

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

Submerged Heritage Potopljena baština

Number 2 / Broj 2, Zadar, December 2012 / Prosinac 2012.

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The background of the page is a photograph of a white ship's hull. On the hull, the words "RPM NAUTICAL FOUNDATION" are printed in a large, serif font. To the left of the text is a green compass rose. The ship is moving through the water, with a wake visible on the right. The sky is clear and blue.

IMPRESSUM

SUBMERGED HERITAGE / *POTOPLJENA BAŠTINA*

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

Number / Broj 2

Zadar, December / Prosinac 2012.

Publisher / Izdavač:

International Centre for Underwater Archaeology in Zadar - UNESCO Category II Centre
Međunarodni centar za podvodnu arheologiju u Zadru - UNESCO centar II kategorije

Urednik / Editor: Luka Bekić

Translation / Prijevod: Neven Ferenčić

Graphic Design / Grafički dizajn: Ivan Diskordia

Tisak / Print: Denona, Zagreb

Naklada / Print run: 400

Nije za prodaju / Not for sale

Frontpage / Naslovnica: Pripreme za spuštanje ROVa / Preparations for a ROV descent (photo: D. Perkić)



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Ministar Biškupić i gradonačelnik Kolega rezu vrpca prilikom otvorenja CPA Zadar 2007.g. / Minister Biškupić and mayor Kolega cutting the ribbon at the opening of CUA Zadar in 2007 (photo: M. Gospić)

UVOD

Navršenih pet godina Međunarodnog centra za podvodnu arheologiju u Zadru, UNESCO-ovog centra II kategorije

Međunarodni centar za podvodnu arheologiju u Zadru osnovan je 2008.g. u skladu s međunarodnim ugovorom potpisanim između Organizacije Ujedinjenih naroda za obrazovanje, znanost i kulturu i Republike Hrvatske. Upravljanje te financiranje centra i njegovih aktivnosti uglavnom provode RH i UNESCO. Mada peta obljetnica nije mnogo, za ovu instituciju to je već povijest, pa tako valja podsjetiti na neke najvažnije datume u stvaranju centra:

- Prijedlog osnivanja regionalnog centra za podvodnu arheologiju potaknuo je intenzivne pregovore između hrvatskih vlasti i UNESCO-a, posebno prilikom Treće ministarske konferencije o kulturnoj baštini u jugoistočnoj Europi koja se održala na Ohridu u bivšoj jugoslavenskoj Republici Makedoniji od 3. do 4. studenog 2006.

- Prijedlog osnivanja Regionalnog centra za podvodnu arheologiju u Zadru, Hrvatska, kao centra kategorije 2 pod pokroviteljstvom UNESCO-a uvršten je u privremeni dnevni red 177. sjednice Izvršnog odbora, na zahtjev Hrvatske, u Parizu 31. kolovoza 2007.

- Izvješće generalnog direktora UNESCO-a o studiji izvedivosti prijedloga za osnivanje Regionalnog centra za podvodnu arheologiju u Zadru, Hrvatska, kao centra kategorije 2 pod pokroviteljstvom UNESCO-a predstavljeno je u Parizu 17. rujna 2007.

- Vlada Republike Hrvatske je na sjednici održanoj 19. ožujka 2008.g. donijela Uredbu o osnivanju Međunarodnog centra za podvodnu arheologiju u Zadru.

- Ugovor između UNESCO-a i Vlade Republike Hrvatske o uspostavljanju Regionalnog centra za podvodnu arheologiju u Zadru, Hrvatska, kao centra kategorije 2 pod pokroviteljstvom UNESCO-a, potpisan je u Parizu, 1. kolovoza 2008. g.

Kroz tih gotovo šest godina od osnivanja, centar je povećavao broj i širio raspon svojih projekata. Još na početku, Republika Hrvatska predviđjela je osnovne aktivnosti centra u svome prijedlogu za osnivanje. Tako je prijedlogu predloženom UNESCO-u poimence predviđeno kako će centar:

- profesionalno objediniti djelatnost podvodne arheologije u Republici Hrvatskoj;
- organizirati kvalitetnu obuku i specijalizaciju stručnjaka u podvodnoj arheologiji na nacionalnoj i međunarodnoj razini;
- promicati jačanje kapaciteta, izvrsnost i znanstvena istraživanja;
- unaprijediti znanstvena i stručna istraživanja podvodnih arheoloških nalazišta;
- analizirati i predstaviti nalaze;
- provoditi konzerviranje podvodnih arheoloških nalaza;
- promicati načela Konvencije i njezinog Priloga.

Na tim se osnovama tijekom ovih pet godina iskristalizirala i vizija Međunarodnog centra za podvodnu arheologiju Zadru a to je očuvanje i promocija podvodne kulturne baštine Hrvatske, jugoistočne Europe i Sredozemlja. Tako je svakodnevna misija djelatnika i suradnika centra zaštita, proučavanje i očuvanje podvodne kulturne baštine u Republici Hrvatskoj, razvitak međunarodne

INTRODUCTION

Five Years of the International Centre for Underwater Archaeology in Zadar, a UNESCO Category 2 Centre

The International Centre for Underwater Archaeology in Zadar was founded in 2008 pursuant to an international agreement signed between the United Nations Educational, Scientific, and Cultural Organization and the Republic of Croatia. The administration and financing of the Centre and of its activities are provided for largely by Croatia and UNESCO. Although five years is not a long time, for the institution it constitutes its history-and in this regard it is worth noting some of the key dates in the Centre's formative period:

- The proposal to establish a regional centre for underwater archaeology prompted intense negotiations between the Croatian authorities and UNESCO, notably on the occasion of the Third Ministerial Conference on Cultural Heritage in South-Eastern Europe that took place in Ohrid (the former Yugoslav Republic of Macedonia) on 3-4 November 2006.

