr. Jeffreya Royala iz RPMNF-a u kolovozu 2014. g. U istraživačkom timu bili su i hrvatski podvodni arheolozi dr. Domagoj Perkić iz Dubrovačkih muzeja, zatim Mladen Pešić, Roko Surić i Marina Šimičić iz MCPA, te George Robb iz RPMNF. Uz njih je u projektu sudjelovalo tehničko osoblje iz SAD-a

several other shipwrecks from other periods have also been found this year. These successes have confirmed the great potential of these research efforts, which have to date, as a result of the inevitable technical problems associated with the highly sophisticated equipment used, often wound up in the proverbial "dead end".

The underwater archaeological research of the waters of Konavle and Župa Dubrovačka was conducted under the expert leadership of archaeologists Dr Luka Bekić of ICUA and Dr Jeffrey Royal of RPMNF in August of 2014. The research team also included Croatian underwater archaeologists Dr Domagoj Perkić of Dubrovnik Museums; Mladen Pešić, Roko Surić and Marina Šimičić of ICUA; and George Robb of RPMNF. They were joined by a technical staff from the USA and Canada and the crew of the R/V Hercules from Poland, Malta and the Philippines.

This year, along with the robotic vehicle (ROV, Remotely Operated Vehicle), the research vessel Hercules was equipped with a new device used to map smaller areas of the seafloor – a sector scan sonar. During a ten-day operation the sector scanner was lowered to some twenty positions in the waters of Konavle and Župa Bay.

2. The sector scan image of the shipwreck off Konavoske Stijene / Sector Scan slika brodoloma kod Konavoskih stijena (photo: RPM database)

The Konsberg MS 1000 Sector Scanner very quickly generates high quality and geometrically precise sonar images. These images are combined to form a map of the seafloor of the area. Given that the image is of high-resolution, shapes are recognisable and thus more readily interpreted. This device was used primarily to acquire precise sonar images of previously identified potential target positions. The targets were determined by an examination of last year's bathymetric maps produced by the multibeam sonar.

i Kanade, te posada broda Hercules iz Poljske, Malte i Filipina.

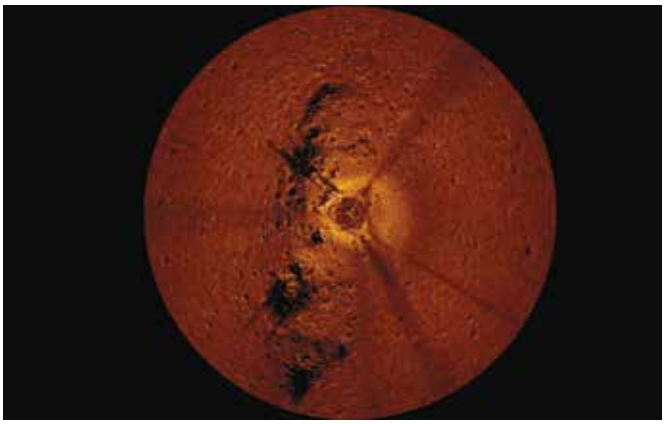
Ove je godine, osim s robot ronilicom (ROV, Remotely Operated Vehicle), istraživački brod Hercules bio opremljen novim uređajem koji se koristi za mapiranje manjih područja morskog dna, Sector Scan Sonar-om. U desetodnevnoj operaciji Sector Scanner je spušten na dvadesetak pozicija u podmorju Konavala i Župskog zaljeva.

Sector Scanner je uređaj marke Konsberg MS 1000. Uređaj vrlo brzo generira visoko kvalitetne i geometrijski precizne sonarne slike. Ove se slike spajaju i tako se stvara karta područja morskog dna. S obzirom da je snimak visoke rezolucije, moguće je prepoznati oblike i tako ih lakše protumačiti. Ovaj je uređaj uglavnom korišten za dobivanje preciznih sonarnih slika ranije određenih pozicija potencijalnih meta. Mete su određene pregledom

3. Deploying the ROV to a position foreseen for investigation Spuštanje ROV-a na poziciju predviđenu za pregledavanje (photo: M. Šimičić)

The sector scanner is attached to a steel tripod and is lowered to the seafloor using a windlass where it is placed at a suitable location to gather data. The head of the sector scanner makes a full circle (360˚) sending a signal and in this manner showing the area around the sonar in detail. The sector scan sonar is linked by cable to a computer in the ship's operation's centre. A sonar image is immediately shown on this computer in real time. The technician operating the sector scanner monitors the sonar image generated on the computer and can set the scanning radius to from one thousand to three metres – for the most part radial ranges of 30, 20, 15, 10, 5 or 3 metres are selected.

When the head of the sector scanner is in place it required from two to five minutes to generate a complete sonar image (full circle) – as the radius is increased, however, the quality of the image deteriorates. It is also very important at what height from the seafloor the head is moving as the image acquired will be that of the line of sight from that elevation. Images acquired by the sector scan sonar can later be compiled into a photomosaic providing us with a precise sonar image of a given area (site).



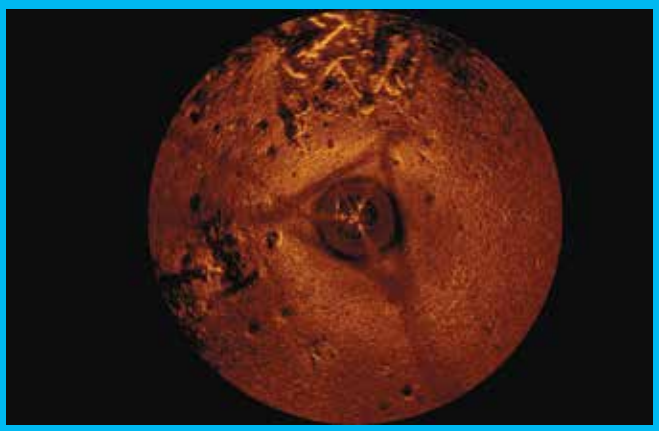
4. The sector scan image of the shipwreck at Cape Lokvice showing the entire outline of the ship / Sector Scan slika brodoloma kod rta Lokvica na kojoj je vidljiv cijeli obris broda (photo: RPM database)

With the objective of better documenting sites, the sector scan sonar was lowered to the two most important sites we discovered in 2012 in the waters of Konavle (Royal, Bekić 2012). These are the positions of two shipwrecks that were discovered with the help of a multibeam sonar and the RPM ROV in the first research campaign. These shipwrecks are at Konavoske Stijene (CR12-AA / Molunat 1) and at Cape Lokvice (CR12-AB / Molunat 2). Besides the improved images generated by the sector

prošlogodišnjih batimetrijskih karata dobivenih višesnopnim sonarom (Multibeam Sonar).

Sector scanner se pričvršćen na čelični tronožac i uz pomoć vitla spušta na morsko dno, gdje se na povoljnom mjestu fiksira te se prikupljaju podaci. Glava sector scanner-a kružnom putanjom (360˚) odašilja signal i na taj način detaljno prikazuje područje, ocrtavajući kružni prikaz područja oko sonara. Sector Scan sonar je povezan kabelom s računalom koje se nalazi u brodskom operativnom centru. Na ovom se računalu odmah emitira sonarna slika u realnom vremenu. Tehničari koji upravljaju Sector Scanner-om prate sonarnu sliku na računalu i mogu namjestiti radijus skenera od 1000 do 3 m, a uglavnom se biraju rasponi radijusa od 30, 20, 15, 10, 5 ili 3 m).

Kada je glava Sector scanner-a na položaju, potrebno je od 2 do 5 minuta kako bi se dobila potpuna sonarna slika (puni krug), ali što se povećava radijus prikaza, kvaliteta slike se smanjuje. Također, vrlo je važno na kojoj visini od morskog dna se glava okreće, jer će dobivena slika odgovarati polju vidljivosti s te visine. Slike dobi-



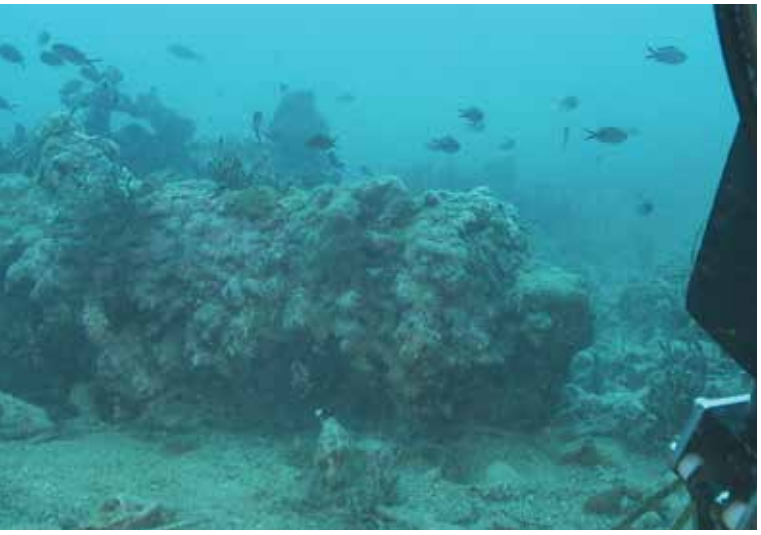
5. Large anchors are visible in the sector scan image of the shipwreck at Cape Lokvice / Sector Scan slika brodoloma kod rta Lokvica na kojoj su vidljiva velika sidra (photo: RPM database)

vene Sector Scan sonarom se naknadno mogu spojiti u fotomozaik, čime dobivamo precizniju sonarnu sliku određenog područja (nalazišta).

U svrhu bolje dokumentacije nalazišta, Sector Scan sonar spušten je na dva najvažnija nalazišta koja smo otkrili 2012. g., a nalaze se u podmorju Konavala (Royal, Bekić 2012). Radi se o položajima dva brodoloma koji su otkriveni uz pomoć višesnopnopnog sonara i ROV-a RPM-a u prvoj istraživačkoj kampanji. To su brodolom

scan sonar, the shipwrecks were again imaged by the ROV's cameras. Using the ROV's mechanical arm another sherd of the belly and handle of a pot was extracted from a potential Byzantine shipwreck at the Konavoske Stijene position. We also acquired better images of the large anchors of the shipwreck at Cape Lokvice.

At the Seka Velika (CR13-AE) position – the site of submerged dolia already known to us in the waters of Cavtat



6. One of the canons at the shipwreck from Napoleonic wars / Jedan od topova na brodolomu iz doba Napoleonskih ratova (photo: ROV camera)

– the sector scanner and ROV cameras were lowered in the hope of discovering the ship that transported these vessels. The devices searched the area around the dolia, but unfortunately did not yield new results. The ROV was also lowered to a location where a sunken ship from the period of the Napoleonic wars found its final resting place in a natural depression on the seafloor. The ROV cameras toured the site and its remains were recorded in detail on this occasion.

This year the sector scanner and ROV were also lowered at the location of a sunken sailboat not far from Cape Kostur (Kostur - CR13-AA; Bekić, Šimičić 2013). Last year we dove to about forty metres to examine the remains of the wooden ship that had been identified as a potential site on the Hercules bathymetric map. This year again poor visibility caused by discharge from a hydroelectric plant impaired the quality of the ROV video but the sector scanner managed to acquire much better images.

The anomaly recorded on the seafloor by the multibeam sonar at the Brdo Križ site (CR 14-AC) was checked using

7. Lowering the sector scan sonar and tripod to the seafloor at Konavoske Stijene / Spuštanje Sector Scan sonara s tronoščem u podmorje kod Konavoskih stijena (foto: M. Šimičić)

kod Konavoskih stijena (CR12-AA / Molunat 1) i kod Rta Lokvica (CR12-AB / Molunat 2). Osim boljih snimaka dobivenih Sector Scan sonarom, brodolomi su ponovno snimljeni kamerama ROV-a. Uz pomoć mehaničkim ruka ROV-a izvađen je još jedan ulomak trbuha i ručke lonca s potencijalnog bizantskog brodoloma na poziciji Konavoske stijene. Također su dobivene i bolje slike velikih sidara na brodolomu kod Rta Lokvica.

Na poziciju već otprije poznatog nalazišta potopljenih dolija, u podmorju Cavtata, Seka velika (CR13-AE), spušten je Sector Scanner i kamere ROV-a, sve u nadi da se pronađe brod koji je ove posude prevozio. Uređajima se pretraživalo područje uokolo dolija, ali na žalost pretraga nije dala novih rezultata. ROV je spušten i na lokaciju gdje je u prirodnoj udubini morskog dna svoj mir pronašao

8. All movement by the ROV and other equipment is controlled and monitored from the ship's operations centre / Svi pokreti ROV-a i ostale opreme nadziru se i provode iz brodskog operativnog centra (photo: L. Bekić)

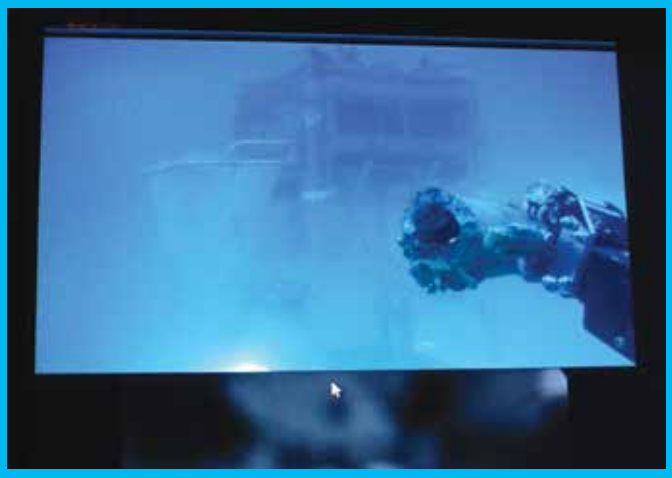
the sector scan sonar and ROV cameras. It was concluded that it is most likely a sunken amphibian vehicle, likely from World War 2. It is interesting to note that two similar vessels, landing crafts, were found two years ago at nearby positions (Royal, Bekić 2012).

The Cape Pelegrin A (CR14-AB) position was registered as a possible shipwreck during last year's research campaign. Lowering the sector scanner and the ROV camer-

10. Amphora's burried in rows are visible under the sand at Cape Pelegrin B site / Amfore zakopane u nizu, naziru se ispod pijeska na nalazištu rt Pelegrin B (ROV camera)

as into the depths of the sea it was established that this is a post medieval shipwreck lying at a depth of about seventy metres. No objects that might date it were, unfortunately, observed on the vessel, but the wooden ribs of the former hull are visible. A number of other loca-

11. Deputy Minister Berislav Šipuš and the archaeologists inspect the find of an amphora section from Cape Pelegrin B / Zamjenik ministrice Berislav Šipuš i arheolozi pregledavaju nalaz dijela amfore s rta Pelegrin B (photo: M. Šimičić)



9. The ROV deploys its mechanical arm to carry an amphora sherd to the TMS underwater station, Rt Pelegrin B / ROV mehaničkom rukom nosi ulomak amfore do TMS podvodne stanice, Rt Pelegrin B (photo: I. Iglesias)

potopljeni brod iz Napoleonskih ratova. Kamere ROV-a su obišle su ovaj lokalitet te su njegovi ostaci ovom prilikom detaljno snimljeni.

Sector Scanner i ROV su ove godine spušteni i na lokaciju potopljenog jedrenjaka nedaleko rta Kostur (Kostur - CR13-AA; Bekić, Šimičić 2013). Tamo je prošle godine, na dubini od 40-ak metara, ronjenjem pregledan ostatak drvenog broda, koji se do tada ukazivao kao potencijalna lokacija na batimetrijskoj karti Herculesa. I ove godine je loša vidljivost uvjetovana ispustom hidrocentrale narušila kvalitetu video snimaka ROV-a, ali je Sector Scanner uspio postići mnogo bolje slike.

Anomalija koju je zabilježio višesnopni sonar (Multibeam sonar) na poziciji u podmorju brda Križ (CR 14-AC) provjerena je Sector Scan sonarom i kamerama ROV-a. Zaključeno je kako se najvjerojatnije radi o potopljenom amfibijskom vozilu, vjerojatno iz Drugog svjetskog rata. Zanimljivo je da se na obližnjim pozicijama nalaze još dva slična plovila, desantni brodovi, pronađeni prije dvije godine (Royal, Bekić 2012).

Pozicija Rt Pelegrin A (CR14-AB) u prošlogodišnjoj je istraživačkoj kampanji evidentirana kao mogući brodolom. Spuštanjem Sector Scanner-a i ROV kamera u morske dubine, utvrđeno je kako se radi o novovjekovnom brodolomu koji leži na dubini od 70-ak metara. Na nažalost nisu uočeni predmeti koji bi ga datirali, ali su vidljiva drvena rebra nekadašnjeg trupa. Na isti način pregledan je i još niz drugih lokacija, koja su se isticala na batimetrijskoj karti, ali je uglavnom bila riječ o modernim ostacima kao što su dijelovi brodske

12. Martensen, Bekić and Hutchins clean the amphorae from the shipwreck at Rt Pelegrin B / Martensen, Bekić i Hutchins čiste amforu s brodoloma Rt Pelegrin B (photo: D. Perkić)

tions were examined in this manner that were identified on the bathymetric map, but these were for the most part modern remains such as parts of ship's equipment or geological phenomenon such as large rocks.

The most interesting, however, are the discoveries of two previously unknown Roman period shipwreck with cargoes of Lamboglia 2 and Dressel 6A type amphorae in the northwest part of the Župa Bay seafloor. Both are relatively close to Kupari, one near Cape Pelegrin (Pelegrin B), and the other near Cape Sveti Petar (Sv. Petar B).

The multibeam image of the Cape Pelegrin B position (Rt Pelegrin B) shows an agglomeration of rounded objects. This image intrigued the researchers and the sector scanner was deployed. The image acquired by the sector scanner did not resolve the doubts in interpreting this agglomeration, but it was quickly resolved by the deployment of the ROV. The ROV's video cameras showed numerous belly sections of Lamboglia 2 / Dressel 6A transition type amphorae covered by sand and silt and marine organisms. In order to undertake an analysis the ROV's mechanical arm was used to extract one complete

opreme ili geološkim pojavama poput velikog kamena.

No najzanimljivija su otkrića dvaju do sad nezabilježenih antičkih brodoloma sa teretom amfora Lamboglia 2 i Dressel 6A tipa u sjeverozapadnom dijelu podmorja Župskog zaljeva. Oba se nalaze razmjerno blizu Kupara, jedan u blizini rta Pelegrin (Pelegrin B), a drugi kod rta Sv. Petra (Sv. Petar B).

Multibeam snimka pozicije Rt Pelegrin B pokazivala je nakupinu zaobljenih predmeta. Ova je slika zaintrigirala istraživače stoga je na poziciju spušten Sector Scanner. Slika dobivena Sector Scannerom nije riješila nedoumice oko tumačenja ove nakupine, no to je brzo razriješeno spuštanjem ROV-a. Video kamere ROV-a pokazale su brojne trbuhe amfora prijelaznog tipa Lamboglia 2 / Dressel 6A prekrivene pijeskom i muljem i morskim organizmima. Kako bi se napravile analize, mehaničkim rukama ROV-a je s ovog novootkrivenog rimskog brodoloma izvučena jedna cijela i jedan ulomak vrata i oboda amfore Lamboglia 2 / Dressel 6A prijelaznog tipa.

Sector Scan snimka je i na poziciji Kupari - Sveti Petar B (CR13-AD) pokazivala nakupinu zaobljenih predmeta. Na poziciju je spušten ROV i njegove kamere su usprkos slaboj vidljivosti zabilježile veće i manje zaobljene predmete. Mehaničke ruke ROV-a bile su preslabe da razmaknu oblo kamenje

13. One of the amhora bellies protruding from the oval ballast stones at St. Peter B site / Jedan od trbuha amfora koji izviruje između oblog balastnog kamena na nalazištu Sv. Petar B (photo: ROV camera)

Lamboglia 2 / Dressel 6A transition type amphora and a rim and neck sherd from another.

At the Kupari - Sveti Petar B (CR13-AD) position the sector scan image also showed an agglomeration of rounded objects. The ROV was deployed at the position and its cameras recorded larger and smaller rounded objects in spite of the poor visibility. The mechanical arm of the ROV was too weak to move apart the rounded stones incrusted into a single large conglomerate. The quantity of sediment put the researchers in doubt as to whether this was just a large cluster of stones or something else.

A team of divers consisting of Luka Bekić, Mladen Pešić and Domagoj Perkić, accompanied by Marina Šimičić Mirko Maslać of the Župa Dubrovačka Diving Club, dove at the location a few days later with the objective of determining exactly what was being observed. The dive, which took them down over forty metres, established that this was in fact a shipwreck with a cargo of Lamboglia 2 type amphorae – the second such new discovery of the year. The view from the ROV was unclear because the amphorae were incrusted beneath a pile of rounded stones, likely the ship's ballast, and only their rounded belly sections were visible. Because the team could not stay at the bottom for long on account of the decompression procedure, they were unable to extract a single archaeological artefact. Therefore, with the objective of a more precise determination of the character and dating of this shipwreck, a team of divers will return here next year. By all accounts this ship sunk bel-

14. One of the amphorae at the Sv. Petar B site, entirely fused with its surroundings – to the left is the upper section and neck, to the right the belly of the amphora / Jedna od amfora na nalazištu Sv. Petar B, sasvim sraštena s okolinom - lijevo gornji dio s vratom i ručkom, desno trbuh amfore (photo: M. Pešić)

inkrustrirano u jedan veliki konglomerat. Količina sedimenta je istraživače stavila u nedoumicu radi li se o velikoj nakupini kamenja ili nečemu drugom.

Stoga je ronilačka ekipa, Luka Bekić, Mladen Pešić i Domagoj Perkić u pratnji Marine Šimičić i Mirka Maslaća iz ronilačkog kluba Župa dubrovačka nekoliko dana kasnije zaronila na tu lokaciju kako bi se točno utvrdilo o čemu je riječ. Po uronu na preko 40 metara, utvrđeno je kako se stvarno radi o brodolomu s teretom amfora Lamboglia 2 tipa, drugom novootkrivenom ove godine. Pregled ROV-om nije bio jasan jer se amfore nalaze inkrustrirane ispod hrpe oblog kamena, vjerojatno brodskog balasta, a vidljivi su im samo obli trbusi. S obzirom da se zbog dekompresijskih postupaka ekipa nije mogla duže zadržavati na dnu, nije se uspjelo odvojiti niti jedan arheološki predmet. Stoga će se zbog točnijeg

15. Ronilac uz kavez s amforama kod Cavtata / A diver alongside the cage with amphorae off Cavtat (photo: L. Bekić

ly-up and the ship's ballast of round stones wound up above the cargo of amphorae, which is a very rare situation.

In the frame of the research of the waters of Konavle and Župa Dubrovačka, ICUA Zadar staff, accompanied by divers of the Epidaurum Diving Club from Cavtat, toured a newly installed protective cage at the site of a shipwreck with late Roman amphorae. The dive determined that the new cage is in good condition, demonstrating the need to replace the other cages in the Adriatic Sea with this new, stronger model. The site was also imaged by the R/V Hercules sector scanner with the objective of the mapping of the seafloor.

The importance of these research efforts and the collaboration of Croatian and foreign researchers was demonstrated by the interest expressed by Deputy Culture Minister Berislav Šipuš who spent a working day with the research team aboard the R/V Hercules.

određivanja karaktera i datacije ovog brodoloma, ronilačka ekipa na njega vratiti iduće godine. Prema svemu sudeći, ovaj brod je potonuo naopako, te se tako brodski balast oblog kamena našao iznad tereta amfora, što je vrlo rijetka situacija.

U sklopu istraživanja podmorja Konavala i Župe dubrovačke djelatnici MCPA Zadar uz pratnju ronilaca ronilačkog kluba Epidaurum iz Cavtata obišli novopostavljeni zaštitni kavez na nalazištu brodoloma s kasnoantičkim amforama. Ovim je zaronom utvrđeno kako je novi kavez u dobrom stanju što pokazuje potrebu zamjene i ostalih kaveza na Jadranu ovim novim, čvršćim modelom. Lokalitet je u svrhu mapiranja podmorja snimljen i Sector Scanner-om Herculesa.

Značaj ovih istraživanja i suradnje hrvatskih i inozemnih istraživača potvrdio je svojim zanimanjem i zamjenik ministrice kulture prof. Berislav Šipuš, koji je s istraživačkom ekipom na R/V Herculesu proveo jedan radni dan.

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16. A part of this year's research team, from left / Dio ovogodišnje ekipe, s lijeva: Domagoj Perkić, Marina Šimičić, Mladen Pešić, Alex Van Reeven, Berislav Šipuš, Jeffrey Royal, Luka Bekić, Kelcy Martensen, Ily Iglesias, Cameron Hutchins (squats/čuči).

Three Shipwrecks at Cape Uljeva near Ližnjan

Tri brodoloma na rtu Uljeva kod Ližnjana

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The International Centre for Underwater Archaeology in Zadar conducted its third underwater archaeological research campaign at Cape Uljeva in the second half of September 2014. The remains of three shipwrecks are found close to one another at Cape Uljeva. The investigation of these shipwrecks also saw a survey of the surrounding area that falls under the protected zone. The research was conducted with the support of the Tourism Board of the Municipality of Ližnjan and the cultural heritage protection programme of the Croatian Ministry of Culture. An international school of underwater archaeology was held in the frame of the research under the aegis of the UNESCO Office in Venice.

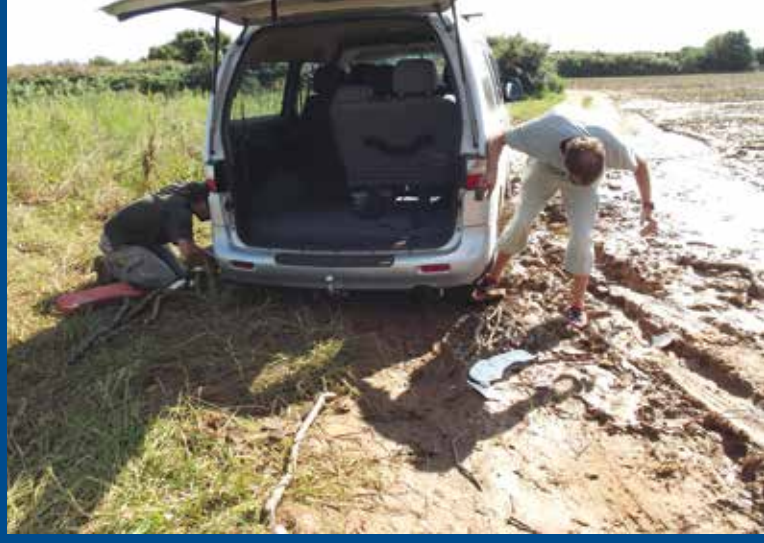
Serving as expert leader of the archaeological research campaign was Luka Bekić DSc, with deputy leader Mladen Pešić, both of the ICUA in Zadar. The other members of the expert team are archaeologists Marina Šimičić and Roko Surić of ICUA, Miran Erič of the Institute for the Protection of Cultural Heritage of Slovenia and course participants Jelena Čelebić, Zdravka Georgieva, Darko Kovačević, Nikola Paskali, Aleksandar Sajdl and Melanie Münzner. Joining the diving

2. Tables with drawings of the grids and pits are part of the basic gear for divers at Uljeva / Table s nacrtima mrežišta i jama su osnovni pribor ronilaca na Uljevi (photo: M. Šimičić)

1. The distribution of the mass of amphorae sherds at the seabed at Uljeva A / Raspored mase dijelova amfora na morskom dnu Uljeve A (photo: M. Pešić)

Međunarodni centar za podvodnu arheologiju u Zadru proveo je treću kampanju podvodnog arheološkog istraživanja na rtu Uljeva u drugoj polovini rujna 2014. g. Na rtu Uljeva se na maloj udaljenosti nalaze ostaci tri brodoloma. Uz istraživanja na ovim brodolomima, pregledavano je i okolno područje koje spada u zonu zaštite. Istraživanja su provedena uz pomoć Turističke zajednice Općine Ližnjan i programa zaštite kulturne baštine Ministarstva kulture RH. U sklopu istraživanja je organizirana i međunarodna škola podvodne arheologije pod pokroviteljstvom UNESCO-vog ureda u Veneciji.

Stručni voditelj arheološkog istraživanja bio je dr. sc. Luka Bekić, a njegov zamjenik Mladen Pešić, oboje iz MCPA u Zadru. Ostatak stručne ekipe činili su arheolozi Marina Šimičić i Roko Surić iz MCPA, Miran Erič iz Zavoda za varstvo kulturne dediščine Republike Slovenije te polaznici tečaja Jelena Čelebić, Zdravka Georgieva, Darko Kovačević, Nikola Paskali, Aleksandar Sajdl i Melanie Münzner. Uz ronilačku



3. The van transporting ICUA equipment gets stuck in mud / Kombi s opremom MCPA je zapeo u blatu (photo: M. Šimičić)

team in the research effort was a multibeam echosounder sonar imaging team under the leadership of archaeologist Sašo Poglajen of Harpha Sea from Slovenia.

The remains of three shipwrecks are situated on shallow submarine rocks facing Cape Uljeva, which shut off the entrance to the left to the broad Kuje Cove at Ližnjan (Bekić 2012a, 2013). Uljeva A are the remains of a shipwreck situated on the northwest section of the rocks, while Uljeva C is situated some fifty metres to the southwest of it. About one hundred fifty metres to the southeast, at the southern end of the rocks, are the remains of shipwreck Uljeva B.

The terrain is composed of a large submarine rock extending to a length in excess of 200 metres along the shore and with a width of over fifty metres from the shore on which smaller rocks alternate at depths of from 5 to 0.5 metres. It was this that was fatal for the ships that ran aground here. It is very likely that this occurred when a strong bora wind was blowing, preventing mariners from properly manoeuvring their vessel to Kuje Cove where they might have found a safe haven. The wind and waves threw them against the rocks to the left side of the entrance to the cove. It is likely that the ships fell apart here, battered by waves, with the cargo strewn among the crevices of the rocky submarine terrain. It is here, among these sand-filled pits, that we now find sherds from amphorae and other pottery. Because of the rocky terrain we do not expect to find the wooden hull of the vessel, but it is not impossible that smaller sections of the ship's beam or plating could be found in some of the deeper pits. Individual bronze and iron spikes have already been found at the positions of both of the larger shipwrecks, bearing witness to the remains of the ships' structures.
The objective of the research is to collect as much data as possible that might shed light on the history of these ships and to collect important artefacts and thus save them from looting and devastation. In terms of methodology, with this objective in mind, it was decided that all of the pits in the submarine terrain in which there were finds would be excavated and the finds brought to the surface. On board our boat we documented the finds, counted and weighed them and selected typologically significant artefacts for removal and further study. All the rest, which refers primarily to the mass of amphora belly sections, are restored to the

ekipu na istraživanjima je sudjelovao i tim za snimanje višesnopnim sonarom pod vodstvom arheologa Saše Poglajena iz Harpha Sea, Slovenija.

Ostaci čak tri brodoloma smješteni su na plitkim hridinama ispred rta Uljeva, koji s lijeve strane zatvara ulaz u prostranu uvalu Kuje kod Ližnjana (Bekić 2012a, 2013). Uljeva A su ostaci brodoloma smješteni na sjeverozapadnom dijelu hridina, dok je Uljeva C smješten pedesetak metara jugozapadnije od njega. Oko 150 metara jugoistočnije, na južnom završetku hridinastog terena, nalaze se ostaci brodoloma Uljeva B.

Teren je velika podvodna hrid dužine preko 200 metara uzduž obale i širine preko 50 metara od obale, na kojoj se manje stijene izmjenjuju od dubine 5 do 0,5 metara. Upravo ta okolnost bila je kobna za brodove koji su se tu nasukavali. Vrlo vjerojatno se to događalo kada je bila jaka bura, koja je spriječila moreplovce da pravilno izmanevriraju brod prema uvali Kuje, gdje su mogli naći spas, nego su ih vjetar i valovi odnijeli na stijene s lijeve strane ulaza u uvalu. Brodovi su se tu od udaranja valova vrlo vjerojatno raspali, a teret se rasuo po škrapama hridinastog tla. Upravo tu, u jamama napunjenim pijeskom, danas pronalazimo ulomke amfora i ostale keramike. Zbog kamenitog tla, ne očekuju se nalazi drvenog brodskog trupa, ali nije isključeno da će se manji dijelovi brodskih greda ili oplate pronaći u ponekim dubljim jamama. Već su na pozicijama oba veća brodoloma pronađeni pojedini brončani i željezni klinovi koji svjedoče o ostacima konstrukcije broda.

Cilj istraživanja je prikupiti čim više podataka koji mogu otkriti povijest ovih brodoloma, a ujedno prikupiti važnije predmete i na taj način ih spasiti od krađe i devastacije. Metodološki gledano, da bi se taj cilj postigao, odlučeno je iskopavati sve jame u podmorskom terenu u kojima ima nalaza i njih sve izvući na brod. Na brodu se vrši dokumentiranje nalaza, prebrojavanjem i vaganjem svih prikupljenih nalaza te odabirom tipološki

same pits from which they were extracted. In this manner we do not impact the integrity of the site, i.e. it will remain visually as it was found. The large number of sherds on the seabed, namely, makes diving at this position interesting and attractive.

A fixed grid was placed on the seabed in the form of numbered spikes with the aim of documenting the finds in a spatial reference. This grid was measured several times and entered into the Site Recorder software application used to document underwater archaeological research. Based on the grid the pits are subsequently drawn in and numbered, like stratigraphic units on land. In this manner each artefact found is attributed to one of the pits, the exact position of which is known within the shipwreck. We feel that the final mapping will offer us a template from which we will be able to drawn more conclusions on the size of the ships and the manner in which they broke up here.

This year September was unfavourable in terms of meteorological conditions, as was the entire summer. On several occasions storm precipitation was of such intensity that Kuje Cove was rendered murky from soil runoff making it impossible to work at Uljeva – a situation we have not observed in the five years since we began archaeological research at this position. As a result the number of excavations, i.e. the number of pits investigated, is less than in

značajnijih ulomaka i predmeta koji se uzimaju za daljnje proučavanje. Sve ostalo, a pritom se misli uglavnom na masu dijelova trbuha amfora, se vraća u iste jame u kojima je pronađeno. Na taj način se ne mijenja integritet nalazišta, odnosno on će vizualno ostati onakav kakav je i zatečen. Naime, velik broj ovih ulomaka na morskom dnu čini ronjenje na ovom položaju zanimljivim i atraktivnim.

Kako bi se nalazi dokumentirali u prostoru, pod morem je postavljena fiksna mreža u vidu klinova s brojevima. Ovo mrežište je nekoliko puta izmjereno i postavljeno kao osnova u kompjuterski program Site recorder, koji se koristi za dokumentiranje podvodnih arheoloških istraživanja. Na osnovu tog mrežišta, naknadno se ucrtavaju jame, koje dobivaju svoj broj, poput stratigrafskih jedinica na kopnu. Na taj način je svaki pronađeni predmet pripisan nekoj od jama, kojoj se zna točan položaj unutar pozicije brodoloma. Smatramo da će nam konačno mapiranje nalaza dati neki obrazac, po kojem ćemo moći zaključiti nešto više o veličini brodova i načinu na koji se on ovdje raspao.

Ove godine je rujan bio meteorološki nepovoljan, uostalom kao i cijelo ljeto. U nekoliko navrata je nevrijeme donijelo takvu kišu, da se uvala Kuje zamutila od nanesene zemlje na taj način da na Uljevi nije bilo zadovoljavajuće vidljivosti za rad, što je situacija koju nismo zamijetili u posljednjih 5 godina otkada arheološki istražujemo ovu poziciju. Stoga su i rezultati iskopavanja, odnosno broj istraženih jama, manji nego u prošle dvije godine.

4. The ICUA team set up the research equipment at the tip of the cape / Ekipa MCPA složila je opremu za istraživanje na vrhu rta (photo: Canon Powershot G15)

5. The Harpha Sea team spent the entire day imaging the Uljeva seabed with sonar / Ekipa Harpha Sea cijeli dan je sonarom snimala podmorje Uljeve (photo: M. Šimičić)

the past two years. Besides the rainy days and the murky sea, there were a number of spells of the strong bora wind that made the site inaccessible from the outer sea side and the already cited rain made access along all routes towards the cape inaccessible due to mud.

In order to have the research proceed at a better tempo we took a new approach by having the team debark on the cape to the inner side the shipwreck and transport the pump and all equipment through the shallows and on foot over the tip of the cape to a position closest to the shore, this being the Uljeva C site. The water pump was placed here on the rocks beside the sea and the piping and dredgers extended to the site to a length of almost eighty metres, which is the maximum reach of our equipment. Thus we began trenching at this site this year, the only site that can be investigated with the aid of water pump from the onshore side of Uljeva. The results of the research of the Uljeva C shipwreck proved to be worthy of future investigation and we can say that these clouds did have a silver lining.

The few days of good weather were, of course, used for some other very important activities. This year we worked out the

Uz kišne dane i mutno more, bilo je i nekoliko jačih bura, koje nam nisu dozvolile pristup nalazištu s vanjske morske strane, a već spomenute kiše učinile su sve staze prema rtu neprohodnim zbog blata.

Kako bi se istraživanja ipak odvijala nekim tempom, pristupili smo novoj strategiji, tako da se ekipa iskrcala na rt s unutrašnje strane brodom i prenijela pumpu i svu opremu kroz plićak i pješke preko vrha rta do pozicije koja je najbliža obali, a to je Uljeva C. Ovdje na hridima uz more postavljena je vodena pumpa, a crijeva i mamuti su provučeni do nalazišta u dužini od gotovo 80 metara što je krajnji doseg naše opreme. Tako su ove

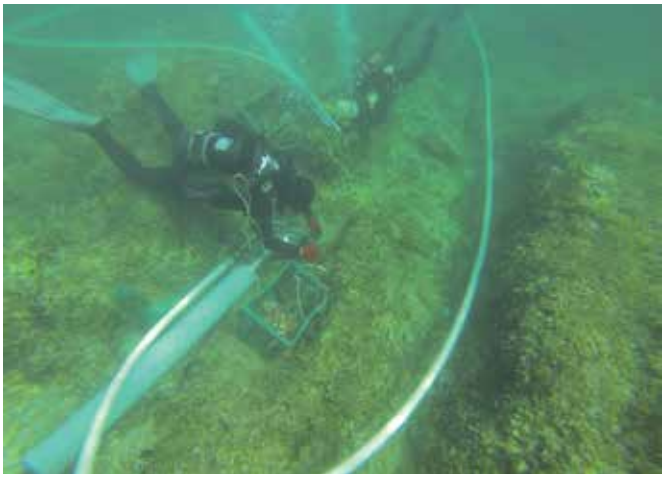
6. A bathymetric map of the seabed of the rock at Uljeva created by Harpha Sea / Batimetrijska karta morskog dna hridi kod Uljeve izrađena od Harpha Sea.

detail of measurement with multibeam sonar with the objective of creating a precise bathymetric map of the entire submarine rock along Cape Uljeva. The experienced Slovenia company Harpha Sea has been hired for the job as it has equipment for bathymetric surveying in shallow waters, as shallow as 0.6 metres. Their experience in mapping all Slovenian underwater archaeological sites was also of inestimable value. The boat-mounted sonar, controlled by the crew, took readings at points every ten centimetres on the seabed. The final result of this imaging is a detailed map of the site of such excellent resolution that it shows practically even the smallest pit and crevice on the bottom. This map will now serve for the creation of a new map of the site and the indication of every individual pit and individual find as required. Its digital form is suitable for the creation of the most diverse depictions of the distribution of finds and the site in multicolour 3D display. The final results of the research will thus be entirely clear and legible and also be located within a system of absolute coordinates, as will the map itself. Thus the successful creation of a bathymetric map of the site will assist us in working more effectively in coming years and, in the final tally, to present the site in the best possible manner, perhaps the greatest achievement of this year's campaign.

Many more small finds were collected this year from the Uljeva A shipwreck than from Uljeva B. Predominant at both sites are potsherds. At the Uljeva C shipwreck we find numerous bricks for which it is not certain whether they were the ship's ballast or cargo. In any event the ship also transported quite a bit of diverse pottery and glass, although it is not clear at this stage of the investigation whether this was the cargo or part of the ship's galley equipment.

At Uljeva A we continued this year with excavation of pits at the centre of the site. Eight were investigated in total, yielding

8. Excavations at Uljeva A / Iskopavanja na uljevi A (photo: L. Bekić)



godine započeta i sondiranja ovog nalazišta, jedinog kojeg je moguće istraživati vodenom pumpom s kopnene strane Uljeve. Rezultati istraživanja brodoloma Uljeva C pokazali su se vrijednim budućeg istraživanja, pa možemo reći kako je to bila sreća u nesreći.

7. Some of the finds of Uljeva A / Neki nalazi s Uljeve A (photo: M. Šimičić)

Ipak, rijetki mirniji dani dobro su iskorišteni i za neke druge vrlo važne aktivnosti. Tako su ove godine dogovorena detaljna mjerenja višesnopnim sonarom (multibeam) u cilju izrade precizne batimetrijske karte cijele hridi uz rt Uljeva. Za te potrebe je angažirana iskusna slovenska tvrtka Harpha Sea, koja ima opremu za vršenje batimetrijskih mjerenja u plitkom moru, do dubine od čak 0,6 metara. Ujedno, njihovo iskustvo u mapiranju svih slovenskih podvodnih arheoloških nalazišta bilo je od neprocjenjive vrijednosti.

Sonar montiran na brodu i kontroliran od strane posade, očitavao je točke svakih deset centimetara na dnu. Konačni rezultat ovog snimanja je detaljna karta nalazišta, koje je tako dobre rezolucije, da se na njoj vide gotovo i najmanje jame i procijepi u dnu. Ovakva karta će sada poslužiti za izradu nove mape nalazišta i označavanje svih pojedinih jama i pojedinačnih nalaza prema potrebi. Njen digitalni oblik pogodan je za izradu najrazličitijih prikaza rasporeda nalaza i nalazišta, u višebojnom 3D prikazu. Konačni rezultati istraživanja na taj način će biti u potpunosti jasni i čitljivi, a ujedno biti smješteni u apsolutnom koordinatnom sustavu, kao i sama karta. Tako je uspješna izrada batimetrijske karte nalazišta, koja će pomoći da narednih godina efektivnije radimo, a u konačnici i da prezentiramo nalazište na najbolji način, možda najveće postignuće u ovogodišnjoj kampanji.

Od pokretnih nalaza ove godine je skupljeno mnogo više s brodoloma Uljeva A nego s Uljeve B. Na oba nalazišta prevladavaju ulomci keramike. Na brodolomu Uljeva C pronalaze se brojne opeke, za koje nije sigurno da li su predstavljale brodski balast ili teret. U svakom slučaju na brodu se prevozilo i dosta različite keramike te stakla, ali na ovom stupnju istraživanja nije jasno da li je to bio teret ili brodska kuhinjska oprema.

finds of sherds from amphorae, parts of necks, feet and handles. Among the special finds we see several well preserved amphorae plugs. Along with the amphorae an important find is the base of a cooking pot. These pits were registered in the Site Recorder map last year, so that there was no need to measure and draw them in this year. Twelve pits have been excavated at Uljeva A so far, in which we found a total of 717 kilograms of finds that have been raised to the boat. Of this we recorded 1,730 sherds from amphorae of which fifteen spikes, fifteen plugs, fifty-one handle sections and twenty-two rim sections. Along with these there are numerous other finds of individual forms of the ship's galley pottery and glass.

Only two pits have been entirely excavated at Uljeva B. Various sections of amphorae were found in pit BJ 28; in pit BJ 28 for the most part numerous sections of Aegean Coarse Ware, i.e. Aegean cooking ware, of which some sherds are exceptionally well preserved considering the finds we otherwise find here. The new pits were measured and entered into the Site Recorder map. At Uljeva B a total of twenty-three pits were investigated in which we gathered over 180 kilograms of finds. Among the amphorae sherds we isolated thirty-two spikes, three plugs, fifty-one handle sections and forty-eight rim sections. Other finds include six spikes, six ballast stones and three glass fragments. Two pits were excavated at Uljeva C. Pit CJ 1 is a sandy space between higher ridges to the west, lower rock partitions to the east and rock to the north that separate it from CJ 2. The space of CJ 2 is similarly bordered and is somewhat larger than CJ 1. Both pits yielded very fragmented potsherds, often with glazed walls and numerous fragments of various glass ware and two iron spikes or couplings. Bricks of coarse manufacture were not collected, with the exception of a few samples, as they were evidently used as the ship's ballast.

9. Excavations at Uljeva C / Iskopavanje na Uljevi C (photo: L. Bekić)

Na Uljevi A se ove godino nastavilo s iskopavanjem jama u središnjem dijelu nalazišta. Istraženo ih je ukupno osam, a u njima su pronađeni ulomci amfora, dijelovi grla, dna i ručaka. Od posebnih nalaza bilježimo nekoliko dobro sačuvanih čepova amfore. Osim amfora važan je i pronalazak dna lonca za kuhanje. Ove jame bile su ucrtane u nacrt Site recordera još prošle godine, tako da ih nije bilo potrebno mjeriti i ucrtavati ove godine. Na Uljevi A je dosada iskopano 12 jama u kojima se nalazilo sveukupno 717 kilograma nalaza, koji su izvađeni na brod. Od toga je zabilježeno 1730 ulomaka amfora od kojih 15 šiljaka, 15 čepova, 51 dio ručke, 22 dijela oboda. Uz njih tu su i brojni drugi nalazi pojedinačnih oblika posuđa brodske kuhinjske keramike i stakla.

Na Uljevi B su u potpunosti iskopane samo dvije jame. U jami BJ27 pronađeno je raznih dijelova amfora, a u jami BJ 28 uglavnom brojni dijelovi Aegean Coarse Ware, odnosno egejskog kuhinjskog posuđa, od kojih su neki ulomci izvanredno dobro sačuvani, s obzirom na nalaze koje inače ovdje nalazimo. Nove jame su izmjerene i ubačene u plan na Site recorderu. Na Uljevi B je pregledano sveukupno 23 jame u kojima je prikupljeno preko 180 kilograma nalaza. Među ulomcima amfora izdvojeno je 32 šiljka, 3 čepa, 51 dijela ručke i 48 dijelova oboda. Od ostalih nalaza to je 6 klinova, 6 balastnih kamenova i 3 ulomka stakla.

Na Uljevi C iskopane su dvije jame. Jama CJ 1 je pješčani prostor između viših litica na zapadu, niže kamene pregrade na istoku i kamena na sjeveru koji ga dijeli od CJ 2. Prostor CJ 2 je slično omeđen i nešto je veći od CJ 1. U obje jame pronađeni su sitniji ulomci keramike, koja često ima cakljene stijenke te brojni ulomci različitih staklenih posuda te dva željezna klina ili spojnice. Opeke grube izrade nisu prikupljene, osim par uzoraka, jer su one očito korištene kao brodski balast.

Sustavna arheološka istraživanja brodoloma na rtu Uljeva su i prilika za održavanje Naprednog tečaja podvodne arheologije, koji se na ovom mjestu održao već treći puta. Tečaj se organizira prema programu MCPA Zadar uz podršku UNESCO-vog ureda u Veneciji, a cilj mu je osposobiti mlade podvodne arheologe za samostalan rad u svojim zemljama. Kao i prošlih godina, na teoretskim predavanjima i praktičnim terenskim vježbama i ove godine je sudjelovalo 7 arheologa. Oni su imali priliku unaprijediti svoje znanje novim tehnikama i testirati svoje vještine praktičnim radom u zahtjevnom projektu. Ližnjan je očito vrlo povoljno okruženje za takve programe, jer su sedmorica polaznika pokazala izuzetnu spremnost za suočavanje sa svim zadacima koji su pred njih postavljeni.

10. Diving at the remains of the Roman shipwreck at Sika rock near Ližnjan / Sl. Ronjenje na ostacima antičkog brodoloma na hridi Sika kod Ližnjana (photo: L. Bekić)

Systematic archaeological research of the shipwrecks at Cape Uljeva is also an opportunity to stage the Advanced underwater archaeology course that has already been held here on three occasions. The course is organised according to the programme of ICUA Zadar and with the support of the UNESCO Office in Venice and has as its objective to train young underwater archaeologists for independent work in their respective countries. As in years past, seven archaeologists took part in the theoretical lectures and hands-on field exercises. They had an opportunity to improve their knowledge with new techniques and test their skills during practical work on a demanding project. Ližnjan is clearly a very suitable setting for programmes like this one, as the seven participants demonstrated exceptional readiness to face the assignments put to them.

Besides the research at the Uljeva rock, the team of archaeologists on two occasions undertook an archaeological survey of the shipwreck on the Sika rock near Ližnjan. This shipwreck was discovered a few years ago, but has never been researched. The objective of this submarine survey was to determine whether there was a need and potential to research this shipwreck and to collect data on its condition and the dispersion of finds on the seabed.

To the south side of Sika rock are the remains of the cargo of a ship that transported amphorae of the Dressel 6B type and

11. Some of the finds from Sika rock near Ližnjan / Neki nalazi s hridi Sika kod Ližnjana (photo: M. Šimičić)

Uz istraživanja na hridi Uljeva, arheološka ekipa je u dva navrata rekognoscirala položaj antičkog brodoloma na hridi Sika blizu Ližnjana. Ovaj brodolom je otkriven još prije nekoliko godina, ali nikada nije bio istraživan. Cilj ovih podmorskih pregleda je ustanoviti postoji li potreba i potencijal za istraživanje ovog brodoloma te prikupljanje podataka o njegovom stanju i disperziji nalaza na dnu.

Na hridi Sika se na južnoj strani nalaze ostaci tereta broda koji je prevozio amfore tipa Dressel 6B te tzv. Spicatum opeke. Amfore su u momentu brodoloma očito bile pune, jer se pronalazi i mnoštvo keramičkih čepova. Zbog velike izloženosti valovima juga, nalazište je jako oštećeno i nalazi razbacani po širem prostoru. Neki nalazi s ovog brodoloma već su objavljeni (Bekić 2012b).

Prilikom pretraživanja Kuja i Uljeve korišten je i Side scan sonar od MCPA, pa je njime pronađen moderan ribarski brod, koča, potopljen kod Kargadura. Ujedno je i ponovno otkriven položaj aluminijskog krila zrakoplova JNA koji se navodno srušio u

spicatum type bricks. The amphorae were clearly full at the moment of the shipwreck as we also find an abundance of ceramic plugs. The high level of exposure to waves created by the jugo wind has cause extensive damage to the site and the finds are strewn across a broad area. Some of the finds from this shipwreck have already been published (Bekić 2012b).

ICUA employed side scan sonar during the examination of Kuje and Uljeva, which allowed us to discover a modern fishing vessel, a trawler that sank at Kargadur. We also again identified the position of the aluminium wing of a Yugoslav People's Army (JNA) aircraft that allegedly fell at Kuje in the 1980s. Photographic documentation was made back in 2009 in a meadow of Neptune grass, but its precise position had not to date been recorded.

All three of the shipwrecks at Uljeva are significantly destroyed as a result of the circumstances in which they came to grief and as a result of devastation due to the accessibility of the site, but it does, nevertheless, constitute valuable source of data to archaeological science. For now we have an outline of the dating of all three ships, and some idea of the origin of the cargo. To have an overview of the entire history of these events, however, research will have to be continued.

It is important, therefore, that the shipwrecks be fully researched and remain in situ in another fashion so that they might potentially be used as a tourism attraction in Ližnjan. That is precisely why all of the amphorae sherds not required for dating and characterising the shipwreck are restored to the pits in which they were found. By the end of the project we hope that we will help the Municipality of Ližnjan come up with a way to popularise the cultural heritage of this important maritime position.

Kuje osamdesetih godina. Njega smo fotodokumentirali još 2009. g. u polju posidonije, ali točna pozicija mu dosada nije bila zabilježena.

Sva tri brodoloma na Uljevi jesu značajno uništeni zbog okolnosti stradavanja, kao i zbog devastacije zbog dostupnosti nalazišta, međutim ipak predstavljaju dragocjen izvor podataka za arheološku znanost. Za sada već imamo obrise datacije sva tri broda, pa donekle i ideju o porijeklu tereta. Ipak, za sagledavanje cijele povijesti ovih događaja biti će potrebno nastaviti s istraživanjima.

Stoga je važno da se brodolomi istraže u cijelosti, a na drugi način ostanu "in situ" kako bi se potencijalno iskoristili kao turistička atrakcija u Ližnjanu. Upravo stoga se svi ulomci amfora koji nisu nužno potrebni za dataciju i karakter brodoloma, vraćaju u jame na kojima su se nalazili. Na kraju projekta nadamo se kako ćemo Općini Ližnjan pomoći da osmisli način popularizacije kulturne baštine ovog važnog pomorskog punkta.

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12. The Uljeva 2014 team (left to right) / Sl. Ekipa Uljeva 2014 (s lijeva): Nikola Paskali, Darko Kovačević, Miran Erič, Aleksandar Sajdl, Melanie Münzner, Luka Bekić, Roko Surić, Jelena Čelebić, Marina Šimičić, Zdravka Georgieva, Valentina Todoroska, Mladen Pešić (photo: N. Lazarević)

New Research of the Roman Shipwreck at the Islet of Babuljaš

Nova istraživanja antičkog brodoloma kod otočića Babuljaša

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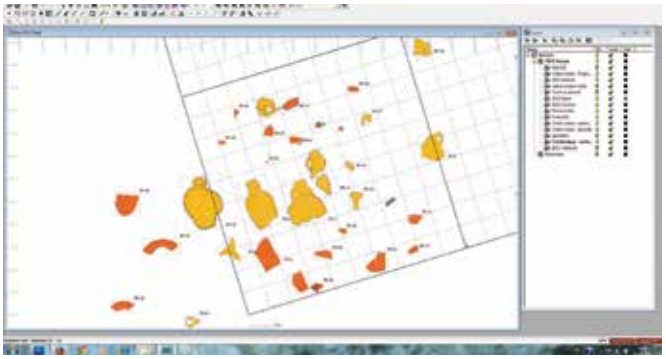
The second underwater archaeological research campaign of the Roman shipwreck off the islet of Babuljaš was conducted in May of 2014. After an initial archaeological survey of the terrain (Pešić, Meštrov 2012) and archaeological excavations (Pešić 2013), research of this interesting shipwreck in the waters of Pakoštane continued this year. As in previous years, the research effort was financed by the Tourism Board of the Municipality of Pakoštane, with the archaeological research conducted by the International Centre for Underwater Archaeology in Zadar in collaboration with the Han-Vrana Agency. Serving as campaign leader was Mladen Pešić, with deputy campaign leader Luka Bekić DSc, joined by a team of experts consisting of Anita Jelić, Marina Šimičić, Roko Surić and Marko Meštrov. The international component of the expert archaeological team consisted of Roman Scholz and Antje Fischer (Germany), Nemanja Čavlović (Montenegro) and Elizabeth (Lisa) Briggs (USA).

The research was conducted this year over a surface area of twenty square metres, rounding out the area researched over two years at six by six metres. The trenches are concentrated in one spot and the method of documentation initiated last year was continued this year. All separate finds were measured from fixed points and a map was made of the site and the distribution of the finds within a grid frame. The final map is created in the Site Recorder software application, which allows us to have a detailed view of the distribution of finds and offers the possibility of various views of finds based on typological characteristics. Finally, this method offers data on the distribution of finds within the shipwreck and allows us to determine the orientation of the ship and a number of other data on the organisation of the ship's cargo and equipment.

It was already determined last year that the bulk of the cargo transported by the ship off Babuljaš consisted of

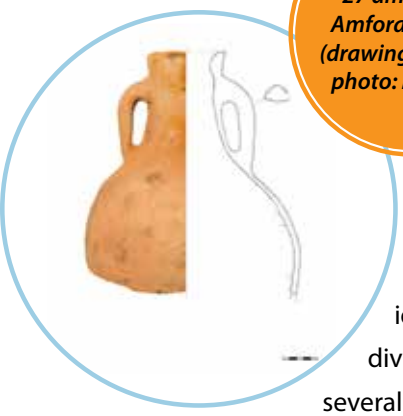
1. Final planning ahead of a dive / Posljednji dogovori prije ronjenja (photo: M. Pešić)

Druga arheološka kampanja podvodnih istraživanja antičkog brodoloma kod otočića Babuljaša obavljena je tijekom mjeseca svibnja 2014. g. Nakon početnih rekognosciranja terena (Pešić, Meštrov 2012), i arheoloških iskopavanja (Pešić 2013) ove je godine nastavljeno istraživanja zanimljivog brodoloma u Pakoštanskom podmorju. Kao i dosadašnjih godina, istraživanja je financirala Turistička zajednica općine Pakoštane, a arheološka istraživanja proveo je Međunarodni centar za podvodnu arheologiju u Zadru u suradnji sa javnom ustanovom Han-Vrana. Voditelj istraživanja bio je Mladen Pešić, zamjenik voditelja dr.sc. Luka Bekić, a s njima su kao stručni dio ekipe u istraživanju sudjelovali Anita Jelić, Marina Šimičić, Roko Surić i Marko Meštrov. Međunarodni dio stručne arheološke ekipe su činili Roman Scholz i Antje Fischer (Njemačka), Nemanja Čavlović (Crna Gora) i Elizabeth (Lisa) Briggs (S.A.D.).



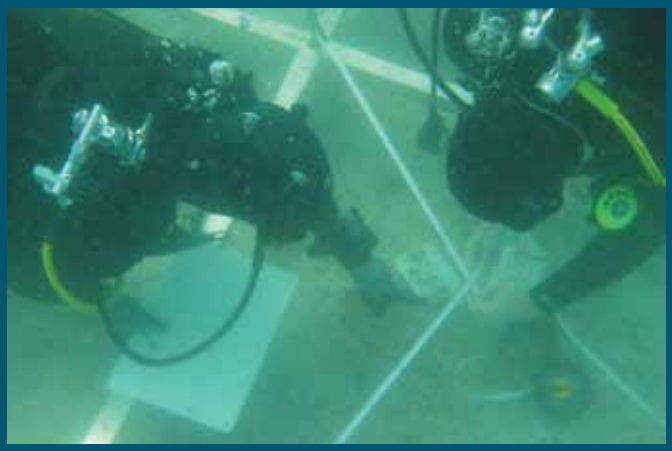
2. A part of the site as seen in the Site Recorder / Prikaz dijela nalazišta u Site Recorderu (photo: M. Pešić)

North African amphorae of various types. The most numerous were amphorae of the Keay XXV type that appear on four versions – also of North African provenance are amphorae of the Keay XXVII and XXXVB type (Keay 1984). Most of these amphorae were used for the transport of oil and wine, but there are indications that the XXXVB type was used for the transport of fish sauces – a much-valued foodstuff in the Roman world (Bonifay 2004, 135). Other types of amphorae were also discovered during this year's research campaign that have not yet been typologically identified. The most interesting is an amphora with broad handles bearing strap-like grooves, with a neck decorated with a series of horizontal and wavy incisions. Based on typological characteristics its origin could be in the eastern Mediterranean area and – given that it was the sole specimen at the shipwreck site – we cannot say whether it was, like the North African amphorae, a part of the cargo.



4. A Keay 27 amphora / Amfora Keay 27 (drawing: L. Bekić; photo: M. Pešić)

Along with the amphorae, which the ship off Babuljaš transported as its primary cargo, the secondary cargo includes an entire range of coarse and fine ware originating from various parts of North Africa. We can divide the coarse ware into several basic types according to Hayes – 181, 197, 182 and 196 – and all of the types can be placed by time of manufacture in the late 4th and early 5th century (Hayes 1972). For the most part these are vessels of large dimensions that served for the preparation of food, and we find a large number of lids that were used to cover these vessels.



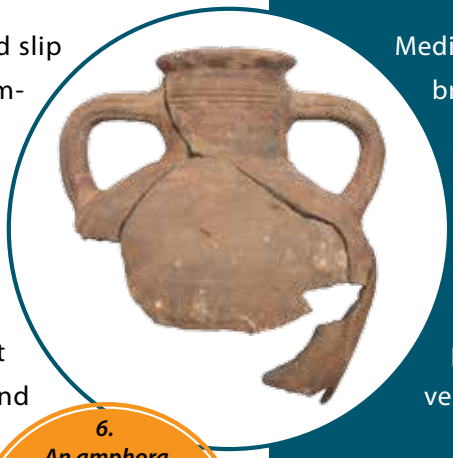
3. Each separate find is measured out in detail / Svaki posebni nalaz detaljno je izmjeren (photo: M. Šimičić)

Istraživanja su ove godine provedena na površini od 20 m2, čime se tijekom dvije godine zaokružila površina istraženog područja na 6x6 metara. Sonde su koncentrirane na jednom mjestu, a način dokumentacije koji je započet prošle godine je nastavljen i ove. Svi posebni nalazi su izmjereni od fiksnih točaka, te je napravljen plan nalazišta i raspored nalaza unutar kvadratne mreže. Završni plan se izrađuje u programu Site Recorder, koji omogućuje uvid u detaljan raspored nalaza, a daje i mogućnost različitih pregleda nalaza prema tipološkim karakteristikama. U konačnici se na ovaj način dobivaju podatci o rasporedu nalaza unutar brodoloma, moći će se odrediti orijentacija broda, a dobit će se i niz drugih podataka o organizaciji brodskog tereta i opreme.

Već je prošle godine ustanovljeno da je glavnina tereta koji je brod s Babuljaša prenosio bila sastavljena od sjevernoafričkih amfora različitih tipova. Najbrojnije su amfore tipa Keay XXV koje se javljaju u četiri inačice, a osim njih sjevernoafričkoj provenijenciji pripadaju i tipovi Keay XXVII i XXXVB (Keay 1984). Većina ovih amfora koristila se za prijevoz ulja i vina, ali postoje naznake da se tip XXXVB koristio i za prijevoz ribljih umaka, koji su bili dragocjena namirnica u rimskom svijetu (Bonifay 2004, 135). Tijekom ovogodišnjih istraživanja otkriveni su i novi tipovi amfora koje su još uvijek tipološki neodređene. Najzanimljivija je amfora sa širokim ručkama i trakastim utorima na njima, te vratom koji je ukrašen nizom horizontalnih i valovitih ureza. Prema tipološkim karakteristikama bi njeno porijeklo moglo biti na prostoru istočnog

5. 4. A Keay 25 amphora / Amfora Keay 25 (drawing: L. Bekić; photo: M. Pešić)

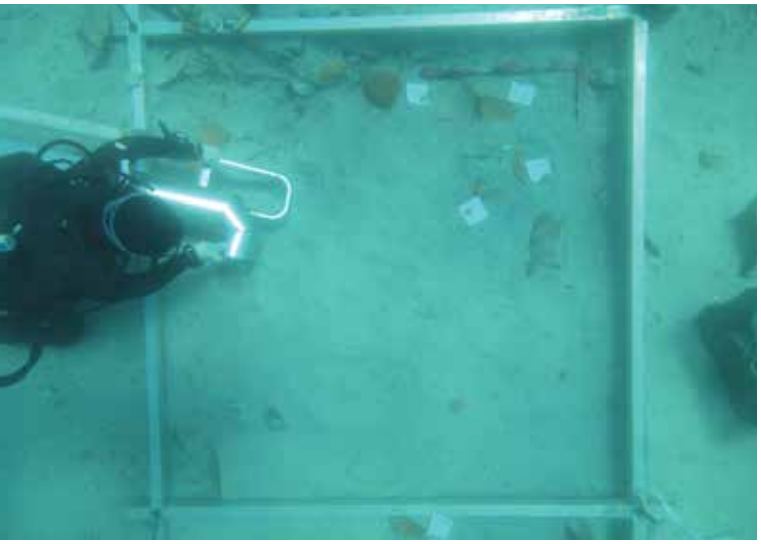
The greatest number of African red slip ware or terra sigillata chiara ceramic finds are fine pottery of orange colour with a slip of the same colour. This type of ware belongs to the category of luxury ware and, at this site, the majority of this ceramic ware is of the Hayes 50B type that is dated to the period of the 4th and 5th centuries. After a luxurious small bowl was found last year with a depiction of a leopard and a lion, we were fortunate enough again this year to find another specimen of a small bowl of the same type, but in a better state of preservation with a very nice depiction. On the small bowl we recognise the depiction in relief of the figure of a shepherd with Phrygian cap dressed in a tunic carrying a ram over his shoulder with another ram standing next to him. This depiction may be characterised as being of the Good Shepherd, which is in fact a personification of Christ. The small bowl belongs to the Hayes 53A type, which is dated to the period from 350 to 430 (Hayes 1972, 78-82).



6. An amphora with horizontal and wavy decoration / Amfora s horizontalnim i valovitim ukrasom (photo: M. Pešić)

The remains of the ship's wooden structure have yet to be found, but because of the breadth of the site there is a possibility that it will be discovered in further research efforts. Certainly telling in favour of the existence of the ship's structure in this area is the find of lead plating of small dimensions and bronze and iron nails. Bronze nails appear in two variants – all are of square cross-section and

7. Excavation and find documentation / Iskopavanja i dokumentacija nalaza (photo: M. Pešić)



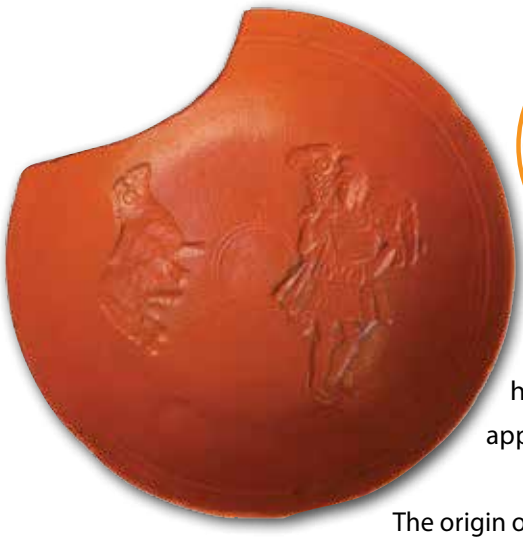
Mediterana, a budući da je to jedini primjerak s brodoloma, ne možemo reći da li je ona, kao i sjevernoafričke amfore, bila dio tereta.

Uz amfore, koje je brod s Babuljaša prevozio kao primarni teret, kao sekundarni teret nalazimo čitavu paletu grubog i finog posuđa porijeklom iz različitih dijelova sjeverne Afrike.

Grubo posuđe možemo razdijeliti u nekoliko osnovnih tipova po Hayes-u - 181, 197, 182, 196, a svi tipovi se prema vremenu proizvodnje mogu smjestiti u kraj 4. i početak 5. st. (Hayes 1972). Uglavnom se radi o zdjelama većih dimenzija koje su služile za pripremu hrane, a nalazimo i veći broj poklopaca koji je služio za pokrivanje istih.

Najveći broj keramičkih nalaza koje se naziva African red slip ware, ili terra sigillata chiara, predstavlja finu keramiku narančaste boje s premazom u istoj nijansi. Ovakav tip posuđa

8. The find of a bowl with depiction in relief / Pronalazak zdjele s reljefnim ukrasom (photo: L. Bekić)



9. A bowl with depiction in relief / Zdjela s reljefnim prikazima (photo: M. Pešić)

some have a broad, calotte-shaped head, while some appear without heads.

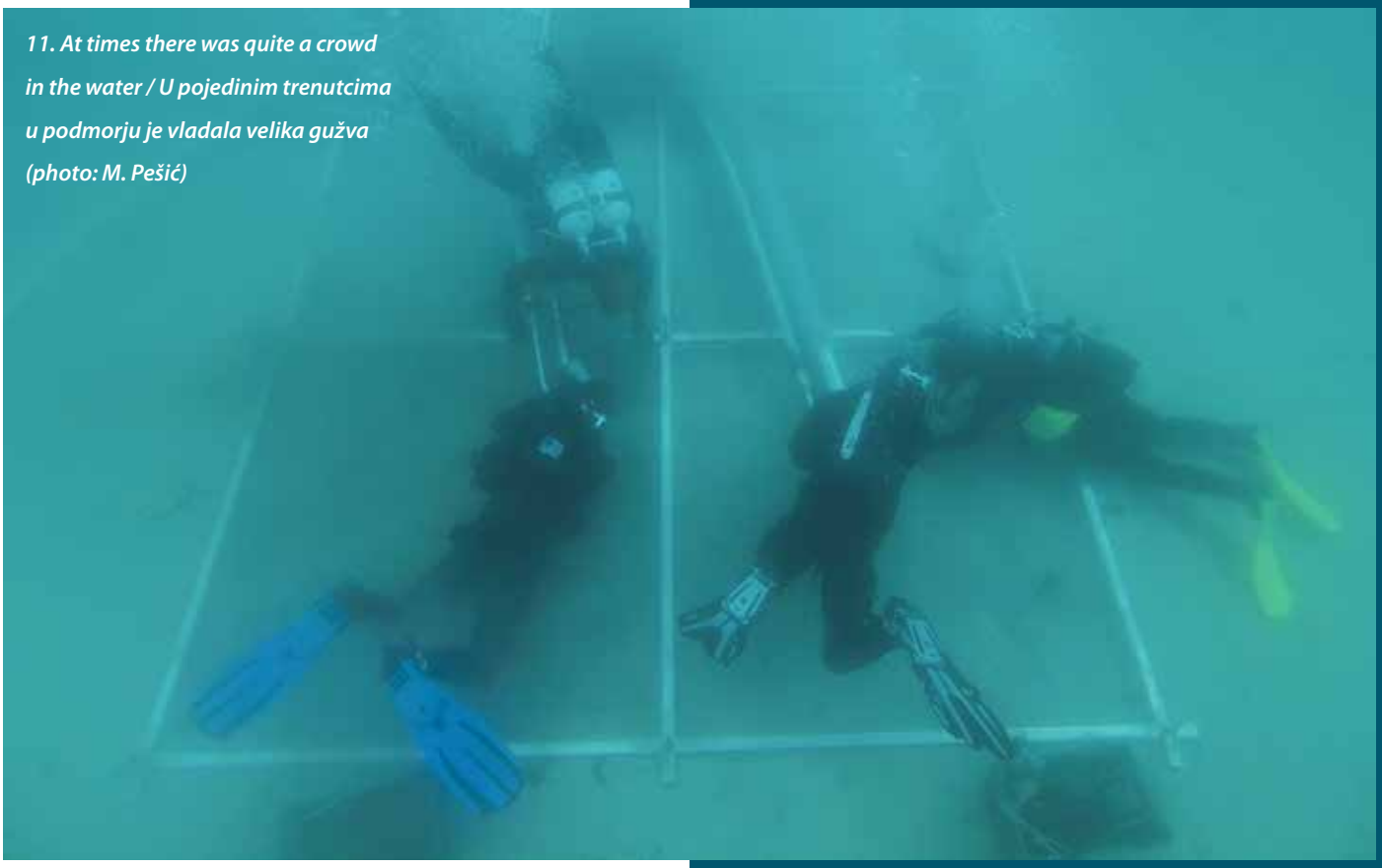
The origin of the amphorae and the coarse and sigillata ware from Babuljaš may be at-

10. Excavation of a grid quadrant with dredger / Iskopavanje kvadranata s mamut sisaljkom (photo: M. Šimičić)

spada u kategoriju luksuznog posuđa, a na nalazištu većina takvog keramičkog posuđa pripada posudama Hayes 50B koje se datiraju u period 4. i 5. st. Nakon što je prošle godine nađena luksuzna zdjelica s prikazom leoparda i lava, i ove smo godine imali sreću naći još jedan primjerak zdjelice istog tipa, ali bolje očuvane i s vrlo lijepim prikazom. Na zdjelici se u reljefnom ukrasu prepoznaje lik pastira s frigijskom kapicom obučenim u tuniku, koji preko ramena nosi ovna, a uz njega stoji još jedan ovan. Ovakav prikaz može se okarakterizirati kao prikaz Dobrog pastira, što je zapravo personifikacija Krista. Zdjelica pripada tipu Hayes 53A koji se datira u period od 350. - 430 g. (Hayes 1972, 78-82).

Ostatci drvene brodske konstrukcije još uvijek nisu nađeni, no zbog širine nalazišta postoji mogućnost da će biti otkriveni u daljnjim istraživanjima. U prilog postojanju brodske konstrukcije na ovom dijelu, zasigurno ide u prilog pronalazak olovnih oplata manjih dimenzija te brončanih i željeznih čavala. Brončani čavli se javljaju u dvije varijante, svi su četvrtastog presjeka, neki imaju široku kalotastu glavu, dok se neki javljaju bez glave.

Porijeklo amfora, grubog i sigilatnog posuđa s Babuljaša može se pripisati većem broju proizvodnih radioničkih krugova s teritorija današnjeg Tunisa, koji su u vrijeme rimske vladavine pripadali provincijama Zeugitana i Byzacena. Očigledno je da su zahtjevi tržišta na koje je ciljao vlasnik



11. At times there was quite a crowd in the water / U pojedinim trenutcima u podmorju je vladala velika gužva (photo: M. Pešić)

tributed to a large number of workshop circles in the territory of present-day Tunisia that, during Roman rule, were part of the provinces of Zeugitana and Byzacena. It is evident that the demands of the market targeted by the owner of the cargo were diverse and that there was a need for the products we find at the site of the shipwreck to be sourced from various parts of the North African provinces.

12. The team of archaeologists from the research at Babuljaš in 2014 / Arheološka ekipa s istraživanja Babuljaša 2014: from the left / S lijeva: Marko Meštrov, Roko Surić, Nemanja Čavlović, Mladen Pešić, Antje Fischer, Marina Šimičić, Anita Jelić, Roman Scholz, Elizabeth Briggs, Luka Bekić (photo: Nadji Laguna)

tereta bili raznoliki, te je postojala potreba da se proizvodi koji nalazimo na brodolomu dopreme iz različitih dijelova sjevernoafričkih provincija.

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Continued Research of Suleiman's Bridge at Darda

Nastavak istraživanja Sulejmanovog mosta u Dardi

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Following a two-year pause archaeological research has again been conducted at the site of the remains of a magnificent structure honoured by contemporaries with epithets such as *Il ponte famoso d'Essek* or *Die so berühmte und wunderbahre Essecker Brücke* (Mutnjaković 2014, 13). The northern end of the bridge landed at Darda in the immediate vicinity of the Esterhazy palace. It was here that two archaeological campaigns have been conducted to date, the first in June of 2009 and the second in October of 2011 (Pešić 2011, 10 - 19). This year's archaeological research at the site, running from October 27 to 31, was conducted by the International Centre for Underwater Archaeology in Zadar (ICUA). The research was led by campaign leader Mladen Pešić and deputy campaign leader Luka Bekić DSc, joined by Marina Šimičić and Roko Surić of ICUA. Assistance in land excavation was provided by Toni Rak and Dinko Kmoničeк. The chief objectives of this campaign were to supplement data on the distribution of the underwater site, the search for new structural elements on the bottom of the fishpond and the continuation of manual excavation of the embankment material removed from the fishpond in 2008.

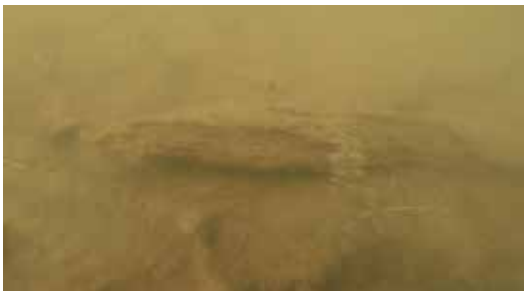
Nakon dvije godine pauziranja, ponovno su provedena arheološka istraživanja na lokalitetu koji sadrži tragove veličanstvene građevine, koju su suvremenici častili epitetima *Il ponte famoso d'Essek* ili *Die so berühmte und wunderbahre Essecker Brücke* (Mutnjaković 2014, 13). Most se sjevernim dijelom spajao s kopnom u Dardi, u neposrednoj blizini dvorca Esterhazy. Upravo na tom mjestu do sada su provedene dvije arheološke kampanje, prva u lipnju 2009. g. i druga u listopadu 2011. g. (Pešić 2011, 10 - 19). Ovogodišnja arheološka istraživanja na tom lokalitetu, u trajanju od 27. do 31. listopada, provodio je Međunarodni centar za podvodnu arheologiju u Zadru (MCPA). Voditelj istraživanja bio je Mladen Pešić, zamjenik voditelja dr.sc.Luka Bekić, a u istraživanju su sudjelovali Marina Šimičić i Roko Surić (MCPA). Pomoć pri kopnenom iskopavanju su pružili Toni Rak i Dinko Kmoničeк. Glavni ciljevi ovogodišnje kampanje bili su nadopuna podataka o rasprostiranju podvodnog nalazišta, potraga za novim konstruktivnim elementima na dnu ribnjaka, te nastavak ručnog iskopavanja nasipa koji je izvađen iz ribnjaka tijekom 2008. g.

1. A graphic representation of Suleiman's bridge / Grafika s prikazom Sulejmanovog mosta (Pelc 2014, Sl. 15)

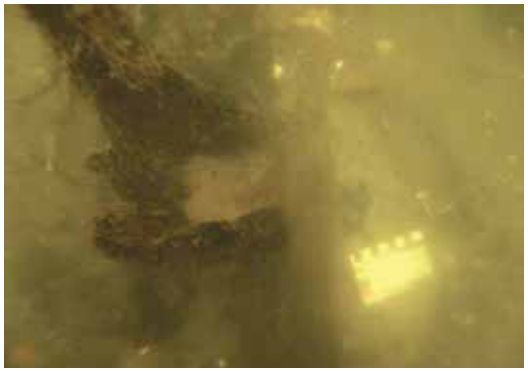
2. The divers found various artefacts at the bottom of the pond related to the use of the bridge / Na dnu jezera ronioci su nalazili razne predmete povezane s korištenjem mosta (photo: L. Bekić)

With the objective of acquiring the best possible results it was decided that the research would be led in parallel in the water and on land. Daily dives in the cold and murky water (mostly by the Bekić - Pešić pair) constituted the most anticipated and fascinating part of the day. Standard archaeological excavation assisted by an water pump dredger was not possible at this site, primarily on account of the very murky water and the lack of currents that would improve visibility. Only a surface examination of the bottom was, therefore, undertaken, with the divers also examining the shallow layer of silt that could be penetrated by hand. Because of the conditions in the water and the weight of the artefacts raised to the water's surface, a small rubber dinghy was employed during the investigation in which one person always accompanied the pair of divers. Unlike previous campaigns, the relatively high water level in

3. The remains of a wooden pile, hardly visible on account of the poor visibility / Ostatak drvenog pilona koji se jedva nazire zbog loše vidljivosti (photo: M. Pešić)



4. Remains of the wooden structure at the bottom of the fishpond / Ostaci drvene konstrukcije na dnu ribnjaka (photo: M. Pešić)



U cilju dobivanja što boljih rezultata odlučeno je kako će se istraživanja paralelno voditi u vodi i na kopnu. Svakodnevni zaroni u hladnu i mutnu vodu (uglavnom para Bekić - Pešić) predstavljali su najiščekivaniji i najzanimljiviji dio dana. Standardna arheološka iskopavanja pomoću mamut sisaljki na ovom nalazištu nisu bila moguća, prvenstveno radi velike zamućenosti vode, kao i radi nedostatka strujanja koja bi pomogla poboljšanju vidljivosti. Iz tih se razloga vršio samo površinski pregled, s tim da su ronioci pregledavali i plitki sloj mulja u koji je dopuštao prodiranje rukom. Zbog uvjeta koji su vladali u vodi, ali i težine predmeta koji su se dizali na površinu, prilikom istraživanja koristio se mali gumeni čamac

5. The rubber dinghy was a great help in extracting artefacts from the fishpond / Gumeni čamac uvelike je pomogao u izvlačenju predmeta iz ribnjaka (photo: M. Šimičić)

u kojem je jedna osoba bila uvijek u pratnji ronilačkog para. Za razliku od prijašnjih kampanja, relativno visok vodostaj ribnjaka rezultirao je poboljšanom vidljivošću od čak pola metra, pa se na nekim mjestima obavila fotodokumentacija.

Istraživanjem u ribnjaku pronađeni su novi dijelovi konstruktivnih elementa. Njihovom analizom potvrdila se pretpostavka nastala iz analize ranije pronađenih elemenata, a to je da se za spajanje umjesto metalnih, koriste drveni klinovi kružnog i četvrtastog presjeka. Pronađeni su dijelovi koji se mogu okarakterizirati kao elementi koji su tvorili ogradu - rukohvat i okomite gredice za nasad, a pronađena je i široka daska s utorima, koja bi mogla biti dio hodne površine mosta u koju je bila zabijena ograda. Među najzanimljivije drvene

6. Bekić at the moment of the discovery of the integrally preserved small vessel / Bekić u trenutku pronalaska cjelovito sačuvane posudice (photo: M. Pešić)

the fishpond resulted in improved visibility by as much as half a metre, allowing photographic documentation in places.

The investigation of the fishpond yielded new sections of structural elements. An analysis of these elements confirmed the postulates that emerged from an analysis of previously discovered elements, that being that wooden pegs of round or square cross-section, rather than metal spikes, were used for joining. Sections were found that could be characterised as elements forming the railing/handrail and the socketed vertical uprights, and a wide plank was found with grooves that may have been a part of the bridge's walking surface into which the railing was socketed. Certainly numbered among the more interesting wooden structural elements is a squared wooden beam the purpose of which remains to be ascertained. It is characterised by a groove of square cross-section at its middle and a protruding perforated "lug" on one end. An interesting structure was also found that consists of a vertical beam of square cross-section that is socketed into a groove on another horizontal beam of similar cross-section. What the function of this structure was is not altogether clear. Along with wooden elements that can be attributed to the bridge, other wooden artefacts were also found at the bottom of the pond, the most interesting of which is part of the wooden lid of a barrel.

Unlike previous campaigns, this one yielded a more significant quantity of very small archaeological material. Along with wooden elements a number of typologically and chronologically similar finds were discovered that could be dated to the time of the existence of the bridge. Their greatest concentra-

konstruktivne elemente svakako spada četvrtasta drvena greda kojoj namjenu tek treba otkriti. Karakteriziraju je utor kvadratnog presjeka na središtu i izbočena "ušica" s rupom na jednom kraju. Pronađena je i jedna zanimljiva konstrukcija koje se sastoji od okomite grede kvadratnog presjeka koja ulazi u utor druge horizontalne grede sličnog presjeka. Nije sasvim jasno koja je funkcija ove konstrukcije. Osim drvenih elemenata koji se mogu pripisati mostu, na dnu jezera pronađeni su i drugi drveni predmeti, od čega je najzanimljiviji dio drvenog poklopca bačve.

Za razliku od prijašnjih kampanja, ova je iznjedrila značajniju količinu sitnog arheološkog materijala. Osim drvenih elemenata na samom dnu ribnjaka nađena je i određena količina tipološki i vremenski sličnih nalaza koji se mogu datirati u vrijeme postojanja mosta. Njihova najveća koncentracija nalazi se na rubnim dijelovima mosta, što je i logično, jer vjerojatnost da će predmet pasti sa strane mosta puno je veća nego da će pasti direktno ispod njega. Među pronađenim nalazima se ističu ulomci keramičkog posuđa, naročito dijelovi oboda i dna novovjekovnog glaziranog

7. Cjelovito sačuvana posudica / The intact vessel (photo: R. Surić)

posuđa. Među predmete koji su obilježili ovogodišnju kampanju spada cjelovito sačuvani vrčić ili lončić s jednom ručkom i glaziranom unutrašnjošću. Ovakve posude se datiraju u period 16. i 17. st. Neki dijelovi dna ribnjaka

tion is at the perimeters of the bridge, which is logical, as the likelihood that an object would fall to the side of the bridge is much greater than that it would fall directly beneath it. Prominent among the finds discovered are sherds of ceramic vessels, in particular parts of the rims and bases of post-medieval glazed ware. Among the artefacts that marked this year's campaign is an integrally preserved small jug or small pot with one handle and glazed interior. Vessels like this one are dated to the 16th and 17th centuries. Some parts of the bottom of the fishpond contain greater quantities of integrally preserved bricks or fragments of bricks, but their purpose at the bottom of the fishpond for now remains unclear. A greater quantity of faunal bones was also found and one stone fragment that could be characterised as part of a cannon ball.

In the frame of the examination of the bottom of the Mala Đola fishpond it was decided that a dive should also be undertaken below the embankment of Esterhazy palace. A large quantity of construction material, stone and brick is to be found along the bank of the pond, between which we find scattered small archaeological material from various periods, predominantly from the post-medieval and contemporary periods. There is an interesting find of two sherds of Celtic pottery that can be dated to the 2nd to 1st century BCE. These sherds point to the possibility that there may have been a La Tene period settlement alongside this small Baranja region fishpond.

Along with underwater research – as in the case of previous campaigns – archaeological research was also conducted on land at the sand embankment that was dredged from the fishpond back in 2009. Excavation of the embankment yielded finds of a large quantity of wooden elements, the majority of which we can characterise as piles, while only a small part are planks. Thirty-three new wooden piles were discovered in varying states of preservation. As with previously excavated piles they differ in terms of their dimensions, and in terms of their cross-section, which may be circular, square or polygonal. The piles, made of oak, have suffered significant decay in the few years they have been on dry land, and in some cases large sections of the posts disintegrate at the touch. As in the water, wooden elements with pegs were also found in the embankment.

What was expected with regard to the excavation of the embankment was the discovery of small archaeological finds.

8. Unloading of the artefacts extracted during dives / Iskrcavanje izronjenih predmeta (photo: M. Šimičić)

sadrže veće količine fragmenata ili cjelovito sačuvanih opeka, no njihova svrha na dnu ribnjaka za sada ostaje nerazjašnjena. Pronađena je i veća količina životinjskih kostiju te jedan kameni ulomak koji bi se mogao okarakterizirati kao dio topovske kugle.

9. A section of a wooden beam with the remains of wooden pegs / Komad drvene grede s ostacima drvenih klinova (photo: M. Šimičić)

U sklopu pregleda dna ribnjaka Mala Đola odlučilo se zaroniti i ispod nasipa dvorca Esterhazy. Uz samu obalu nalazi se veća količina građevinskog materijala, kamena i opeke, a između njih se nalazi raštrkan sitni arheološki materijal iz različitih razdoblja, pretežno novovjekovnog i modernog doba. Zanimljiv nalaz predstavljaju dva ulomka keltske keramike koja se može datirati u 2.-1. st. pr. Kr. Ti ulomci ukazuju mogućnost da se uz ovaj mali baranjski ribnjak nalazilo i naselje iz latenskog doba.

10. Celtic pottery found near the Esterhazy castle / Keltska keramika pronađena pod dvorcem Eszterhazy (photo: L. Bekić)

Osim podvodnih, kao i u slučaju prethodnih kampanja, provedena su i kopnena arheološka istraživanja nasipa pijeska koji je jaružanjem izvađen iz ribnjaka još 2009. g. Iskopavanjem nasipa pronađena je veća količina drvenih elemenata od kojih većinu možemo okarakterizirati kao pilone, dok je tek manji dio dasaka. Otkrila su se 33 nova drvena pilona različitog stanja očuvanosti. Kao i kod prethodno iskopanih pilona može se vidjeti da se razlikuju po dimenzijama,

11. The finds are commented immediately after a dive / Odmah nakon zarona se komentiraju pronalasci (photo: I. Getto)

Most frequently we came across various faunal bones that will be sent for analysis. Sherds of post-medieval ceramic ware are very important. Prominent among the many interesting sherds is part of a Turkish smoking pipe with a decoration in the form of a horizontal crescent and concentric circles that

12. Ceramic pot discovered in the embankment / Keramički lonac pronađen u nasipu (photo: M. Šimičić)

was manufactured in one of the Turkish workshops in the period from the 17th to 18th century. Another interesting find is of an almost intact ceramic artefact for which we cannot with certainty say whether it is a cup or some type of stove tile. Besides potsherds, a large quantity of metal artefacts of various shapes was also found. Most of the artefacts require conservation-restoration treatment in order for us to even attempt to ascertain their purpose. Artefacts that are immediately recognisable are two metal knives. The first knife has the remains of the rivets that held the handle in place. The second – and certainly the more interesting knife – has a preserved wooden handle and copper plating with an incised decoration and remains of wood that without a doubt belong to the destroyed wooden sheath.

Samples of the wooden piles were taken during the campaigns in 2009 and 2011 that were sent for analysis to deter-

ali i presjeku, koji može biti kružni, kvadratni ili poligonalni. Piloni, inače izrađeni od hrastovine, tijekom nekoliko godina koje su proveli na suhom doživjeli su znatno propadanje, pa se u pojedinim slučajevima i veći komadi grede raspadaju već pri samom dodiru. Kao i u vodi, i u nasipu su se pronašli drveni elementi s klinovima.

Ono što se očekivalo u vezi iskapanja nasipa jest pronalazak sitnih arheoloških nalaza. Najčešće se nailazilo na razne životinjske kosti, koje će se poslati na analizu. No, vrlo važni su ulomci novovjekovnog keramičkog

13. Unusual ceramic vessel or a stove tile / Neobična keramička posuda ili pećnjak (photo: L. Bekić)

posuđa. Među brojnim interesantnim ulomcima ističe se dio turske lule s ukrasom u obliku ležećih polumjeseca i koncentričnih kružnica, koja je bila izrađena je u nekoj od turskih radionica u periodu 17. -18. st. Zanimljiv je i nalaz gotovo cjelovitog keramičkog predmeta, za koji ne možemo sa sigurnošću reći dali se radi o čaši ili nekom tipu pećnjaka. Osim ulomaka keramike pronađena je i velika količina metalnih predmeta raznih oblika. Većina predmeta morati će proći konzervatorsko - restauratorsku obradu kako bi se uopće pokušala definirati njihova svrha. Predmeti koji se odmah mogu prepoznati su dva metalna noža. Prvi nož na sebi ima ostatke zakovica koje su

14. A knife with bone handle and the remains of the sheath / Nož sa koštanom drškom i ostacima korica (photo: R. Surić)

15. Excavation of the embankment dredged from the fishpond / Iskopavanje nasipa uz ribnjak (photo: L. Bekić)

mine the age and type of wood used. A dendrochronological analysis was conducted at the Gozdarski inštitute Slovenije (Forestry Institute of Slovenia). The results indicate that the piles were made of oak wood (Quercus species) that was felled prior to 1562. This information points to the conclusion that the material for the construction of the bridge was collected in advance, resulting in the amazing speed of its erection.

The results yielded by the multiannual archaeological research of the land and underwater sections of the Suleiman's Bridge site are certainly significant in what they tell us about this magnificent structure. The analysis of wooden elements found will significantly elucidate the characteristics of the bridge, while a more detailed analysis of the archaeological finds will shed more light on life on and around the bridge. It is encouraging to note that during this year's research campaign we sensed a positive curiosity in the broader public, both for the research effort and for the presentation of the bridge, which gives us hope that this site will in the future be presented in the manner it truly deserves.

držale dršku. Drugi i svakako, zanimljiviji željezni nož na sebi ima sačuvanu drvenu dršku, a sačuvali su se bakreni lim s urezanim ukrasom, i ostaci drva, koji nesumnjivo pripadaju uništenim drvenim koricama.

Tijekom kampanja 2009. i 2011. g. uzeti su uzorci drvenih pilona, koji su se poslali na analize vrste drva i starosti. Izvršena je dendrokronološka analiza u Gozdarskom inštitutu Slovenije. Rezultati pokazuju da su piloni izrađeni od hrastovog drva (Quecrus species), koje je bilo posječeno prije 1562. g. Taj podatak nas upućuje na zaključak kako se građa za izradu mosta prikupljala unaprijed, što je rezultiralo nevjerojatnom brzinom izgradnje.

Rezultati dobiveni višegodišnjim arheološkim istraživanjem kopnenog i podvodnog dijela lokaliteta "Sulejmanov most" svakako su značajni za rasvjetljavanje ove veličanstvene građevine. Analiza pronađenih drvenih elemenata uvelike će razjasniti same karakteristike mosta, dok će podrobnija analiza arheoloških nalaza približiti sliku života vezanog uz most. Ohrabrujuća je činjenica da se za vrijeme ovogodišnjeg istraživanja osjetila pozitivna znatiželja kod javnost, kako za samo istraživanje, tako i za prezentaciju mosta, što ulijeva nadu kako će ovaj lokalitet u budućnosti biti prezentiran na način na koji on to zaista i zaslužuje.

16. Ovogodišnja arheološka istraživanja na lokalitetu Sulejmanov most (photo: M. Pešić) / This year's archaeological research at the Suleiman's Bridge site (photo: M. Pešić)

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Continuing the Archaeological Survey of the Waters of Zadar County

Nastavak rekognosciranja podmorja Zadarske županije

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The Zadar County archaeological survey programme continued in 2014. Under the patronage of the Croatian Ministry of Culture ICUA staff examined a series of interesting locations across the entire county and discovered several new shipwrecks that will supplement our knowledge of the movement and intensity of maritime traffic in the Adriatic Sea. We should also note that we had great assistance from local divers in this, providing us with information on sites – in particular the Foka diving club of Šimun on the island of Pag and the Scuba Adriatic diving club of Zaton with the help of which we located new Roman period shipwreck positions.

The Metla Shallows (Plič Metla) is situated at the northern entrance to the Rivanj Channel (Rivanjski kanal) near the eastern shore of the island of Sestrunj. The high point of the shallows is at a depth of two metres and is marked with a small lighthouse, the foundations of which are built onto the submarine rock. In the past the location, without visible surface markings, was a great danger to seafarers navigating this area. In the Roman period it was fatal to a ship transporting Lamboglia 2 type amphorae that ended its travels here. Today the remains of its cargo are visible strewn across the rock and firmly fused to it. Although traces of the dev-

Program rekognosciranja Zadarske županije nastavio se provoditi i tijekom 2014. g. Pod pokroviteljstvom Ministarstva kulture RH djelatnici MCPA pretraživali su niz zanimljivih lokacija na području cijele županije, te otkrili i nekoliko novih brodoloma koji će nadopuniti sliku o kretanju i intenzitetu pomorskog prometa na Jadranu. Ovom prilikom moramo napomenuti da smo veliku pomoć imali i od lokalnih ronioca, od kojih smo dobili niz informacija o nalazištima, a posebno ronilačkih klubova „Foka" iz Šimuna na otoku Pagu i „Scuba Adriatic" iz Zatona uz čiju pomoć smo locirali nove pozicije antičkih brodoloma.

Plič Metla je smještena na sjevernom ulasku u Rivanjski kanal u blizini istočne obale Sestrunja. Vrh pliči se nalazi na dubini od 2 metra, a obilježena je manjim svjetionikom čija baza je napravljena na podmorskoj hridi. U prošlosti je lokacija bez vidljive površinske oznake bila velika opasnost za moreplovce koji su plovili ovim krajem. Tijekom antičkog vremena bila je kobna za brod koji je prenosio amfore tipa Lamboglia 2, a koji je svoje putovanje završio upravo ovdje. Danas su ostatci njegovog tereta vidljivi raštrkani po hridi i čvrsto su srasli s njom. lako su tragovi devastacija brodoloma očiti, osim samih amfora primijećena je i veća količina keramičkih pločica šesterokutnog oblika koje su služile za popločenje podova u termama, a na ovom brodolomu su zasigurno bile dio tereta. Na drugoj poziciji podmorske hridi su vidljivi koncentrirani nalazi balastnog kamenja, kamenog ugljena i keramičkih ulomaka. Budući da ostatci broda nisu vidljivi, možemo pretpostaviti da se i ovdje radi o potencijalnom brodolomu - najvjerojatnije parobrodu koji je možda bio samo privremeno nasukan na plitku stijenu, a naknadno dotegljen u sigurnu luku.

1. Fragments of amphorae between the rocks of the Metla shallows / Krhotine amfora između stijena na pliči Metla (photo: M. Pešić)

astation of the shipwreck are evident, a large quantity of hexagonal ceramic tiles used to pave the floors of thermae, that were certainly part of the cargo of this sunken vessel, were observed along with the amphorae. At a second position on the submarine rock we see concentrated finds of ballast stones, stone coal and potsherds. As the remains of a ship are not visible we can presume that this was a potential shipwreck – most likely a steamship that was only temporarily aground on the shallow rock before being towed to a safe harbour.

At the islet of Lukar near Pag we discovered a site of very interesting appearance. A large quantity of fragmented amphorae has at one section fused into a conglomerate of 1.5 by 1.5 metres. Smaller aggregations of fused material can be found in the surrounding area, covered by sherds. The amphorae that constitute the bulk of the cargo from this shipwreck are of the Porto Recanati type, with Dressel 2-4 type amphorae also found alongside them. Some of the Porto Recanati type amphorae bear a decoration on their elongated necks in the form of a large wavy line, which will assist us in the more precise determination of their origin and analogy to the cited type. Based on the finds discovered the shipwreck can be dated to the late 1st or 2nd century.

3. A great concentration of amphorae at Lukar / Velika koncentracija amfora na Lukaru (photo: M. Pešić)

Shipwrecks with Porto Recanati type amphorae are rare in the Adriatic and the only one known to us is at Školjić near Unije (Jurišić 2000, 22).

In the area of the island of Lavdara there is evidence of quarries used in the Roman and post medieval periods – they were particularly suitable because of the proximity of the stone to

2. Ballast stones, stone coal and potsherds at the Metla shallows / Balastno kamenje, kameni ugljen i fragmenti keramike sa pliči Metla (photo: M. Pešić)

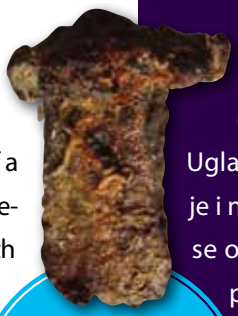
Kod otočića Lukara blizu Paga otkriveno je nalazište vrlo zanimljivog izgleda. Radi se o velikoj količini fragmentiranih amfora koje su jednim dijelom srasle u konglomerat veličine 1,5x1,5 metara. Uokolo se mogu pronaći i manje nakupine slijepljenog materijala na širokom prostoru koji je prekriven krhotinama. Amfore koje su činile glavninu tereta na brodolomu pripadaju tipu Porto Recanati, dok se uz njih mogu naći i amfore tipa Dressel 2-4. Neke od amfora tipa Porto Recanati na izduženom vratu nose ukras u obliku velike valovnice, što će pomoći pri točnijem određivanju porijekla i analogija navedenog tipa. Na osnovu pronađenih nalaza brodolom se može datirati u kraj 1. ili 2. st. Brodolomi s Porto Recanati tipom amfora su rijetki na Jadranu, a jedini poznati je onaj sa Školjića kod Unija (Jurišić 2000, 22).

Na prostoru otoka Lavdare postoje dokazi o kamenolomima koji su bili korišteni u rimsko i novovjekovno vrijeme, a osobito su bili pogodni radi blizine kamena moru i lakše mogućnosti transporta brodovima. Jedan od kamenoloma zasigurno se nalazio i iznad uvale Muline na Lavdari, a dokazi koje smo našli svjedoče i o transportu kamena kroz samu uvalu (Rube Filipi 2001, 149). Konfiguracija podmorskog terena koji relativno naglo pada u dubinu čak i u samoj uvali, pogodovala je brodovima da na ovoj poziciji mogu ukrcavati kvalitetni kamen koji se vadio na otoku, a izvori vode nađeni u neposrednoj blizini zasigurno su ovu lokaciju činili još atraktivnijom (Rube Filipi 2001,121). Prilikom pregleda uvale nađeno je više različitih tipova antičkih amfora od kojih se sa sigurnošću može prepoznati dno amfore tipa Forlimpopoli koja se koristila tijekom 1. st., te grlo s ručkama tipa Late Roman 1 amfore, koje se koriste u širokom rasponu od 4.-7. st., a proizvodile su se na Cipru i mediteranskoj obali Turske (Williams 2005,158-159). Uvala se koristila i u novovjekovnom

4. A Porto Recanati type amphora from Lukara Amfora tipa Porto Recanati s Lukara (photo: M. Šimičić)

the sea and the easier possibility of transport by sea. One of the quarries was certainly located above Muline Cove on Lavdara and the evidence we have found bears witness to the transport of stone through the cove itself (Rube Filipi 2001, 149). The configuration of the submarine terrain that also drops relatively steeply in the cove itself was suitable for vessels that could have taken on loads of high quality stone quarried on the island at this position, and the springs of water found in the immediate vicinity certainly made this location even more attractive (Rube Filipi 2001,121). During the examination of the cove we found several different types of Roman amphorae of which we can with certainty identify the base of a Forlimpopoli type amphora used in the 1st century and the neck and handle of a Late Roman 1 type amphora used in the broad time period of the 4th to 7th century and manufactured both on Cyprus and the Mediterranean shores of Turkey (Williams 2005,158-159). The cove was also used in the post medieval period, attested to by the presence of fragments of glazed pottery and glass receptacles. The most important evidence of the use of quarries is a massive iron wedge used when separating blocks of stone, although the time of its production is unknown to us given that the morphology of

5. A Late Roman 1 amphora from Lavdara / Amfora Late Roman 1 s Lavdare (photo: M. Šimičić)



6. A massive iron wedge from Lavdara / Masivni željezni klin s Lavdare (photo: M. Šimičić)

periodu, o čemu svjedoče fragmenti glazirane keramike i stakleni recipijenti. Kao najvažniji dokaz korištenja kamenoloma nađen je jedan masivni željezni klin koji je služio prilikom razdvajanja kamenih blokova, ali vremenski period kada je izrađen nam je nepoznat, budući da se njihova morfologija nije puno mijenjala tijekom stoljeća.

U novim rekognosciranjima otkrivena su i dva brodoloma s teretom amfora sjevernoafričke provenijencije. Prvi brodolom nalazi se na otoku Istu, u Škardskom prolazu. Ostatci brodoloma teško su vidljiv, budući da su dosta devastirani i skriveni između velikih stijena i visoke trave posidonije. Na nekoliko pozicija napravljene su manje sonde te je otkriveno da osim površinskih nalaza postoji i slojevitost nalazišta. Uglavnom se nalaze fragmenti trbuha amfora, a nađeno je i nekoliko fragmenata koji se mogu determinirati. Radi se o ulomcima amfora sjevernoafričke provenijencije, prvenstveno tipa Keay XXV, zatim nekoliko fragmenata Spatheion amfore, ali i amfora porijeklom sa istočnog mediterana - amfore tipa Late Roman 1. Drugi brodolom nalazi se na otoku Velikom Brušnjaku kod Paga. Na dubini od 10-22 metra uočljiva je razasuta velika količina oboda, dna i tijela amfora. Preliminarna analiza tipova amfora koje smo našli govori nam da se radi o amforama tipa Keay XXVII, Keay XXV

7. The remains of a shipwreck lie hidden among the rocks and Neptune grass at the island of Ist / Među stijenama i Posidonijom na Istu se kriju ostatci brodoloma (photo: M. Pešić)

8. Divers investigate a devastated shipwreck at Veli Brušnjak / Ronioc pregledava devastirani brodolom na Velikom Brušnjaku (photo: M. Šimičić)

these objects has not changed much over the centuries. The latest archaeological surveying has also revealed two shipwrecks with a cargo of amphorae of North African provenance. The first shipwreck is off the island of Ist in the sea passage off the island of Škarda. The remains of the shipwreck are not easily discernable having been significantly devastated and being concealed between large rocks and meadows of tall Neptune grass. Small trenches were excavated at several positions revealing that, besides the surface finds, the site is layered. For the most part we find sherds from the belly section of amphorae, with some fragments found that can be identified by type. These are sherds of amphorae of North African provenance, primarily of the Keay XXV type, several fragments of Spatheion amphorae and amphorae originating in the eastern Mediterranean – amphorae of the Late Roman 1 type. The second shipwreck is situated off the island of Veli Brušnjak near Pag. A large quantity of strewn rims, bases and bodies of amphorae are visible at a depth of some ten to twenty-two metres. A preliminary analysis of the amphorae types we have found tell us that these are amphorae of the Keay XXVII, Keay XXV (several variants) and Africana II C type (Keay 1984; Bonifay 2004). Both shipwrecks can be approximately dated to the period from the 4th to 5th century.

9. Various types of North African amphorae from Veli Brušnjak / Različiti tipovi sjevernoafričkih amfora s Velikog Brušnjaka (photo: M. Šimičić)

(više varijanti) i Africana II C (Keay 1984; Bonifay 2004). Oba brodoloma okvirno se mogu datirati u period 4.-5. st..

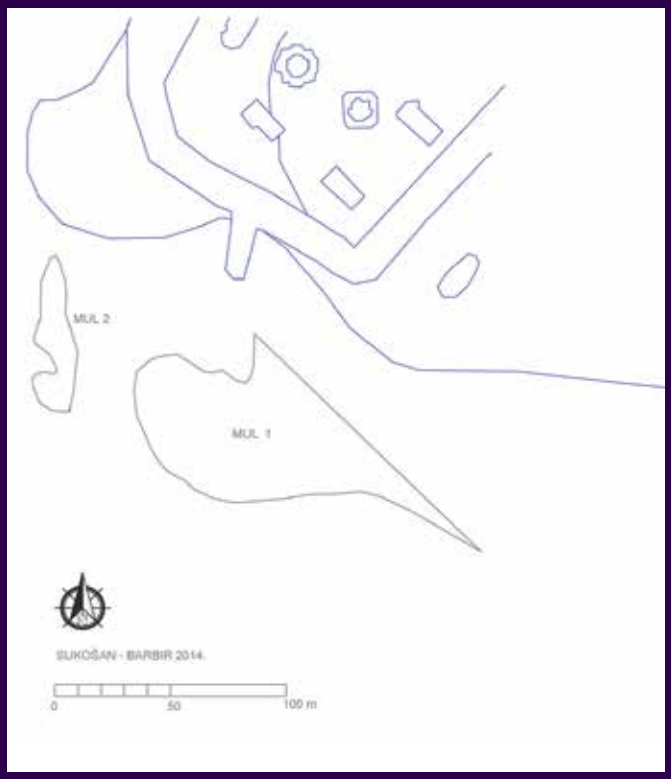
Podmorje sjevernog dijela Ugljana skrivalo je još jedan iznimno rijedak brodolom koji je ovom prilikom otkriven. Na dubini od oko 8 metara rasprostire se široko polje krhotina narebrenih amfora. Amfore nisu cjelovito očuvane, ali se prema vidljivim karakteristikama može zaključiti da su manjih dimenzija, nemaju izraženi vrat, a specifične su im trakaste ručke koje izlaze iz oboda i visoko se izdižu iznad vrata. Ove amfore mogu se datirati u period 13./14. stoljeća i pripadaju bizantskom proizvodnom krugu, a tipološki se mogu svrstati u tip VII prema Bakirtzisu (Bakirtzis 1989, 75). Na Jadranu je osim nekoliko pojedinačnih primjera zabilježen samo jedan brodolom koji je prenosio ovakav tip amfora, a nalazi se kod otočića Merara istočno od rta Ploče (Zmaić 2012, 478-479).

I tijekom ove godine nastavljeno je rekognosciranje lokacija koje su već otprije registrirane u svrhu uvida u stanje njihove očuvanosti i ugroženosti. U sklopu ovog dijela programa napravljeni su geodetski snimci nepokretnih struktura, lučkih instalacija i koncentracija arheoloških nalaza na lokacijama Sukošan-Barbir i Biograd-Kumenat.

The waters of the northern part of Ugljan hide another very rare shipwreck that was discovered on this occasion. At a depth of some eight metres there is a broad field of scattered sherds of ribbed amphorae. The amphorae have not been preserved intact, but from the visible characteristics we can conclude that they are of smaller size, that they have no pronounced neck, and that they have specific strap handles that stretch out from the rim and rise high above the neck. These amphorae can be dated to the period of the 13th and 14th centuries and come from the Byzantine manufacturing sphere, and can be typologically classified in the VII type according to Bakirtzis (Bakirtzis 1989, 75). With the exception of several individual specimens only one shipwreck is known of in the Adriatic Sea to have transported this type of amphorae, situated off the islet of Merara to the east of Cape Ploče (Zmaić 2012, 478-479).

10. Fragments of amphorae of the Byzantine type from Ugljan / Fragment amfore bizantskog tipa sa Ugljana (photo: M. Šimičić)

In this year we continued the archaeological survey of locations that have previously been registered with the objective of checking up on the condition of their preservation and level of threat. In the frame of this part of the programme a geodetic survey was made of the immobile structures, harbour installations and the concentration of archaeological finds at the Sukošan-Barbir and Biograd-Kumenat locations.



11. The geodetic survey of the harbour structures at the Sukošan-Barbir site / Geodetski snimak lučkih struktura na lokalitetu Sukošan-Barbir (author: M. Šimičić)

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12. Ostatci brodskog tereta bizanstskih amfora s Ugljana / The remains of a ship's cargo of Byzantine amphorae from Ugljan (photo: M. Pešić)

The submerged harbour of Amathus and its future perspectives

Το αρχαίο λιμάνι της Αμαθούντας και οι μελλοντικές του προοπτικές

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The archaeological site of Amathus is situated on two coastal cliffs at the west of Ayios Tychonas village, with a natural harbour located to the south (Fig. 1). It had flourished in the Cypro-Classical I Period (475-400 BCE), and the French School at Athens had been excavating there since the 1970s. In 1984-1986, a team led by Jean-Yves Empereur investigated the submerged outer harbour, being a highlight in the discipline of Maritime Archaeology in Cyprus since the excavation of the Kyrenia Ship.

The team established the preliminary topographic and structural elements of the enclosed outer harbour. They discovered that the inner silted circular basin at the southernmost part of the lower city was possibly connected to it (Aupert and Hermary 1980, 221; Empereur & Verlinden 1987, 7), and it is thought to be invoking the Phoenician harbour building techniques (Theodoulou 2006, 148) (Fig. 2-3).

In 2005, the Department of Fisheries and Marine Research published a report on creating an artificial reef, incorporating the ancient harbour (Ramos-Esplá 2005,1). The creation of the artificial reef focused on the establishment of marine protection zones and all diving activities at the area should be monitored and regulated (Ramos-Esplá 2005, 86-90). Yet, there is no submerged

Ο αρχαιολογικός χώρος της Αμαθούντας βρίσκεται μεταξύ δύο παράλιων λόφων στα δυτικά της κοινότητας Αγίου Τύχωνα, μ' ένα φυσικό λιμάνι στα νότιά του (Εικ. 1). Άνθισε κατά την Κυπροκλασική Ι Περίοδο (475-400 BCE), κι η Γαλλική Σχολή Αθηνών ανέσκαπτε εκεί από τη δεκαετία του 1970. Μεταξύ 1984-1986, ο Jean-Yves Empereur με την ομάδα του διερεύνησαν το βυθισμένο εξωτερικό λιμένα, ένα σημαντικό γεγονός για την Ενάλια Αρχαιολογία της Κύπρου από την ανασκαφή του καραβιού της Κερύνειας.

Η ομάδα κατέγραψε τα αρχικά τοπογραφικά κι αρχιτεκτονικά στοιχεία του κλειστού εξωτερικού λιμανιού. Ανακάλυψαν ότι η επιχωμένη εσωτερική λιμενική λεκάνη στο νοτιότερο άκρο της πόλης ήταν πιθανότατα ενωμένη με τον εξωτερικό λιμένα (Aupert and Hermary 1980, 221; Empereur & Verlinden 1987, 7), και θυμίζει τις φοινικικές κατασκευαστικές μεθόδους λιμανιών (Theodoulou 2006, 148) (Εικ. 2-3).

Το 2005, το Τμήμα Αλιείας και Θαλασσίων Ερευνών εξέδωσε μια έκθεση για τη δημιουργία τεχνητού υφάλου, ενσωματώνοντας το αρχαίο λιμάνι (Ramos-Esplá 2005, 1). Η δημιουργία του τεχνητού υφάλου επικεντρωνόταν στην καθιέρωση θαλασσίων ζωνών προστασίας, με όλες τις καταδυτικές δραστηριότητες στην περιοχή να εποπτεύονται (Ramos-Esplá 2005, 86-90). Εντούτοις, δεν υπάρχει σχέδιο διαχείρισης ενάλιας πολιτισμικής κληρονομιάς για το λιμάνι, παρόλο που αναμένεται να το επισκέπτονται δύτες.

Η ανάγκη για σχέδιο διαχείρισης του λιμανιού έγινε εντονότερη με τη δημιουργία του υφάλου. Όμως, η απουσία νομοθετικού πλαισίου για την ενάλια πολιτισμική κληρονομιά στην Κύπρο

1. A satellite view of the ancient site, the silted basin and the harbour (marked with yellow points) – the view is north (Google Earth) / Δορυφορική λήψη του αρχαίου οικισμού, του φραγμένου εσωτερικού λιμανιού και του υποθαλάσσιου λιμένα (σημειωμένα με κίτρινο) – η όψη είναι βόρεια (Google Earth).

2. General view of the Amathus agora and the inner basin of the harbour, marked with a red dotted line – the view is south-east (photo M. Ktori) / Γενική άποψη της Αγοράς της Αμαθούντας και της εσωτερικής λιμενικής λεκάνης, σημειωμένης με κόκκινη διακεκομμένη γραμμή – η όψη είναι νοτιοανατολική (φωτ. Μ. Κτωρή).

3. Another view of the Amathus agora and the inner basin of the harbour, marked with red dotted line – the view is south (photo M. Ktori). / Άποψη της Αγοράς της Αμαθούντας και της εσωτερικής λιμενικής λεκάνης, σημειωμένης με κόκκινη διακεκομμένη γραμμή – η όψη είναι νότια (φωτ. Μ. Κτωρή).

cultural heritage management plan for the harbour although divers are expected to visit it.

The creation of the reef intensified the need for a management plan for the harbour. Still, the absence of laws and regulations regarding submerged cultural remains in Cyprus perplexes the situation. Hence, the management possibilities suggested here are based on the UNESCO 2001 Convention of Underwater Cultural Heritage.

In such a case, the three options implemented internationally are underwater parks, preserves, and dive trails. Initially, one must identify the various site-related issues, the existing resources, the interest groups, and establish a decision process before proceeding further. Then, the development of a project requires the evaluation of any studies previously conducted at a site, which is a site-related issue for the ancient harbour as it had been partially excavated. The survey and excavation of the harbour are project prerequisites. A complete survey marking of any features of interest should be followed by the full excavation of the basin of the harbour and the area outside it, ensuring that any archaeological features or remains are recovered and preserved.

The survey can begin as early as April and the excavation in June, allowing time to evaluate the survey data and reassess the excavation plan (Rule 20; Maarleveld, Guérin & Egger 2013, 151-155). The Conservation Laboratory for Underwater Antiquities of the Department of Antiquities will handle any artefacts retrieved (Rule 24; Maarleveld, Guérin & Egger 2013, 179-200), while the local dive shops can pro-

περιπλέκει το θέμα. Επομένως, οι προτάσεις διαχείρισης που παρουσιάζονται εδώ βασίζονται στη Συνθήκη Ενάλιας Πολιτισμικής Κληρονομιάς της UNESCO του 2001.

Σε μια τέτοια περίπτωση, οι τρεις διεθνείς πρακτικές είναι τα υποβρύχια πάρκα, ζώνες και μονοπάτια καταδύσεων. Αρχικά, πρέπει να καταγραφούν τα διάφορα ζητήματα του αρχαιολογικού χώρου, οι υπάρχοντες πόροι, οι ενδιαφερόμενες ομάδες, και να καθιερωθεί μια διαδικασία προτού προχωρήσει το θέμα. Μετά, η ανάπτυξη ενός έργου απαιτεί την αξιολόγηση των προηγούμενων μελετών που είχαν γίνει για το χώρο, ένα πρόβλημα στην προκειμένη περίπτωση καθώς ο αρχαίος λιμένας δεν είχε ανασκαφεί πλήρως. Η πλήρης επισκόπησή του με την επισήμανση σημείων ενδιαφέροντος θα πρέπει να ακολουθηθεί και από πλήρη ανασκαφή της λεκάνης και της εξωτερικής περιφέρειας, διασφαλίζοντας ότι τα όποια αρχαιολογικά ευρήματα θα τύχουν της κατάλληλης φροντίδας.

Η επισκόπηση μπορεί να ξεκινήσει τον Απρίλη και η ανασκαφή τον Ιούνη, δίνοντας χρόνο για την αξιολόγηση των δεδομένων που θα έχουν συλλεχθεί ώστε να γίνουν τυχόν αλλαγές στο πλάνο της ανασκαφής (Κανόνας 20; Maarleveld, Guérin & Egger 2013, 151-155). Το Εργαστήριο Συντήρησης Εναλίων Αρχαιοτήτων του Τμήματος Αρχαιοτήτων θα συντηρήσει τα ευρήματα που θα βρεθούν (Κανόνας 24; Maarleveld, Guérin & Egger 2013, 179-200), ενώ οι τοπικοί όμιλοι καταδύσεων μπορούν να προσφέρουν τεχνική βοήθεια και να προμηθεύσουν μπουκάλες κατάδυσης, και να ενημερώσουν το κοινό. Η κοινότητα Αγίου Τύχωνα έδειξε ενδιαφέρον για το λιμάνι, κι η υποστήριξη κι εμπλοκή τους στην προστασία της πολιτισμικής κληρονομιάς πρέπει να ενθαρρυνθεί. Επίσης, η ανάλυση των

4. Possible dive entry point at the northwest part of the ancient harbour – the view is southwest (photo M. Ktori) / Πιθανό σημείο κατάδυσης στα νοτιοδυτικά του αρχαίου λιμένα – η όψη είναι νοτιοδυτική (φωτ. Μ. Κτωρή).

vide technical assistance and tank refills, and help raising awareness. The municipality of Ayios Tychonas has shown interest in the harbour, and their support and engagement in safeguarding cultural heritage should be encouraged. Furthermore, the post-fieldwork analysis of the collected data will provide the project manager with the necessary information to finalise the management plan.

After the excavation, one should choose a suitable submerged heritage option. T. Hannahs (2003, 11) presents the ideal decision process in such a selection and an evaluation form to assess the potential of a site. The harbour is already part of a Marine Reserve without promoting it to its full potential. If one would answer the questions of the evaluation form they would read as follows: the public would appreciate the site more by accessing it; it is a key archaeological site threatened by unregulated human activities; it should be fully excavated and recorded; prohibiting public access during the excavation may not be an option; alternative options should be explored.

As seen in Table 1, I have adapted the form to fit the needs of the harbour. There are 18 fields in four different areas, on a scale from 5 to -5. The total maximum achievable

δεδομένων μετά την περάτωση της ανασκαφής θα δώσει τις απαραίτητες πληροφορίες στο διευθυντή του έργου ώστε να κάνει την τελική διαμόρφωση του πλάνου διαχείρισης.

Μετά την ανασκαφή πρέπει να επιλεγεί η κατάλληλη πρόταση διαχείρισης ενάλιας πολιτισμικής κληρονομιάς. Ο T. Hannahs παρουσιάζει την ιδανική διαδικασία επιλογής σε τέτοιες

Conditions	Quality of historic experience	Archaeological significance	Vulnerability of resource	Safety
Current	2	5	4	5
Visibility	3	3	N/A	3
Depth	5	5	N/A	5
Temperature	5	5	N/A	5
Fauna	4	N/A	3	5
Flora	4	N/A	3	5
Traffic	3	N/A	3	5
Fragility	4	4	4	N/A
Historical associations	5	5	N/A	N/A
Uniqueness	5	5	N/A	N/A
Loose artefacts	N/A	3	3	N/A
Excavation of the site	N/A	-3	N/A	N/A
Access	5	N/A	N/A	5
Dive information (trail)	-5	-5	N/A	N/A
Representativeness	3	3	3	N/A
Integrity	4	4	4	N/A
Complexity	3	3	4	N/A
Modern debris	3	N/A	3	3
Totals	**53/80**	**37/65**	**34/50**	**41/45**
Final value	**165/240**			

Scale:

5 = Outstanding	-1 = Unfortunate
4 = Excellent	-2 = Undesirable
3 = Very Good	-3 = Bad
2 = Good	-4 = Very Bad
1 = Fair	-5 = Disastrous
0 = Neutral	N/A = Not Available

Table 1. The adapted and completed evaluation form for the potential of the ancient harbour of Amathus as an underwater archaeological park (form M. Ktori, after Hannahs 2003: 13) / Πίνακας 1. Η τροποποιημένη και συμπληρωμένη φόρμα αξιολόγησης για τις δυνατότητες του αρχαίου λιμένα της Αμαθούντας ως υποβρύχιου αρχαιολογικού πάρκου (φόρμα Μ. Κτωρή, βάσει Hannahs 2003: 13).

5. Possible dive entry point at the northwest part of the ancient harbour – the view is southwest (photo M. Ktori) / Πιθανό σημείο κατάδυσης στα νοτιοδυτικά του αρχαίου λιμένα – η όψη είναι νοτιοδυτική (φωτ. Μ. Κτωρή).

score is 360 points, with an average of 180 points. For Amathus, the total maximum score is 240 points and the average 120 points. If the average is required to establish an underwater park, Amathus harbour with a total of 165 points and scoring more than 50% in each category, well exceeds that limit. There is more potential as improvements can be made and increase its future scores. One can argue that the creation of an underwater park instead of a preserve would be the optimum solution, given the archaeological importance of the site, the sensitivity of the marine environment and the necessity to regulate activities in the area.

Of course, the harbour needs further promotion and can be used as an educational tool (Rule 35; Maarleveld, Guérin & Egger 2013, 305-308). It can be employed as such by primary and secondary school teachers. The

περιπτώσεις και μια φόρμα αξιολόγησης για την προοπτική ενός χώρου (2003, 11). Ο λιμένας αποτελεί ήδη μέρος της Θαλάσσιας Ζώνης χωρίς όμως να προάγεται πλήρως. Αν κάποιος απαντούσε τις ερωτήσεις της φόρμας, θα διαβάζαμε τα εξής: το κοινό θα εκτιμούσε παραπάνω το χώρο αν είχε πρόσβαση σ' αυτόν· πρόκειται για σημαντικό αρχαιολογικό χώρο που απειλείται από ανεξέλεγκτες ανθρώπινες δραστηριότητες· πρέπει ν' ανασκαφεί πλήρως και να καταγραφεί· το κλείσιμο του χώρου για το κοινό κατά τη διάρκεια της ανασκαφής μπορεί να μην αποτελεί επιλογή· πρέπει να μελετηθούν εναλλακτικές λύσεις. Όπως φαίνεται στον Πίνακα 1, έχω προσαρμόσει τη φόρμα ώστε να αντικατοπτρίζει τις ανάγκες του λιμανιού. Υπάρχουν 18 πεδία σε τέσσερις διαφορετικές κατηγορίες, σε κλίμακα 5 με -5. Οι μέγιστοι συνολικοί βαθμοί είναι 360, με μέσο όρο το 180. Για την Αμαθούντα, η μέγιστη βαθμολογία είναι 240 βαθμοί κι ο μέσος όρος 120. Αν απαιτείται ο μέσος όρος για να δημιουργηθεί ένα υποβρύχιο πάρκο, το λιμάνι της Αμαθούντας συγκεντρώνει 165 βαθμούς και πέραν του 50% σε κάθε κατηγορία, υπερβαίνοντας το μέσο όρο κατά πολύ. Υπάρχουν μεγάλα περιθώρια βελτίωσης που θα αυξήσουν τις μελλοντικές του βαθμολογίες. Θα μπορούσαμε να πούμε ότι

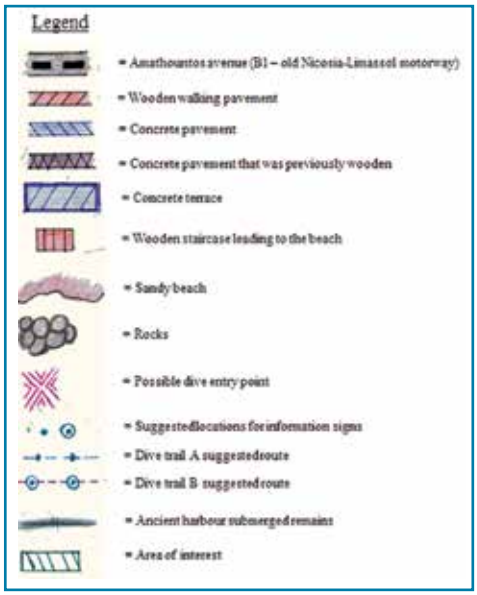
use of Archaeology in a History class makes it more interesting, helps students contextualise concepts, understand and use evidence, and develop historic awareness. Cypriot educators have developed educational material focusing on artefacts (Makriyianni et. al. 2011a and 2011b), and using the city as a large archaeological site (Tuğberk, Pachoulides & Makriyianni 2009). It would be interesting to develop educational material by merging these approaches –since artefacts have been retrieved from the site– with a simplified version for divers. This is a step towards cultivating maritime consciousness from a young age, resulting to respectful adults towards their submerged cultural heritage.

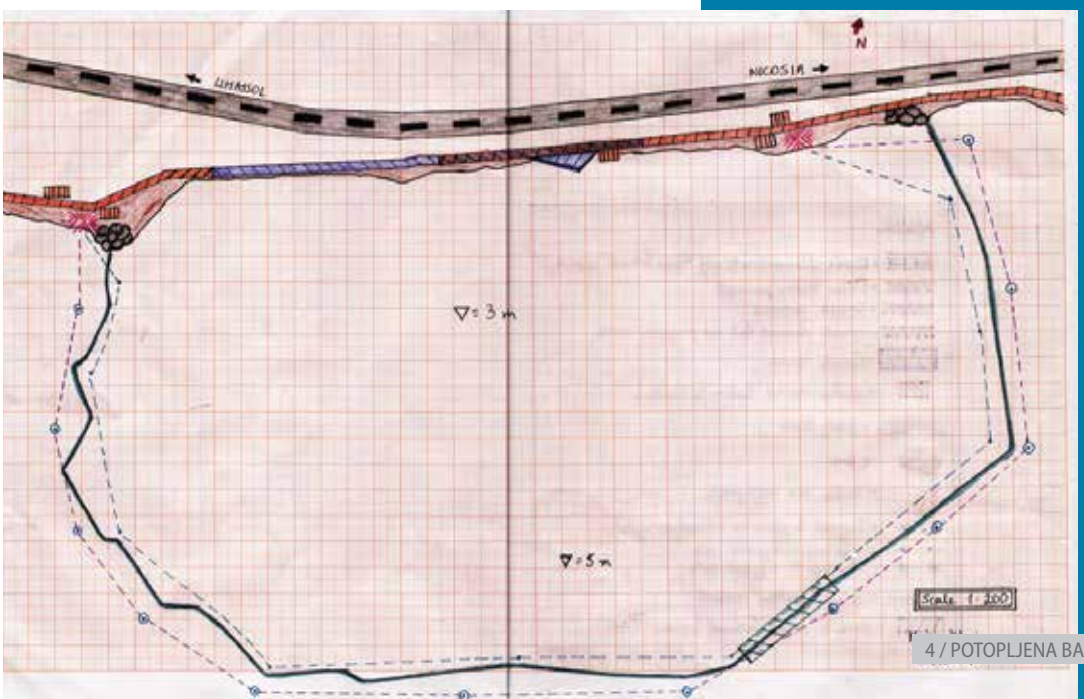
From the three management practices examined, creating a regulated underwater park with incorporated diving trails is the ideal solution. It has never been attempted in Cyprus before and the ancient harbour can be a case study. As it is laborious, establishing a dive trail

η δημιουργία ενός υποβρύχιου πάρκου αντί ζώνης θα ήταν η καλύτερη λύση, δεδομένης της αρχαιολογικής σημασίας του χώρου, του ευαίσθητου θαλάσσιου περιβάλλοντος και της ανάγκης ελέγχου των δραστηριοτήτων στην περιοχή.

Φυσικά το λιμάνι χρειάζεται περαιτέρω προβολή και μπορεί να χρησιμοποιηθεί κι ως εκπαιδευτικό εργαλείο (Κανόνας 35; Maarleveld, Guérin & Egger 2013, 305-308). Μπορεί να χρησιμοποιηθεί ως τέτοιο από εκπαιδευτικούς πρωτοβάθμιας και δευτεροβάθμιας εκπαίδευσης. Η χρήση της Αρχαιολογίας στο μάθημα της Ιστορίας το κάνει πιο ενδιαφέρον, βοηθά τους μαθητές να κατανοούν έννοιες και στοιχεία που μετά τα χρησιμοποιούν, κι αναπτύσσουν ιστορική κατανόηση. Κύπριοι εκπαιδευτικοί έχουν αναπτύξει εκπαιδευτικό υλικό για τεχνουργήματα (Makriyianni et. al. 2011a and 2011b), καθώς και για την πόλη ως ένα μεγάλο αρχαιολογικό χώρο (Tuğberk, Pachoulides & Makriyianni 2009). Θα ήταν ενδιαφέρουσα η ανάπτυξη εκπαιδευτικού υλικού που να συνδυάζει τις δυο προσεγγίσεις, αφού έχουν βρεθεί τεχνουργήματα στο χώρο, καθώς και σε απλοποιημένη μορφή για δύτες. Αυτό είναι ένα βήμα προς την ευαισθητοποίηση από νεαρή ηλικία απέναντι της ενάλιας πολιτιστικής κληρονομιάς με απώτερο στόχο τη γαλούχηση ευσυνείδητων ενηλίκων.

Από τις τρεις πρακτικές διαχείρισης που εξετάστηκαν, η δημιουργία ενός ελεγχόμενου υποβρύχιου πάρκου που θα ενσωματώνει μονοπάτια καταδύσεων είναι η ιδανική λύση. Κάτι τέτοιο δεν έχει γίνει προηγουμένως στην Κύπρο και ο αρχαίος λιμένας μπορεί να αποτελέσει τη βάση για μελλοντικά πάρκα. Επειδή είναι χρονοβόρο, το μονοπάτι καταδύσεων μπορεί ν' αποτελέσει μια πρώτη λύση. Τον Απρίλιο του 2014, λήφθηκαν μετρήσεις και φωτογραφίες





6. Scaled sketch map of the submerged harbour (map M. Ktori, after Azorakos 2004 and Hermary et al. 1987 with corrections) / Χάρτης σε κλίμακα του υποθαλάσσιου λιμένα (χάρτης Μ. Κτωρή, βάσει των Azorakos 2004 και Hermary et al. 1987 με διορθώσεις).

can be an initial solution. In April 2014, measurements and photos were taken during a field survey at Amathus to explore this possibility further (Fig. 4-7).

A dive trail regulates diving traffic and alleviates any stress imposed on the harbour remains. The proposed trails give the opportunity to divers to explore the harbour in two ways. They can either explore the harbour basin externally or internally. Information signs along the routes would give a basic historical outline of the period during which the harbour had flourished, information on the excavations, local marine ecology and future plans (Fig. 6).

In conclusion, the harbour of Amathus deserves more attention and better promotion. This article attempted to offer an overview of the current situation and problems, while offering alternative solutions and insight to what could later transform into the basis of a complete management plan for the site.

κατά τη διάρκεια επισκόπησης πεδίου στην Αμαθούντα, ώστε να διερευνηθεί περαιτέρω αυτή η πιθανότητα (Εικ. 4-7).

Το μονοπάτι θα βοηθήσει στον έλεγχο των καταδύσεων και στον περιορισμό οποιασδήποτε έντασης στην οποία υπόκεινται τα κατάλοιπα του λιμανιού. Τα προτεινόμενα μονοπάτια δίνουν την ευκαιρία στους δύτες να εξερευνήσουν το λιμάνι με δυο τρόπους. Μπορούν είτε να εξερευνήσουν τη λεκάνη εσωτερικά ή εξωτερικά. Κατά μήκος της διαδρομής θα υπάρχουν πινακίδες με πληροφορίες που θα δίνουν συνοπτικά τα ιστορικά στοιχεία της περιόδου άνθισης του λιμανιού, πληροφορίες για τις ανασκαφές, την τοπική θαλάσσια ζωή και τα μελλοντικά σχέδια (Εικ. 6).

Συμπερασματικά, το λιμάνι της Αμαθούντας αξίζει περισσότερη προσοχή και προβολή. Στο άρθρο αυτό επιχειρείται μια σύνοψη της τωρινής κατάστασης και των προβλημάτων, και παράλληλα αναπτύσσονται πιθανές εναλλακτικές λύσεις που θα μπορούσαν μελλοντικά ν' αποτελέσουν τη βάση για ένα ολοκληρωμένο διαχειριστικό έργο του χώρου.

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Illyrian Coastal Exploration Program 2014 Underwater Field School

Podvodna terenska škola u okviru Programa istraživanja ilirske obale 2014.

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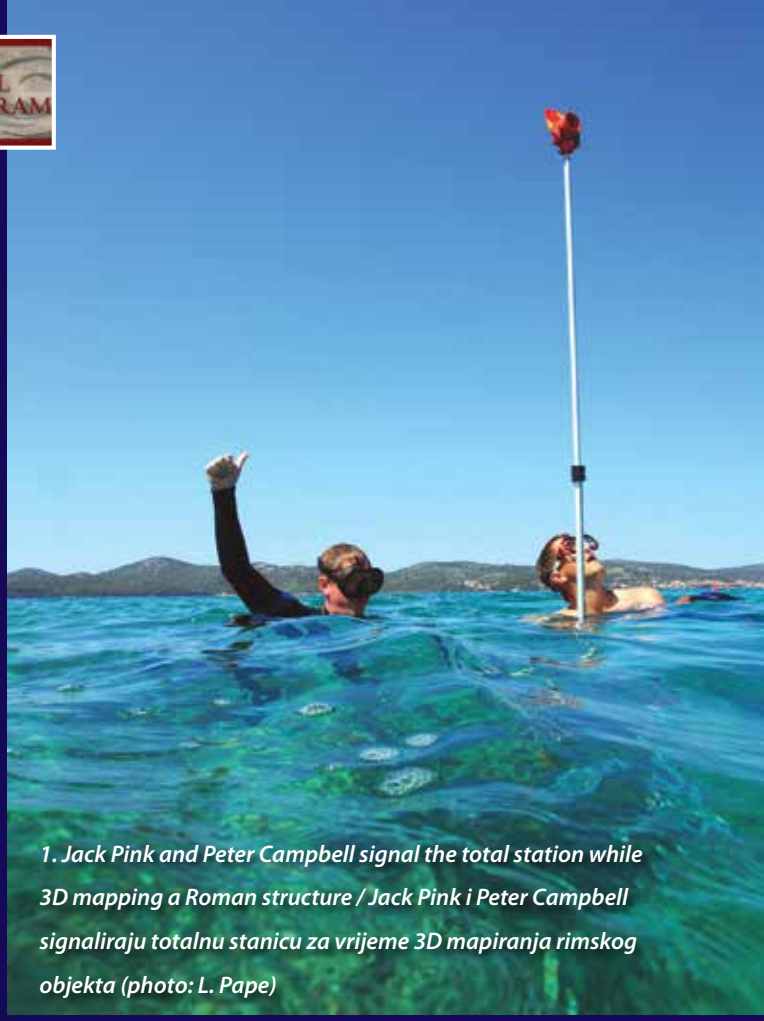

1. Jack Pink and Peter Campbell signal the total station while 3D mapping a Roman structure / Jack Pink i Peter Campbell signaliraju totalnu stanicu za vrijeme 3D mapiranja rimskog objekta (photo: L. Pape)

The Illyrian Coastal Exploration Program (ICEP) returned for its second year of field schools with the International Centre for Underwater Archaeology Zadar (ICUA). The 2013 field school was a great success (Smith et al. 2013) and the 2014 season built upon this success. The team completed more than 200 dives recording archaeology and coastal ecology during the two-week season. The foci of this year's fieldwork were submerged structures around Zadar County, likely dating to the Roman Period.

2. ICUA archaeologist Mladen Pešić describes an amphora type to the students / Arheolog MCPA-e Mladen Pešić studentima opisuje tip amfore (photo: L. Smith)

Program istraživanja ilirske obale (Illyrian Coastal Exploration Program, ICEP) vratio se za drugu godinu terenskih škola u suradnji s Međunarodnim centrom za podvodnu arheologiju u Zadru (MCPA). Terenska škola 2013. bila je pun pogodak (Smith et al. 2013.), a sezona 2014. nastavila se na taj uspjeh. Ekipa je izvela preko dvjesto zarona bilježeći arheologiju i obalnu ekologiju za vrijeme dvotjedne sezone. U fokusu ovogodišnjeg terenskog rada bili su potopljeni objekti diljem Zadarske županije koji vjerojatno potječu iz rimskog razdoblja.

ICEP je istraživačka skupina koju je osnovao dr. Jeff Royal, ravnatelj Pomorske zaklade RPM (RPM Nautical Foundation), sa ciljem integracije istraživanja uzduž istočne obale Jadranskog mora (Royal 2012), koja je dovela do višestrukih suradnji s MCPA-om (Bekić, Šimičić 2013). Peter Campbell i Derek Smith vode terenske škole ICEP-a zajedno s osobljem koje čine dr. Chris Begley, dr. Derek Irwin, mr. Liz Smith, Lee Pape, Tim Dwyer i Nicholas Bartos. Tečaj su vodili zajedno s dr. Lukom Bekićem i arheolozima MCPA Mladenom Pešićem, Marinom Šimičić i Rokom Surićem. U Programu su sudjelovali i gostujući predavači – stručnjaci, David Selmo i Donat Petricioli. Ovo se zajedničko nastavničko osoblje MCPA / ICEP-a izmjenjivalo u održavanju predavanja, praktičnih vježbi i terenskog rada.

3. Students found a target using side scan sonar and then dove on the wreck / Studenti pronalaze cilj koristeći bočni sonar te potom rone do brodoloma (photo: S. Weise)

ICEP is a research group created by RPM Nautical Foundation director Dr Jeff Royal to integrate research along the eastern Adriatic coastline (Royal 2012), which has led to multiple collaborations with the ICUA (Bekić, Šimičić 2013). ICEP field schools are directed by Peter Campbell and Derek Smith together with a staff composed of Dr Chris Begley, Dr Derek Irwin, Liz Smith, MFA, Lee Pape, Tim Dwyer, and Nicholas Bartos. The course was directed together with Dr. Luka Bekić and ICUA archaeologists Mladen Pešić, Marina Šimičić, and Roko Surić. The program also featured specialist guest lectures by David Selmo and Donat Petricioli. This joint ICUA/ICEP faculty rotates between lectures, practical exercises, and fieldwork.

The course is designed for advanced undergraduate or graduate students without prior maritime archaeology or coastal ecology training. Students begin by studying the Nautical Archaeology Society's orientation coursework to become familiar with a variety of field methods. Building on this foundation, students are taken through a series of practical fieldwork exercises including artifact drawing and photography, excavation methods and dredging, reflectance transformation imaging (RTI), digital methods and photogrammetry, sidescan sonar, ecological transect surveys, and total station operation. This suite of skills prepares students for graduate school and the job market.

Fieldwork was conducted in the morning and followed by formal lectures in the ICUA classroom. Lecture topics included theory and ethics, research design, conservation of wet finds, museum and site development, field methods in ecology, site formation processes, underwater excavation, remote sensing, shipboard life, ship construction, maritime cultural

Tečaj je namijenjen naprednim preddiplomskim i diplomskim studentima bez prethodne obuke u području podvodne arheologije ili obalne ekologije. Studenti prvo pohađaju orijentacijska predavanja Pomorskog arheološkog društva (Nautical Archaeology Society) kako bi se upoznali s raznim metodama terenskog rada. Nastavljajući na tim temeljima, studente se vodi kroz niz praktičnih terenskih vježbi, uključujući crtanje i fotografiranje predmeta, metode iskopavanja i vađenja mulja, izradu slikovnog prikaza pretvorbom odraza (Reflectance transformation imaging, RTI), digitalne metode i fotogrametriju, bočni sonar (sidescan sonar),

4. Students conduct an ecology transect / Studenti obavljaju ekološki transekt (photo: L. Pape)

istraživanje ekološkog transekta te rad s totalnom stanicom. Ovim zbirom vještina studente se priprema za diplomske studije i tržište rada.

Terenski se rad provodio ujutro, nakon čega su slijedila formalna predavanja u učionici MCPA-e. Teme predavanja uključivale su teoriju i etiku, osmišljavanje istraživanja, konzervaciju mokrih nalaza, razvoj muzeja i nalazišta, terenske metode u ekologiji, procese nastanka nalazišta, podvodno iskopavanje, daljinsko opažanje, život na brodu, brodogradnju, pomorski kulturni pejzaž, slatkovodnu ekologiju, ekologiju dalmatinske obale, eksperimentalnu arheologiju, osmišljavanje pokusa, digitalni identitet, znanstvenu komunikaciju te digitalne i 3D metode. Arheološka nalazišta pregledana ove sezone uključuju lučki objekt kod Sukošana, mol u Kumentu blizu Biograda na moru te nekoliko sidrišta uzduž Zadarskog kanala. Ovi lučki objekti čine dio rekognosciranja podmorja Zadarske županije koje provodi MCPA, a o kojemu se detaljnije pisalo u prošlogodišnjem broju Potopljene baštine (Pešić 2013.). Istraživanjima

5. Recording a port sherd in situ during the survey / Snimanje keramičkog ulomka in situ tijekom rekognosciranja (photo: T. Dwyer).

landscapes, freshwater ecology, ecology of Dalmatian coast, experimental archaeology, experiment design, digital identity, science communication, and digital and 3D methods.

Archaeological sites surveyed this season include a harbor structure at Sukošan and a rubble quay at Kumenat near Biograd na Moru, as well as several anchorages along the Zadar Channel. These harbor structures are part of the ICUA's Zadar County Survey and detailed in last year's Submerged Heritage (Pešić 2013). The 2014 research examined both archaeological and ecological aspects of each site. Mladen Pešić's (2013) research shows the Sukošan structure was likely part of a villa rustica dating to the 3rd to 4th centuries AD. The Kumenat structure shows evidence of trade including tegulae, amphora sherds, and ballast stone, which Pešić estimates to date around the 1st century AD. The maritime cultural landscape encapsulating these structures will be discussed in an upcoming Oxford University MPhil dissertation by Nicholas Bartos.

Classes taught by Dr. Bekić and the ICUA staff involved practical use and demonstration of the Centre's specialties including remote sensing, underwater excavation methods, and the material culture of the region. A remote sensing survey taught students in the field aboard the ICUA's research vessel near the island of Ugljan. Students learned how to operate a sidescan sonar while searching for a fishing vessel that sank decades ago. Once a candidate target was identified, they dove to ground truth the signal and located the wreck.

6. A tableware fragment found during the survey / Ulomak posuđa pronađen tijekom rekognosciranje (photo: L. Pape).

7. A nudibranch found during the ecology survey / Morski puž golać pronađen tijekom ekološkog pregleda (fotografija: L. Pape). (photo: L. Pape).

provedenim 2014. ispitani su kako arheološki tako i ekološki aspekti svakog nalazišta. Istraživanja Mladena Pešića (2013.) pokazuju da je objekt kod Sukošana vjerojatno bio dio rimske ladanjske vile (villa rustica) iz razdoblja 3. do 4. st. Objekt kod Kumenta pokazuje dokaze trgovine, uključujući tegule, ulomke amfora te balastno kamenje, za koje Pešić procjenjuje da potječu iz razdoblja oko 1. st. Pomorski kulturni pejzaž koji obuhvaća ove objekte bit će tema skorog magistarskog rada Nicholasa Bartosa na Sveučilištu u Oxfordu.

Predavanja dr. Bekića te osoblja MCPA-e uključivala su praktičnu uporabu i prikazivanje specijalističkog rada u Centru, uključujući daljinsko opažanje, metode podvodnog iskopavanja te materijalnu kulturu regije. Daljinsko opažanje predstavljeno je studentima na istraživačkom brod MCPA-e blizu otoka Ugljana. Studenti su naučili kako upravljati bočnim sonarom tražeći ribarski brod koji je potonuo prije nekoliko

8. Dr. Bekić teach students about the sonar system / Dr. Bekić podučava studente o sonarskom sustavu (photo: T. Dwyer).

9. Staff and students (from left to right) / Osoblje i studenti (s lijeva na desno): Svenja Weise, Derek Smith, Jack Pink, Mladen Pešič, Steven Lopez, Kelsey Dwyer, Elizabeth Krueger, Lee Pape, Nicholas Bartos, Marina Šimičić, Peter Campbell, and Tim Dwyer. Missing are / Nedostaju : Luka Bekić, Roko Surić, Liz Smith, Derek Irwin, and Chris Begley (photo: L. Smith)

Fieldwork and lectures were supplemented by visits to some of the extraordinary museums in the Zadar region. Students visited the Zadar Archaeological Museum to get a grasp of comparative artifacts from the Paleolithic through Late Medieval Period. Biograd na Moru Regional Museum is an incredible local museum that houses the 16th century Gnalić shipwreck collection. The Museum of Nin Antiquities contains artifacts from Roman Aenona as well as the early Christian period. Museum highlights included a sewn Roman era vessel and two 11th century AD vessels excavated in the ancient harbor.

There were also opportunities to connect in real time with researchers and the general public internationally. We organized a live two-way video chat with researchers living and working underwater in the Aquarius marine laboratory as part of Mission 31, a record-setting human habitat experiment. We also connected via live video with children at Seattle Aquarium, who asked questions of our field school participants about underwater research in the Mediterranean. Connecting people internationally, and within Croatia, is one of the greatest capacities of ICEP.

With another great year in the books, the ICEP staff looks forward to future projects with the ICUA connecting the resources of the Centre and RPMNF through ICEP education programs. We would like to thank Luka, Mladen, Marina, and Roko, as well as the rest of the ICUA, for hosting this year's ICEP field school. Special thanks to students Kelsey Dwyer, Elizabeth Krueger, Ernie Steven Lopez, Jack Pink, and Svenja Weise.

desetljeća. Nakon što je mogući cilj identificiran, zaronom se potvrdio signal i lociralo brodolom.

Terenski rad i predavanje popraćeni su posjetima nekim od izvanrednih muzeja u zadarskoj regiji. Studenti su posjetili Arheološki muzej Zadra da steknu bolje razumijevanje usporedbe predmeta od razdoblja paleolitika do kasnog srednjeg vijeka. Zavičajni muzej Biograd na moru je sjajni lokalni muzej i dom zbirke brodoloma kod Gnalića iz 16. stoljeća. U Muzeju ninskih starina čuvaju se predmeti iz rimske Aenone i razdoblja ranog kršćanstva. Najvredniji nalazi u muzeju su rimski brod šivane konstrukcije te dva broda iz 11. stoljeća iskopana u staroj luci.

Bilo je i prilika za razgovor u realnom vremenu s istraživačima i širom publikom u svijetu. Organizirali smo dvosmjerni video razgovor uživo s istraživačima koji žive i rade ispod morske površine u podmorskom laboratoriju Aquarius u sklopu projekta Mission 31, pokusom ljudskog staništa u kojem su postavljeni mnogi rekordi. Također smo se spojili putem videa uživo s djecom u Akvariju u Seattleu koji su pitali sudionike terenske škole o podvodnim istraživanjima u Mediteranu. Spajanje ljudi u inozemstvu i unutar Hrvatske jedna je od najznačajnijih mogućnosti ICEP-a.

Nakon još jedne izvrsne godine, osoblje ICEP-a raduje se budućim projektima s MCPA-om, povezujući resurse Centra i RPMNF-a kroz obrazovne programe ICEP-a. Željeli bismo zahvaliti Luki, Mladenu, Marini i Roku i svima ostalima u MCPA za njihovo domaćinstvo ovogodišnje terenske škole ICEP-a. Posebno se želimo zahvaliti studentima Kelsey Dwyer, Elizabeth Krueger, Ernieju Stevenu Lopezu, Jacku Pinku i Svenji Weise.

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Underwater archaeological excavations at the pile-dwelling Vrbnik 2014

Подводни археолошки истражувања на локалитетот Врбник 2014

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The pile-dwelling Vrbnik is situated in the Northern coast of the Ohrid Lake (fig. 1), between the City of Struga and the village of Kalista, in a shallow bay in depth of 3 to 4 meters. It was first noticed in the eighties of the previous century. The first underwater archaeological excavations were made in 1998 and continued in 2001 and 2003 as a mutual project between the "Museum of Macedonia" and the Museum "Dr Nikola Nezlobinski" from Struga.

Underwater archaeological excavations continue in 2012 and 2013 under the leadership of the Museum "Dr Nikola Nezlobinski" from Struga. With these excavations the borders of the pile-dwelling have been approximated, and

1. Pile-dwelling Vrbnik (Google Map) / Локалитет Врбник (Google map)

Локалитетот Врбник се наоѓа на северниот брег од Охридското Езеро (сл.1), помеѓу градот Струга и селото Калишта во плиткиот залив на длабочина од 3 до 4 метри. Прв пат е забележан во осумдесетите години на минатиот век.

Првите подводни археолошки истражувања се направени 1998 година и продолжиле во 2001 и 2003 година како заеднички проект на "Музеј на Македонија" и Народниот музеј "Др. Никола Незлобински" од Струга.

Подводните археолошки истражувања продолжуваат во 2012 и 2013 година под раководство на Народниот музеј "Др. Никола Незлобински" од Струга. Со овие истражувања приближно се одредени границите на наколната населба, а според движниот археолошки материјал локалитетот можеме да го сместиме во рамките на железно време во Македонија, XI – VI век п.н.е.

Истражувањата продолжија и оваа година под раководство на директорот на музеј Струга д-р Сашо Цветковски кој е и координатор на екипата составена од раководителот на проектот Цветлана Кочоска, двајца подводни археолози со сертификати од Интернационалниот Центар за Подводна Археологија од Задар - Никола Паскали и Валентина Тодоровска, нуркачите Александар Булески и Васко Јолески како и

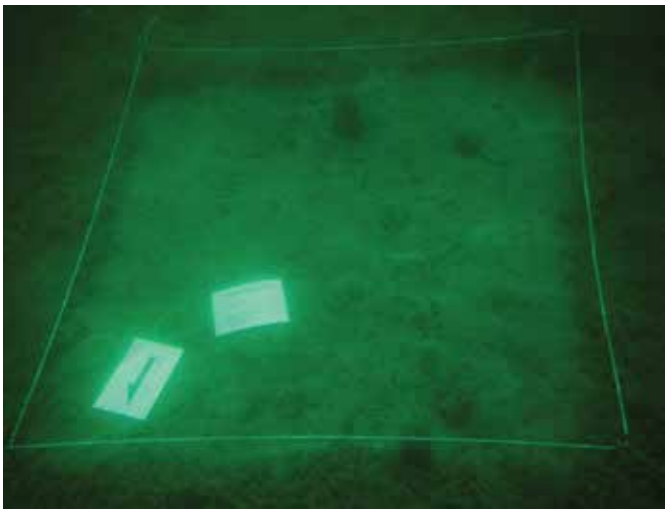
2. Pile-dwelling Vrbnik (photo N. Paskali) / Локалитет Врбник (фото: Никола Паскали)

according to the movable archaeological material the site can be placed in the frames of Iron Age of Macedonia, XI –VI century B.C.

The excavations have continued this year under the leadership of the manager of the Museum of Struga Dr Sašo Cvetkovski who is also a coordinator of the team consisting of the project leader Svetlana Kočoska, two underwater archaeologists with certificates from the International Centre for Underwater Archaeology from Zadar - Nikola Paskali and Valentina Todorovska, the divers Aleksandar Buleski and Vasko Joleski as well as the captain Boro Korkutoski. The goal of this year research is to conduct trench excavation of this site in the central part, to determine if there exist or not older cultural layers.

We began preparing the terrain and we estimated the condition of the site and so it was confirmed that the site is in a good position. There were very small interventions to the square net placed previous years, which we tightened it because a flexible rope has been used and it was loosened due to constant presence of the water.

The trench with dimensions 2x2 m (fig. 3) is added to the old square net to the unexplored part which is situated in the central part of the pile-dwelling. From the earlier excavations it is known that after the layer of grey sludge with thickness of about 20cm appears a layer of yellowish clay. We carefully removed the natural vegetation (fig. 4) and we took it to the surface (fig. 5) to be examined in detail because we have information from earlier excavations that small movable finds have been discovered as: baits, small knives, needles etc. Most probably, the plants growing lift-

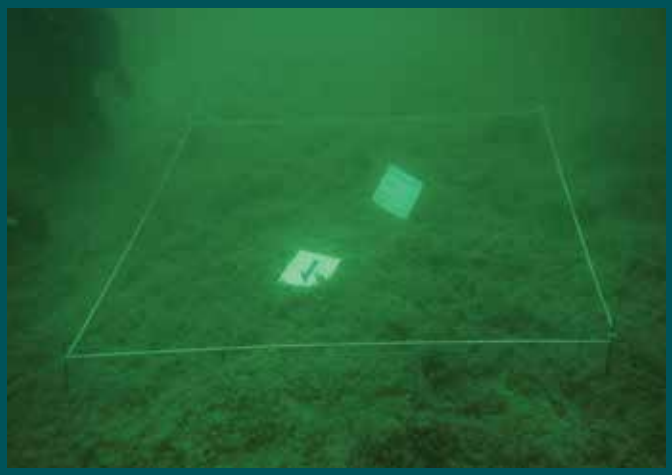


4 . Removed natural vegetation (photo N. Paskali) / Отстранета природна вегетација (фото: Н. Паскали)

капетанот Боро Коркутоски. Целта на овогодинешните истражувања е да се направи сондажно истражување на овој локалитет во централниот дел, за да се утврди дали има или не постари културни слоеви.

Започнавме со припреми на теренот и ја проценивме состојбата на локалитетот со што се увиде дека локалитетот е во добра состојба. Имаше мали интерванции врз квадратната мрежа поставена предходните години која ја затегнавме бидејќи е користено флексибилно јаже кое се разлабавува поради константното присуство на водата.

Сондата со димензии 2 х 2 метри (Сл.3) е надоврзана на старата кавдратната мрежа на неистражен дел кој се наоѓа во централниот дел од наколната населба. Од предходните истражувања ни е познато дека после слојот од сив муљ кој е со дебелина од околу 20см доаѓа слој од жолтеникава глина.



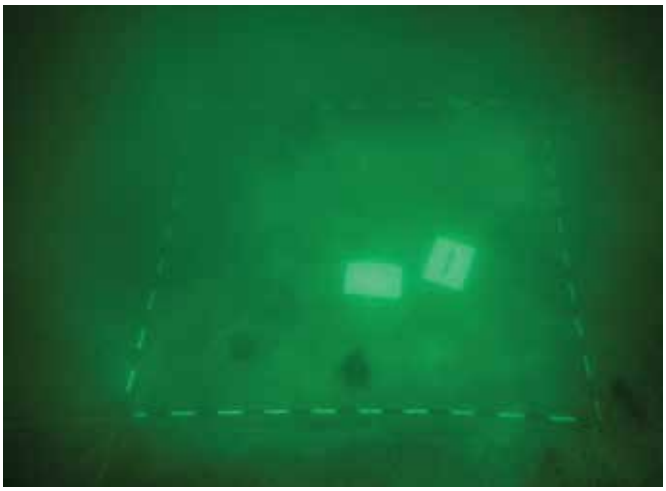
3. Trench 2x2 meters (photo N. Paskali) / Сонда 2х2 метри (фото: Н. Паскали)

Природната вегетација внимателно ја отстранивме (Сл.4) и ја извадивме на површина (Сл.5) детално да се прегледа бидејки од предходните истражувања имаме информации дека се пронајдени ситни движни наоди како што се: јадици, мали ножиња, игли и тн. Најверојатно, растенијата растејќи ги подигнале ситните и лесни наоди на површината и така можат да се најдат низ природната вегетација.

Сондата која на почетокот беше изработена од јажиња прицврстени на железни шипки забодени на дното, ја заменавме со статичен метален квадрат (Сл.6) со исти димензии поставен на истото место.
Со отстранувањето на природната вегетација на површината може да се забележи поголемо присуство

5. Natural vegetation on the surface (photo N. Paskali) / Статичен квадрат (фото: Н. Паскали)

ed the small and light finds to the surface and so they can be discovered through the natural vegetation.



6. Static square (photo N. Paskali) / Статичен квадрат (фото: Н. Паскали)

We replaced the trench which was primarily made of ropes attached to iron bars stuck into the bottom, by a static metallic square (fig. 6) with the same dimensions put on the same place.

7. Ceramic fragments (photo S.Kočoska) / Фрагменти керамика (фото: Ц. Кочоска)

9. Water dredger (photo N. Paskali) / Мамут пумпа (фото: Н. Паскали)

на фрагментирана керамика која е црвено, портокалово и сиво печена, непрочистена. Фрагментите се позиционирани, нанесени на цртеж и отстранети (Сл.7). Ископувавме со мамут пумпа која беше поставена одма над квадратот (Сл.8,9).

На делот од цревото каде што се исфрла отпадниот материјал поставивме мрежа за собирање на пропуштените ситни наоди. Мрежата често ја проверувавме и чистевме.

Започнавме со шмукање на површинската сива муљ (Сл.10) низ која можеа да се забележат помали фрагменти

By removing the natural vegetation to the surface, a large presence of fragmented ceramics can be seen, which is red, orange or grey baked, unpurified. The fragments are positioned, placed on drawing and removed (fig. 7). We excavated by using water dredger which was placed right over the square (fig. 8, 9).

To the part of the hose where the waste material is thrown out we put a net for collecting small finds. We often checked and cleaned the net.

We started by suction of the surface grey sludge (fig. 10) through which we could notice smaller fragments of ceramics. We sucked up slowly and with great attention concentrating on miniature movable finds. We also noticed that there are two layers of grey sludge, the first one lighter in color, and the second one darker and thicker. The first layer or Appearance 1 is 8cm thick, and the second layer of grey sludge or Appearance 2 is 12cm thick. We systematically sucked the grey sludge until reaching the

11. Top of spear in situ (photo N. Paskali) / Врв од копје in situ (фото: Н. Паскали)

yellowish clay layer. It is interesting to say that during suction of Appearance 2 in the northern part of the trench we came across a spear top (fig. 11). It is an iron spear with length of 12,1cm (fig. 12) and is the only sample of this type discovered at this site. Also, with the excavations in the past, whole ceramic crockery with different shapes and use have been discovered, different iron and bronze objects, and one monoxile with length of about 4,5 meters.

10. Suction of Appearance 1 (photo N. Paskali) / Шмукање на појава 1 (фото: Н. Паскали)

керамика. Шмукавме полека и со големо внимание, концентрирани на минијатурните движни наоди. Исто така забележавме дека има два слоја сива муљ од кои првиот е посветол, а вториот е потемен и подебел. Првиот слој или Појава 1 е со дебелина од 8см, а вториот слој од сивата муљ или Појава 2 е со дебелина од 12см.

Систематски ја шмукавме сивата муљ додека не дојдовме до слојот од жолтеникава глина. Интересно е да се каже дека за време на шмукањето на појава 2 во северниот дел од сондата наидовме на врв од копје (Сл.11). Копјето е железно со должина од 12,1 cm (Сл.12) и е единствен ваков примерок од овој тип откриен на овој локалитет. Исто така со истражувањата во минатото се откриени цели керамички садови со најразлична форма и намена, најразлични железни и бронзени предмети, како и еден моноксил со должина од оклу 4,5 метри.

12. Top of spear front side (photo N. Paskali) / 12 Врв од копје предна страна (фото: Н. Паскали)

14, 15, 16. Trech 1 (photo N. Paskali) / 14,15,16 Сонда 1 (фото: Н. Паскали)

Because of limited assets we divided the trench in four squares with dimensions 1x1 meters and we excavated only one of them (fig. 14, 15, 16).

The excavation of clay was difficult because of the small space and the depth of excavation. While excavating we could feel the changes in the color and structure of the clay. The color of the clay changed from yellow to ochre, white. At certain levels the concentration of decomposed white shells is increasing.

The trench reached depth of 2 meters where more layers of shells and different nuances of yellow clay can be spotted. It is interesting to say that at 90cm there appeared light grey layer with thickness of 3cm at the entire surface. After one meter depth the clay is much lighter and paler unlike the more shallow levels. For these data we are going to consult a geologist, to obtain information about the sedimentation of the clay.

Next year it is planned for underwater archaeological excavations at the pile-dwelling Vrbnik to continue with previously determined aims and tasks. Ohrid Lake with a surface area of about 350 km2 abounds with underwater archaeological sites and has a great potential for development of underwater archaeology in Macedonia. In the so far known and discovered archaeological sites are 9 remains from prehistoric pile-dwelling settlements situated all over the Ohrid Lake coast, sunk boats from the First World War situated at the Struga coast, sunk wooden vessel at the monastery St. Naum and many more smaller and larger sites that are to be discovered and explored in the future.

Поради ограничените средства сондата ја поделивме на четири квадрати со димензии 1x1 метар од кои оваа година истаживме само еден од четирите квадрат (Сл.14,15.16).

Ископувањето во глината се одвиваше отежнато заради малиот простор и длабочината на ископување. Додека ископувавме можевме да ги осетиме промените во бојата и составот на глината. Бојата на глината се менуваше од жолта до окер, бела. На одредени нивоа концентрацијата на разградени бели школки се зголемува.

Сондата достигна длабочина од 2 метри во која можат да се забележат повеќе слоеви на школки и различни жолти нијанси на глината. Интересно е да се каже дека на 90см. се појави светло сив слој кој е со дебелина од 3см и го има низ целата површина. После длабочина од еден метар глината е многу посветла и побледа за разлика од поплитките нивоа. За овие податоци ќе се консултираме со геолог, за добивање информации за седиментацијата на глината.

Следната година се планира да продолжат подводните археолошки истражувања на локалитетот Врбник со однапред определени цели и задачи. Охридското Езеро со површина од околу 350км2 , изобилува со подводни археолошки локалитети и има голем потенцијал за развој на подводната археологија во Македонија. Во досега познатите и откриени подводни археолошки локалитети спаѓаат 9 остатоци од праисториски наколни населби распоредени низ целото крајбрежје на Охридското Езеро, потонатите бродчиња од Првата Светска Војна кои се наоѓаат во струшкото крајбрежје, потонатиот дрвен пловен објект кај манастирот Св. Наум и многу други помали или поголеми локалитети кои допрва треба да се откриваат и истражуваат.

Illyrian Coastal Exploration Program 2014 Scientific Diving Course

Tečaj znanstvenog ronjenja u okviru Programa istraživanja ilirske obale 2014.

1. Pool practice at Višnjik pool, Zadar / Vježba u bazenu u Višnjiku, Zadar (photo: D. Smith)

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The Illyrian Coastal Exploration Program (ICEP) conducted scientific diving courses adhering to American Academy of Underwater Sciences (AAUS) standards in the southeastern Europe during the 2012 and 2013 summer field seasons. These courses were offered through a partnership with the Albanian Center for Marine Research in Sarandë, Albania, and brought together international students and researchers to participate in the first scientific diving training in the country. At the beginning of the 2014 summer field season in Croatia, ICEP offered a two-week intensive Scientific Diving Course through the International Centre for Underwater Archaeology (ICUA) in Zadar. The course was directed by Derek Smith as head instructor and his staff, together with Dr. Luka Bekić and ICUA archaeologists Mladen Pešić, Marina Šimičić, and Roko Surić, all of whom participated as course instructors and as Croatian representatives during all field operations.

2. Some of the exercises are organized at islands near Zadar / Neke su vježbe organizirane na otocima u blizini Zadra (photo: D. Smith)

U okviru Programa istraživanja ilirske obale (Illyrian Coastal Exploration Program, ICEP) tijekom terenskog rada u ljetnim sezonama 2012. i 2013. u jugoistočnoj Europi provedeni su tečajevi znanstvenog ronjenja u skladu sa standardima Američke akademije za podvodne znanosti (American Academy of Underwater Sciences – AAUS) Ti su se tečajevi nudili u okviru partnerstva s Albanskim centrom za istraživanje mora u Sarandë u Albaniji, a okupili su međunarodne studente i istraživače koji su sudjelovali u prvoj obuci znanstvenog ronjenja u toj zemlji. Na početku terenskog rada u ljetnoj sezoni 2014. u Hrvatskoj ICEP je ponudio dvotjedni intenzivni tečaj znanstvenog ronjenja u Međunarodnom centru za podvodnu arheologiju (MCPA) u Zadru. Tečaj je vodio Derek Smith kao glavni instruktor i njegovo osoblje, zajedno s dr. Lukom Bekićem i arheolozima MCPA Mladenom Pešićem, Marinom Šimičić i Rokom Surićem, koji su sudjelovali kao instruktori tečaja i kao hrvatski predstavnici tijekom aktivnosti na terenu.

Jedinstveni aspekt tečaja bio je da se postupalo u skladu sa standardima znanstvenog ronjenja Američke akademije za podvodne znanosti (AAUS) i zajedničkim praksama za priznavanje europskih razina kompetencija za znanstveno ronjenje na radu Europskog odbora za znanstveno ronjenje (European Scientific Diving Panel – ESDP) Omogućeno je i priznanje Australazijskog programa za akreditaciju ronioca (Australasian Diver Accreditation Scheme – ADAS) kroz

The unique aspect of the course was that it adhered to both the American Academy of Underwater Sciences (AAUS) Standards for Scientific Diving and the European Scientific Diving Panel (ESDP) Common Practices for Recognition of European Competency Levels for Scientific Diving at Work. Recognition from the Australasian Diver Accreditation Scheme (ADAS) was also made possible through instruction and assessment by a representative of ADAS during the course. At the time of writing, the authors know of no other course that has effectively allowed recognition of the students' scientific diver training across three continents - a first ever course to meet all of the criteria of the international standards and offer this comprehensive outcome. This model can be applied to future international course offerings and helps lay the groundwork for a common worldwide scientific diving training standard.

Staff and students originating from Australia, Austria, Croatia, Cyprus, England, Estonia, Germany, Scotland, and the United States came together for the course, including the current Presidents of the ESDP and AAUS and the Training and Assessment Coordinator from ADAS. Upon completion of all requirements, the students were certified as AAUS Scientific Divers and ESDP European Scientific Divers as well as receiving recognition of training from ADAS. The ESDP certifications were the first issued through the Coordination of Scientific Divers of Croatia, the national organization created to oversee the training and administration of scientific divers in Croatia.

The course exposed students to a variety of habitat types found along the northern Croatian coastline and introduced them to best practices for conducting hypothesis-based research, environmental survey, and archaeological methods. Students completed twenty dives during the two-week course and ex-

3. Practicing diver first aid on board Rava / Vježba pružanja prve pomoći roniocu na brodu Rava(photo: D. Smith)

upute i procjene koje je tijekom tečaja proveo predstavnik ADAS-a. U trenutku pisanja ovog teksta autori nisu znali ni za kakav drugi tečaj u okviru kojega je stvarno omogućeno priznanje obuke studenata za znanstveno ronjenje na tri kontinenta – ovo je uopće bio prvi tečaj koji je ispunio sve kriterije međunarodnih standarda i ponudio ovaj sveobuhvatni ishod. Ovaj se model može primijeniti na buduće međunarodne ponude tečajeva i pomaže u postavljanju temelja za zajednički svjetski standard obuke za znanstveno ronjenje.

Na tečaju su se okupili osoblje i studenti iz Australije, Austrije, Hrvatske, Cipra, Engleske, Estonije, Njemačke, Škotske i Sjedinjenih Država, uključujući aktualne predsjednike ESDP-a i AAUS-a te koordinatora za obuku i procjenu iz ADAS-a. Nakon uspješno završenog tečaja studenti su certificirani kao Znanstveni ronioci prema standardima AAUS-a i Europski znanstveni ronioci prema standardima ESDP-a te su primili priznanje ADAS-a o obavljenoj obuci.

4. Night dive practice near Zadar / Vježba noćnog ronjenja u blizini Zadra (photo: D. Smith)

Certifikati ESDP-a bili su prvi certifikati izdani preko Koordinacije znanstvenih ronilaca Hrvatske, nacionalne organizacije osnovane za nadzor obuke i koordinacije znanstvenih ronilaca u Hrvatskoj.

U okviru tečaja studenti su upoznati s raznolikošću vrsta staništa uzduž sjeverne hrvatske obale te su im predstavljene najbolje prakse za provođenje istraživanja koja se temelje na pretpostavkama, istraživanja okoliša te arheološke metode. Studenti su tijekom dvotjednog tečaja obavili dvadeset zarona i iskusili široki raspon ronilačkih tehnika i okolina poput scenarija spašavanja, vađenja, vođenja hitnih akcija u

perienced a wide range of diving techniques and environments such as rescue scenarios, extractions, emergency diving accident management, navigation techniques, search and light salvage, habitat quantification, assessment of fish populations, artifact and site recording, deeper and night diving considerations, tethered diver and communication operations, and blue water diving techniques.

Despite the fast-paced and rigorous nature of the diving schedule, all ICEP programs seek to balance field logistical experience with high-level academic coursework designed for graduate and undergraduate students conducting their own research and leading their own scientific diving teams. The students learned academic modules in classroom sessions taught by experts in the field from a range of national and international institutions. Academic topics included diving physics and physiology, decompression theory, dive tables and computers, physical and biological oceanography, marine geology and ecological site formation, hazardous marine life identification and prevention of injuries, enriched air nitrox theory and application, equipment maintenance and field repair, and science communication and social media relations.

The students and staff of the 2014 ICEP Scientific Diving Course came from diverse academic and technical backgrounds to form a truly integrated, multi-disciplinary training effort. We would like to thank Luka, Mladen, Marina, and Roko, as well as the rest of the ICUA Zadar, for hosting this year's course. Special thanks to students Kelsey Dwyer, Maria Ktori, Ernie Steven Lopez, Carmen Tania Obied, Jack Pink, Maili Roio, Anya Rutter, David Selmo, Megsie Siple, Esther Unterweger, and Svenja Weise.

slučaju nezgoda pri ronjenju, navigacijskih tehnika, potrage i spašavanje pod svjetlom, kvantitativne procjene morskih staništa, procjena ribljih populacija, evidentiranje predmeta i nalazišta, značajki dubljeg i noćnog ronjenja, vezanog ronioca i komunikacije te tehnika ronjenja u dubokim vodama.

Usprkos brzom i strogom ritmu rasporeda ronjenja, svi programi ICEP-a nastoje uskladiti logističko iskustvo na terenu i akademski rad na visokoj razini namijenjen diplomskim i preddiplomskim studentima koji provode vlastita istraživanja i vode vlastite timove znanstvenih ronilaca. Studenti su akademske module učili na predavanjima u učionicama koje su vodili stručnjaci u tom području iz niza domaćih i međunarodnih institucija. Akademske teme uključivale su fiziku i fiziologiju ronjenja, teoriju dekompresije, tablice ronjenja i računala, fizičku i biološku oceanografiju, geologiju mora i oblikovanje ekološkog lokaliteta, identifikaciju opasnih morskih organizama i sprečavanje ozljeda, teoriju i primjenu obogaćenog zraka (nitroksa), održavanje opreme i popravke na terenu te znanstvenu komunikaciju te odnose s društvenim medijima.

Studenti i osoblje ICEP-ovog Tečaja znanstvenog ronjenja različitog akademskog i tehničkog iskustva ovaj su tečaj učinili uistinu integriranim i multidisciplinarnim. Željeli bismo zahvaliti Luki, Mladenu, Marini i Roku i svima ostalima u MCPA-i u Zadru za njihovo domaćinstvo ovogodišnjeg tečaja. Posebno se želimo zahvaliti studentima Kelsey Dwyer, Mariji Ktori, Ernieju Stevenu Lopezu, Carmen Taniji Obied, Jacku Pinku, Maili Roio, Anyi Rutter, Davidu Selmou, Megsie Siple, Esther Unterweger i Svenji Weise.

4. 2014 Zadar Scientific diving course students and instructors / Studenti i instruktori tečaja znanstvenog ronjenja 2014. u Zadru (photo: D. Smith)

Conservation and Restoration Work on Metal Finds from the Mljet - Sv. Pavao Site

Konzervatorsko-restauratorski radovi na metalnim nalazima s lokaliteta Mljet - Sv. Pavao

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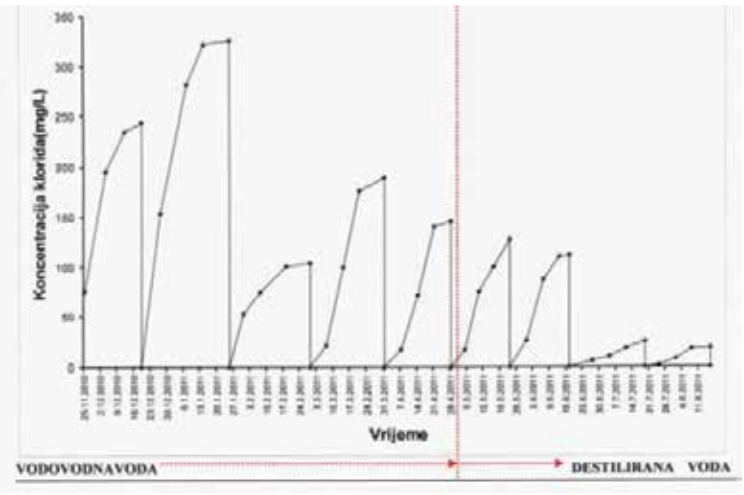
Metal artefacts found during multiannual archaeological research of the post medieval shipwreck at the Mljet - Pličina Sv.Pavao (St Pavao Shallows) underwater site can be divided in terms of metal types into artefacts made of copper alloy, silver, lead and tin. These metals rarely appear in nature in their elementary state and are found primarily as stable ores – as such from the moment they are produced their tendency is to return to their initial natural state and they are highly susceptible to corrosion processes. The metal artefacts found were therefore delivered to the restoration workshop immediately upon extraction so that adequate conservation-restoration treatment would retard the process of their spontaneous mineralisation to the greatest possible extent.

In the preliminary phase of work all received artefacts were recorded and photographed and their state as found documented. The essential desalination process followed documentation of their condition as found in order to free the metal artefacts, which had for many years been exposed to a marine environment, of detrimental salts – chlorides in particular.

The role of chlorides is significant in the corrosion of metal objects and we can say that the problem of their removal is



Metalne predmete koji su pronađeni tijekom višegodišnjeg arheološkog istraživanja novovjekovnog brodoloma na podvodnom lokalitetu Mljet-Pličina Sv.Pavao s obzirom na vrstu metala možemo podijeliti na predmete izrađene od legura bakra, srebra, olova i kositra. Ove vrste metala se u prirodi rijetko javljaju elementarno, nalaze se uglavnom u obliku stabilnih ruda pa od samog trenutka proizvodnje teže vraćanju u svoje prvotno prirodno stanje te su jako podložne korozijskom procesima. Stoga su odmah nakon vađenja iz mora pronađeni metalni predmeti dopremljeni u restauratorsku radionicu kako bi se adekvatnom konzervatorsko-restauratorskom obradom maksimalno usporio proces njihove spontane mineralizacije.

U preliminarnoj fazi rada svi zaprimljeni predmeti su popisani i fotografirani te je dokumentirano njihovo zatečeno stanje. Nakon dokumentiranja zatečenog stanja uslijedio je neophodan proces desalinizacije kako bi se metalni predmeti, koji su dugi niz godina bili izloženi morskom okružju, oslobodili štetnih soli, osobito klorida.

Uloga klorida značajna je pri koroziji metalnih predmeta i možemo reći da je problem njihova uklanjanja jedan od najvažnijih problema konzerviranja arheoloških predmeta od metala. Visok sadržaj klorida u morskoj vodi izaziva jak korozijski napad koji se vađenjem predmeta još pojačava.

Proces desalinizacije je tekao na način da su se predmeti izolirali polipropilenskom mrežicom i postavili u bazen s

1. Diagram of changes in the concentration of chlorides during the desalination process / Dijagram promjene koncentracije klorida u toku procesa desalinizacije

one of the key problems in the conservation of archaeological artefacts made of metal. The high chloride content in seawater causes a strong corrosive attack that is only heightened upon extraction of the artefact.

The desalination process involved the isolation of the artefacts in polypropylene nets and submerging them in vats of tap water. The water in the vats is changed depending on the quantity of leached salts, i.e. the level of the saturation of the water with liberated salts. The level of the water's saturation is monitored using electrical conductivity while the concentration of leached chlorides is determined by potentiometric titration. The changing of the water was effected for as long as the presence of chlorides could be established. Distilled water was used for the last few changes of water to accelerate the desalination effect.

Once desalination was complete the metal artefacts were removed from the water and left to gradually air dry – care was taken to ensure that there were no excessive oscillations in the air temperature during the drying process. Once drying had been completed the artefacts were sorted by type. Each of the artefacts was then inspected under magnification to best analyse the damage and condition of the artefact and make a decision on further conservation-restoration work.

Bronze objects were received in an intact and relatively good state of conservation. Various calcite, organic and corrosion deposits were visible. The original surfaces of all bronze artefacts were damaged. A loss of metal and the effect of active chorine ions were evident on some of the artefacts.

The bronze artefacts were cleaned mechanically by the combined use of various hand and electrical tools. Scalpels of various sizes, an ultrasonic chisel and an electrical micromotor with brushes of varying hardness were employed. Focused work under microscopic magnification removed only those deposits above the original surface and in this manner preserved the authenticity and decorative details of every one of the artefacts.

Cleaning was followed by the active stabilisation of the bronze artefacts by their immersion in a 3 percent alcohol solution of benzotriazole. Partially reconstruction was effected on only some of the bronze artefacts – minor damage and missing sections were filled with a two-component epoxy resin to which the appropriate pigment was added with the objec-

vodovodnom vodom. Voda u bazenu mijenjala se ovisno o količini izlučenih soli odnosno stupnju zasićenosti vode sa oslobođenim solima. Stupanj zasićenosti vode u bazenu pratio se preko električne vodljivosti dok se koncentracija izlučenih klorida određivala potenciometrijskom titracijom. Izmjene vode trajale se sve dok su se mogli dokazati kloridi. U nekoliko zadnjih izmjena vodovodna voda je zamijenjena destiliranom vodom čime se pospješio učinak desalinizacije.

2a. A bronze bell prior to treatment / Brončano zvono prije zahvata (photo: A. Jozić)

2b. The bronze bell post-treatment / Brončano zvono nakon zahvata (photo: A. Jozić)

Po završetku desalinizacije metalni predmeti su izvađeni iz vode i ostavljeni da se postepeno osuše na zraku pri čemu se vodilo računa da ne dođe do prevelikih oscilacija u temperaturi zraka tijekom sušenja. Nakon sušenja predmeti su sortirani po vrsti. Svaki od predmeta je potom pregledan pod uvećanjem kako bi se što bolje analiziralo oštećenja i stanje predmeta te odlučilo o daljnjem tijeku konzervatorsko-restauratorskih radova.

Brončani predmeti zaprimljeni su cjeloviti i u relativno dobrom konzervacijskom stanju. Vidljive su razne kalcitne, organske i korozijske naslage. Izvorna površina svih brončanih predmeta je oštećena. Na pojedinim predmetima vidljiv je gubitak kovine i djelovanje aktivnih iona klora.

Brončani predmeti čišćeni su mehanički, kombiniranom upotrebom raznog ručnog i električnog alata. Korišteni su skalpeli raznih dimenzija, ultrazvučno dlijeto te električni mikromotor s četkicama različitih tvrdoća. Koncentriranim radom pod mikroskopom uklonjene su samo naslage iznad izvorne površine i na taj je način sačuvana autentičnost zajedno s detaljima i ukrasima za svaki pojedini predmet.

Nakon čišćenja provela se aktivna stabilizacija brončanih predmeta njihovim potapanjem u 3%-tnu alkoholnu otopinu benzotriazola. Djelomična rekonstrukcija izvršena je samo na pojedinim brončanim predmetima i to na način da su u cilju strukturalne stabilnosti manja oštećenja i nedostajući dijelovi popunjeni dvokomponentnom epoksidnom smolom uz dodatak odgovarajućeg pigmenta. U završnoj fazi svi

tive of achieving structural stability. In the final phase all bronze objects were protected with a surface coating of lacquer. Silver Turkish akçe and two thalers were received as a single conglomerate. The sedimentary and calcite deposits acted as a "binder" such that the akçe was practically incrusted onto the surface of the two adhering thalers.

Prior to the actual cleaning the conglomerate of akçe and thalers had to be boiled in distilled water in order to soften the deposits acting as a binder. Once the akçe and thalers had been separated by utilising an ultrasonic needle and scalpels of various profiles we undertook mechanical cleaning. An electric micromotor with a small rotating brush of natural hair was used for the mechanical removal of organic deposits and sediments from the surface of the silver coins. The coins were cleaned using the motor at low speed and with frequent alterations of the brush direction to avoid leaving traces of scrubbing that would damage the soft surface of the silver. The lead artefacts were received intact and largely covered by the characteristic deposits of lead oxides, sulphates and carbonates.

3a. A "conglomerate" of akçe and thalers prior to treatment / "Konglomerat " akči i talira prije zahvata (photo: A. Jozić)

Traces of corrosion processes caused by seawater are visible on the surfaces of these artefacts along with various organic and lime deposits. Given that lead is a relatively soft metal that is very easily damaged, a combination of mechanical and chemical methods were employed in cleaning lead artefacts. Lime and organic incrustations were successfully removed by mechanical means using scalpels of various sizes and profiles. The remaining corrosion deposits of lead oxides and carbonates were not removed mechanically in order not to damage the soft lead surface – rather they were softened by a hot aqueous solution of Complexon III (Ethylenediaminetetraacetic acid disodium salt) and removed by gentle scrubbing using a soft brush. Following chemical treatment the traces of chemicals were removed by boiling the lead artefacts in distilled water.

4a. A lead plate prior to treatment / Olovna pločica prije zahvata (photo: A. Jozić)

brončani predmeti su površinski zaštićeni lakiranjem. Srebrne turske akče i dva talira zaprimljeni su u obliku jednog konglomerata. Sedimentne i kalcitne naslage poslužile su kao "vezivo" tako da su akče praktički inkrustrirane za površinu dva slijepljena talira.

Prije samog čišćenja bilo je potrebno konglomerat akči i talira iskuhati u destiliranoj vodi kako bi se omekšalo naslage koje su služile kao vezivo. Nakon odvajanja akči i talira, za što je korištena ultrazvučna igla i skalpeli različitih profila, uslijedilo je mehaničko čišćenje. Za mehaničko uklanjanje organskih naslaga i sedimenata s površina srebrenih novčića korišten je električni mikromotor sa malim rotirajućim četkicama od prirodne dlake. Novčići su čišćeni s malim brojem okretaja motora i uz čestu promjenu smjera četkanja kako bi se izbjeglo ostavljanje tragova četkanja, a time i oštećenja na mekim srebrenim površinama. Olovni predmeti su zaprimljeni cjeloviti, te u većoj mjeri prekriveni karakterističnim korozijskim naslagama olovnih oksida, sulfata i karbonata.

3b. The silver akçe and thalers post-treatment / Srebrene akče i taliri nakon zahvata (photo: A. Jozić)

4b. The lead plate post-treatment / Olovna pločica nakon zahvata (photo: A. Jozić)

Na površinama istih uz razne organske i vapnenačke naslage vidljivi su i tragovi korozijskih procesa uzrokovanih utjecajem morske vode. Budući da je olovo relativno mekan metal kojeg je vrlo lako oštetiti za postupak čišćenja olovnih predmeta upotrijebljena je kombinacija mehaničke i kemijske metode. Inkrustati vapnenačke i organske prirode uspješno su uklonjeni mehaničkim putem pomoću skalpela raznih dimenzija i

The single received artefact made of tin is an interesting jug with handle and a broad profiled foot and a lid. The jug was received in twelve fragments and was preserved in a very poor state of conservation. The fragments were largely covered in sedimentary deposits. Grey-black flecks and powdery grey dust was visible in areas – the characteristic sign of advanced stages of tin corrosion in seawater.

5a. A tin jug prior to treatment / Kositreni vrč prije zahvata (photo: A. Jozić)

The process of removing stubborn sediments from the surface of the tin jug required particular care, given that the corroded fragments of the jug are very brittle and frangible. An ultrasonic chisel and scalpels of various sizes were used to this end. Focused work under microscopic magnification successfully removed most of the sediments from the surface of the tin jug fragments. The remaining smaller deposits collected in depressions were removed by polishing the fragments with synthetic fibre brushes.
To strengthen them the very brittle tin fragments were impregnated following cleaning with the two-component epoxy resin Araldit 2020.

The reconstruction procedure was undertaken given that the original appearance of the tin jug was visible from the received fragments. The impregnated fragments were first preliminarily joined using reversible cyanoacrylate glue. The points of adhesion were then reinforced with glass fibres filled in with two-component epoxy glue with the addition of the appropriate pigment. The same adhesive was used to fill in minor damage points on the surface of the jug to achieve structural stability. In the final phase the surface of the tin jug was protected by a coating it with a mixture of the reversible Paraloid B72 and Cosmoloid H80 in toluene.

Documentation was drawn up following the conducted conservation-restoration work on the metal finds from the Mljet - Pličina Sv. Pavao site detailing all of the procedures employed and all the compounds used and accompanied by photographic documentation of each individual artefact.

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profila. Zaostale korozijske naslage olovnih oksida i karbonata, nisu uklanjane mehanički kako se ne bi oštetila meka olovna površina, već ih se omekšavalo vrućom vodenom otopinom Komleksona III (dinatrijeva sol etilendiamin tetra octene kiseline) i skidalo laganim četkanjem mekanom četkicom. Nakon kemijskog tretmana, tragovi kemikalija uklonjeni su iskuhavanjem olovnih predmeta u destiliranoj vodi.

Jedini zaprimljeni predmet izrađen od kositra je zanimljiv vrč s ručkom, profiliranom širokom nogom i poklopcem. Vrč je zaprimljen u 12 ulomaka i sačuvan je u jako lošem konzervacijskom stanju. Ulomci su u većoj mjeri prekriveni sedimentnim naslagama. Na pojedinim mjestima vidljive su sivo crne mrlje te puderasti sivi prah koji je karakterističan znak uznapredovale korozije kositra u morskoj vodi.

5b. The tin jug post-treatment / Kositreni vrč nakon zahvata (photo: A. Jozić)

Postupak uklanjanja tvrdokornih sedimenata s površine kositrenog vrča iziskivao je posebnu pažnju budući da su korodirani ulomci vrča jako krti i lomljivi. U tu svrhu korišteno je ultrazvučno dlijeto i skalpeli različitih dimenzija. Koncentriranim radom pod mikroskopom uspješno je odvojena većina sedimenata s površina kositrenih ulomaka vrča. Ostale su mjestimično manje naslage koje su bile nakupljene u udubinama. One su uklonjene poliranjem ulomaka sa četkicama od sintetičke dlake. U cilju ojačanja, izrazito krti kositreni ulomci su nakon čišćenja impregnirani dvokomponentnom epoksidnom smolom Araldit 2020.

Budući da je iz zaprimljenih ulomaka vidljiv izvorni izgled kositrenog vrča, uslijedio je postupak rekonstrukcije. Impregnirani ulomci su prvo preliminarno spajani reverzibilnim cianoakrilatnim ljepilom. Mjesto lijepljenja je zatim ojačano staklenim vlaknima koja su zapunjena dvokomponentnim epoksidnim ljepilom, uz dodatak odgovarajućeg pigmenta. U cilju strukturalne stabilnosti istim ljepilom popunjena su i manja oštećenja na površini vrča. U završnoj fazi, kositreni vrč je površinski zaštićen lakiranjem s mješavinom reverzibilnih lakova Paraloid B72 i Cosmoloid H80 u toluenu.

Nakon provedenih konzervatorsko - restauratorskih radova na metalnim nalazima s lokaliteta Mljet - pličina Sv. Pavao, izrađena je dokumentacija u kojoj su opisani svi postupci, navedena sva korištena sredstva i dodane pripadajuće fotografije za svaki pojedini predmet.

Reflectance Transformation Imaging (RTI) and Photogrammetry for Maritime Archaeology

Izrada slikovnog prikaza pretvorbom odraza (RTI) i fotogrametrija za arheologiju pomorstva

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Three-dimensional digital methods have been developing for years, but only recently have they become cheap and widely available. Open access software combined with consumer driven markets means quality 3D data can be produced for free. The International Centre for Underwater Archaeology and the Illyrian Coastal Exploration Project have applied several digital methods as part of our field schools.

Reflectance Transformation Imaging (RTI) uses digital luminance properties to reveal surface texture in great detail. For example, a piece of terra sigillata was found during a survey, but its stamp was unreadable to the naked eye. A sequence of fifty photos with varied angles of light were taken using a digital camera and LED flashlight. The photos were then loaded in the free RTIBuilder software and processed to create a 3D texture.

Trodimenzionalne digitalne metode razvijaju se godinama, ali tek su nedavno postale jeftine i široko dostupne. Softver kojem se može slobodno pristupiti i tržišta koja pokreću potrošači rezultirali su time da se kvalitetni 3D podaci mogu stvoriti besplatno. Međunarodni centar za podvodnu arheologiju i Program istraživanja ilirske obale primijenili su nekoliko digitalnih metoda u našim terenskim školama.

Tehnikom izrade slikovnog prikaza pretvorbom odraza (Reflectance Transformation Imaging – RTI) koriste se svojstva digitalnog osvjetljenja kako bi se vrlo detaljno otkrila tekstura površine. Na primjer, tijekom istraživanja pronađen je komad keramike terra sigillata, ali njezin žig ne može se pročitati golim okom. Digitalnom kamerom i LED svjetiljkom snimljen je niz od pedeset fotografija iz različitih kutova. Fotografije su potom učitane u besplatni softver RTIBuilder i obrađene kako bi se dobila 3D tekstura.

1. The terra sigillata base with a stamped base shortly after discovery / Dno keramike terra sigillata sa žigom nedugo nakon otkrića (photo: L. Smith).

2. A 3D image using specular enhancement to make the stamp legible / Zrcalno povećanje 3D slike kako bi se žig učinio čitljivim (photo: D. Selmo).

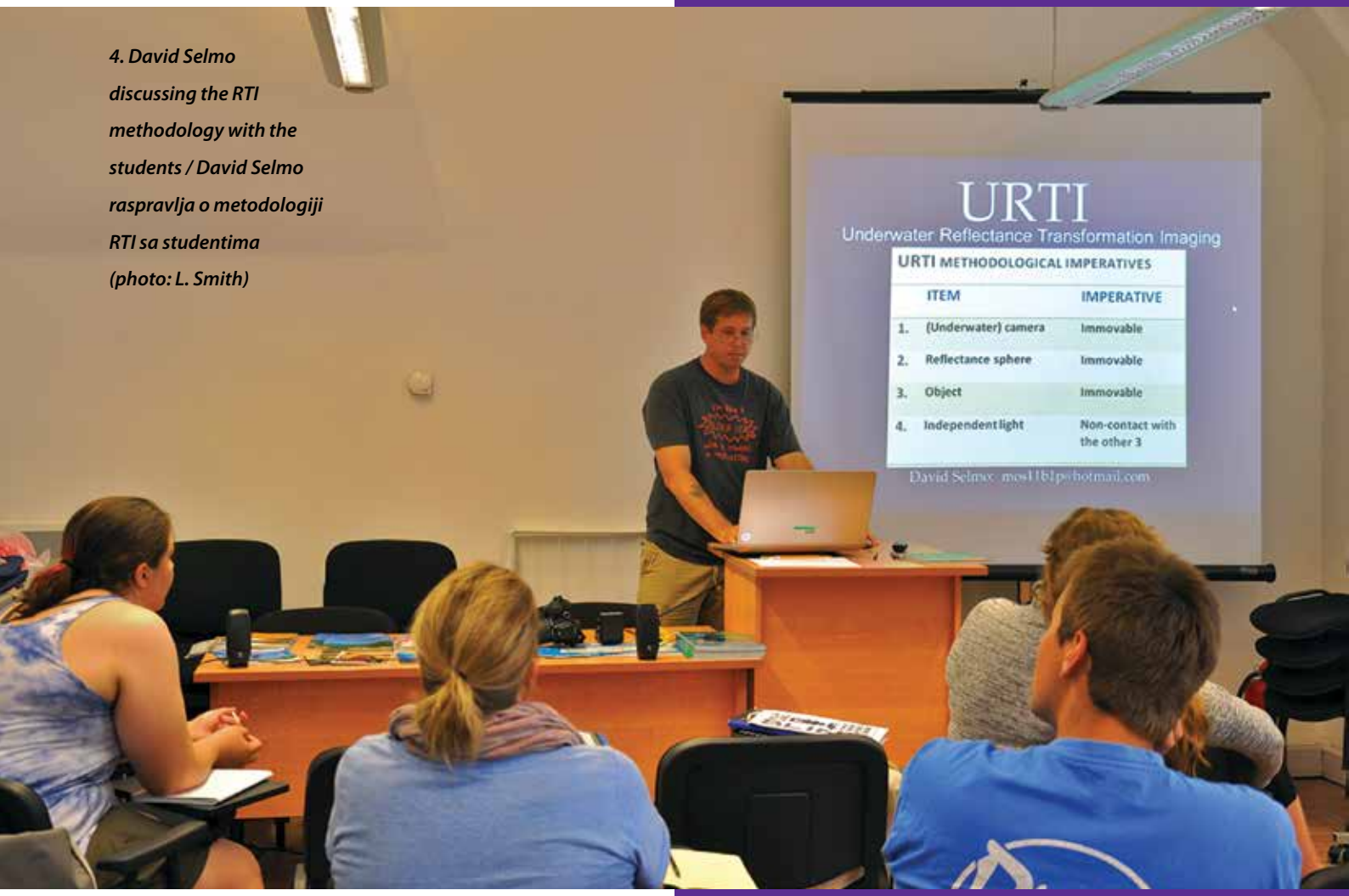
Using specular enhancement it was possible to read the stamp by setting the artificial light to a low grazing angle. The stamp belongs to Vegetus, a potter from the Po Valley dating to 30-10 BC. His wares are mostly found in Italy, though they were traded as far as Austria and Greece.

A journal article titled, "Underwater Reflectance Transformation Imaging (URTI): A new technology for in situ Underwater Cultural Heritage object level recording," is currently under review.

3. Embossed specular enhancement to increase light reflection and make the stamp more readable in this 3D image / Reljefno zrcalno povećanje kako bi se povećala refleksija svjetla i žig učinio čitljivijim na ovoj 3D slici (photo: D. Selmo).

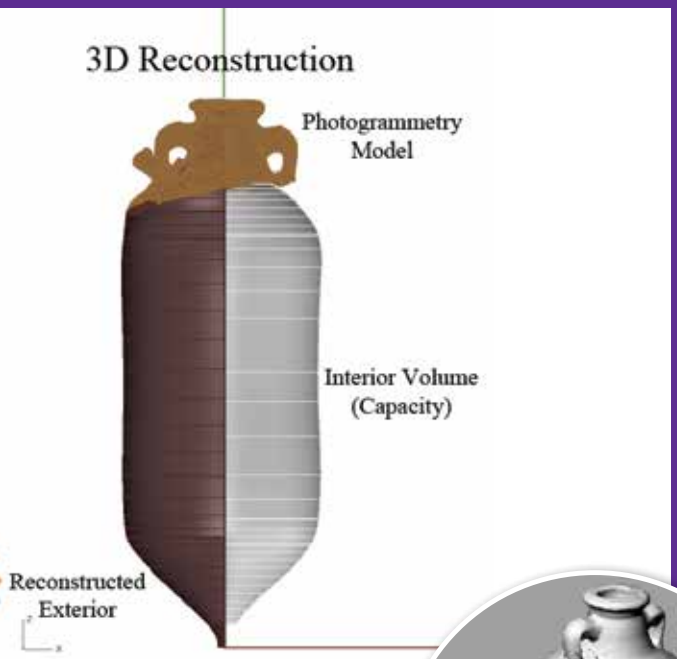
Upotrebom zrcalnog povećanja bilo je moguće pročitati žig na način da je umjetno svjetlo bilo postavljeno pod malim upadnim kutom. Žig pripada Vegetusu, lončaru iz Padske nizine u razdoblju od 30. do 10. godine prije Krista. Njegovi se proizvodi pronalaze uglavnom u Italiji, iako se njima trgovalo čak do Austrije i Grčke.

Članak pod naslovom Underwater Reflectance Transformation Imaging (URTI): A new technology for in situ Underwater



4. David Selmo discussing the RTI methodology with the students / David Selmo raspravlja o metodologiji RTI sa studentima (photo: L. Smith)

Photogrammetry is the process of taking measurements from photographs. Archaeology first used it at Persepolis in 1885; however, these days full 3D models can be created from photographs easily and cheaply. Photogrammetry is now standard on maritime archaeology projects due to its versatility and the widespread availability of underwater digital cameras. The field schools use it as a method to record artifacts and create site plans.



5. Three stages: photograph, 3D model, and reconstruct / Tri faze: fotografija, 3D model i rekonstrukcija (photo: P. Campbell).

Take this fragment of a Keay 35B amphora excavated from the Babuljaš shipwreck as an example. A series of fifteen photographs were uploaded in the free software 123DCatch and within five minutes a 3D model was available. The model was imported into Rhinoceros NURBS to be reconstructed. The Keay 35B shape was imported and fitted to the photogrammetry model to recreate the exterior. Analysis determined the amphora was 90 cm in height with a volume of 41.1 liters. Capacity and extent of trade are central questions to archaeology, meaning there is great potential for this type of analysis on shipwreck and harbor sites.

Digital methods are widely adopted today. It is important to realize that these do not simply produce beautiful images for the public, but allow for analysis unavailable through traditional methods. Digital technologies offer cheap, conservation-safe methods that are widely available for any archaeological project.

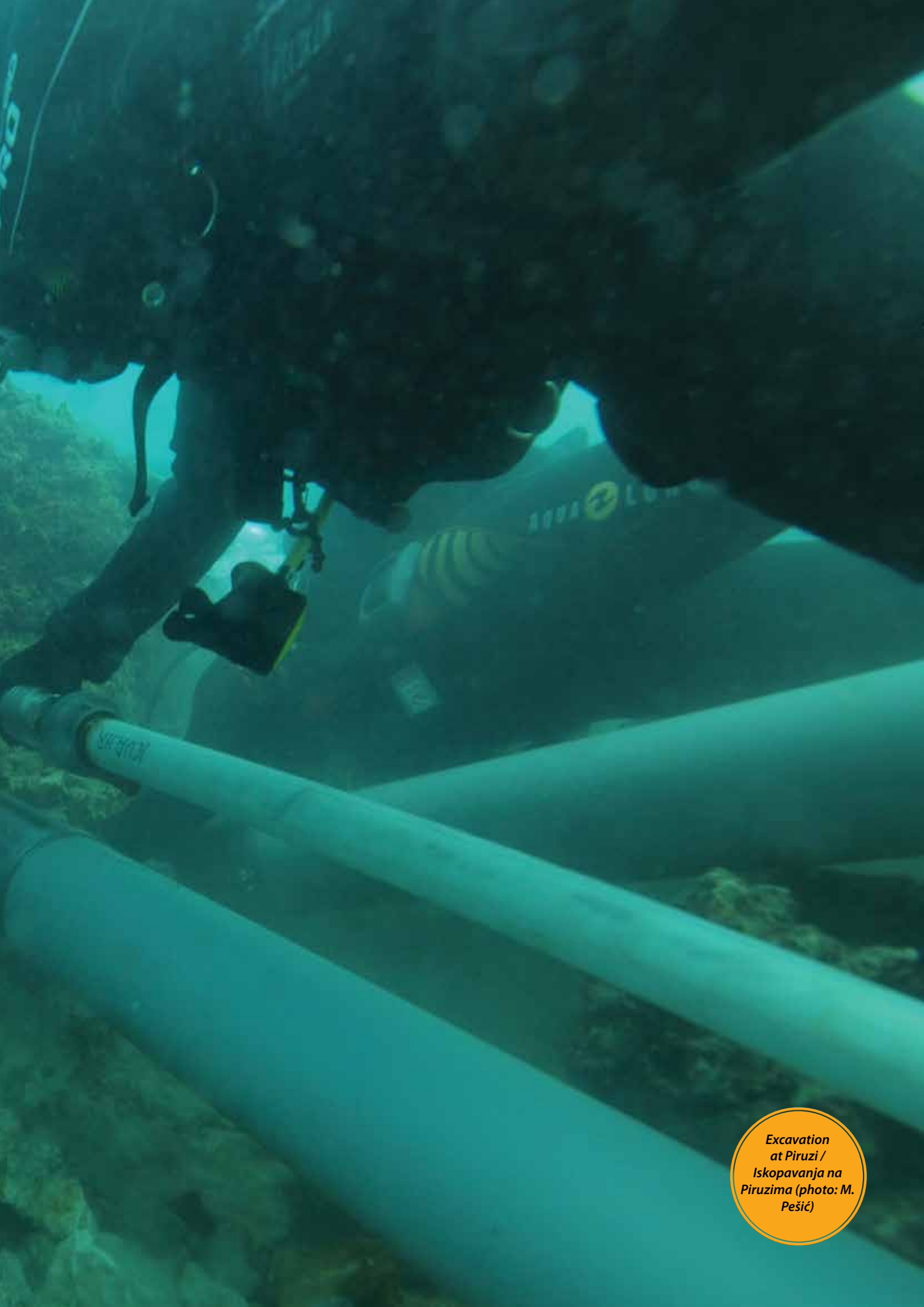
Cultural Heritage object level recording trenutačno je u postupku recenzije.

Fotogrametrija je postupak uzimanja mjera sa fotografija. U arheologiji je prvi put upotrijebljena u Perzepolisu 1885. Međutim, danas se lako i jeftino mogu iz fotografija stvoriti cjeloviti 3D modeli. Fotogrametrija je danas standard u projektima arheologije pomorstva zbog njezine svestranosti i široke dostupnosti podvodnih digitalnih kamera. Terenske škole primjenjuju je kao metodu za evidentiranje predmeta i izradu planova nalazišta.

6. The amphora reconstructed in Rhinoceros NURBS / Amfora rekonstruirana u softveru Rhinoceros NURBS (photo: P. Campbell).

Uzmimo kao primjer ovaj fragment amfore Keay 35B koja je iskopana iz brodoloma kod Babuljaša. Niz od petnaest fotografija učitan je u besplatni softver 123DCatch i u roku od pet minuta bio je dostupan 3D model. Model je uvezen u softver Rhinoceros NURBS za rekonstrukciju. Oblik Keay 35B uvezen je i ugrađen u fotogrametrijski model kako bi se rekonstruirala vanjština. Analizom je utvrđeno da je amfora bila visoka 90 cm i da je imala obujam od 41,1 litru. Kapacitet i doseg trgovine središnja su pitanja za arheologiju, što znači da postoji veliki potencijal za ovu vrstu analize nalazišta brodoloma i luka.

Danas su digitalne metode široko prihvaćene. Važno je shvatiti da se njima ne proizvode samo lijepe slike za javnost, već se omogućuje analiza koja nije dostupna tradicionalnim metodama. Digitalne tehnologije nude jeftine metode kojima se ne ugrožava konzervacija i lako su dostupne za svaki arheološki projekt.



Excavation at Piruzi / Iskopavanja na Piruzima (photo: M. Pešić)

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