- A proposal for the establishment of a regional centre for underwater archaeology in Zadar, Croatia, as a Category 2 centre under the auspices of UNESCO was included in the provisional agenda of the 177th session of the Executive Board, at the request of Croatia, in Paris on 31 August 2007.

- A report was presented in Paris on 17 September 2007 by the Director-General of UNESCO on the feasibility study concerning the proposal for the establishment of a regional centre for underwater archaeology in Zadar, Croatia as a category 2 centre under the auspices of UNESCO.

- At a session held on 19 March 2008 Croatian Government adopted a Regulation establishing the International Centre for Underwater Archaeology in Zadar.

- The agreement between UNESCO and Croatian Government to establish a regional underwater archaeology centre in Zadar, Croatia as a category 2 centre under the auspices of UNESCO was signed in Paris on 1 August 2008.

During the almost six years since its founding the Centre has increased the number and broadened the range of its projects. From

the beginning Croatia set out the basic activities in its proposal to establish the Centre. The proposal presented to UNESCO stated that the Centre would:

- Professionally unify the activity of underwater archaeology in the Republic of Croatia;
- Organize the high-quality training and specialization of experts in underwater archaeology, nationally and internationally;
- Promote capacity-building, the pursuit of excellence and scientific research;
- Improve scientific and expert research of underwater archaeological sites;
- Analyse finds and present them;
- Carry out the conservation of underwater archaeological finds;
- Promote the principles of the Convention and its Annex.

It was on these foundations over the past five years that a vision has crystallised of the mission of the International Centre for Underwater Archaeology in Zadar to preserve and promote the underwater cultural heritage of Croatia, Southeast Europe and the Mediterranean. The daily mission of the professionals and associates of the Centre is to protect, study and preserve the underwater cultural heritage of Croatia, to develop international expert and research cooperation and education in the area of underwater archaeology, and to popularise and present underwater heritage to the expert and broader public.

ICUA Zadar, having emerged from the Croatia Conservation Institute, carrying forward the tradition of underwater archaeology in the frame of the Ministry of Culture and recognising the almost half-century old idea among many underwater archaeologists of the need to create the centre on the Adriatic, achieved much in these few years. During this time it has significantly improved the quality and approach to underwater archaeological research and the restoration and conservation of archaeological artefacts. In adherence to and promoting the UNESCO Convention on the Protection of the Underwater Cultural Heritage, the Centre acts as a referral post for education in the area of underwater archaeology, conservation and restoration for Croatia, Southeast Europe, the countries of the Mediterranean and the world.

Every year ICUA organises several courses in the area of underwater archaeology and diving, and on the restoration and conservation of underwater finds. As many as six different underwater research campaigns are organised every year, most of which are international in character. During the past years ICUA has also organised several notable research and expert symposia, numerous workshops, seminars and public lectures and promotions. Through its Internet site www.icua.hr the Centre regularly publishes announcements and reports on its activities and of the activities of other institutions and experts in the field. It is to be hoped that ICUA will thus contribute significantly to linking experts and the exchange of knowledge.

This yearbook is also particularly significant-as a print media it offers a concise overview of the key projects in underwater archaeology not only pertaining to the Centre in Zadar, but also to other institutions across Europe. The goal of the Submerged Heritage yearbook is, through its content, to contribute to the promotion of underwater heritage and to serve as a bridge of sorts between the expert and broader public. Only in this manner can we improve the overall attitude towards underwater heritage and develop awareness of the need to protect it.

The Editor

stručno znanstvene suradnje i edukacije u polju podvodne arheologije te popularizacija i predstavljanje podvodne baštine stručnoj i široj javnosti.

Kroz tih je nekoliko godina MCPA Zadar, proistekavši iz Hrvatskog restauratorskog zavoda, baštineći tradiciju podvodne arheologije u okviru Ministarstva kulture i uvažavajući gotovo polustoljetne ideje mnogih podvodnih arheologa o potrebi osnivanja ovog centra na Jadranu, postigao mnogo. U ovih nekoliko godina uvelike je unaprijedio kvalitetu i pristup podvodnim arheološkim istraživanjima te restauriranju i konzerviranju arheoloških nalaza. Uvažavajući i promovirajući UNESCO-vu Konvenciju o zaštiti podvodne kulturne baštine, centar djeluje i kao referalna postaja za edukaciju u polju podvodne arheologije te konzerviranja i restauriranja za Hrvatsku, jugoistočnu Europu, zemlje Sredozemlja pa i svijet.

Tako MCPA svake godine organizira nekoliko tečajeva iz polja podvodne arheologije i ronjenja te restauriranja i konzerviranja podvodnih nalaza. Godišnje se organizira i do šest različitih podvodnih istraživanja od kojih većina ima međunarodni znanstveni karakter. Tijekom ovih godina MCPA je organizirao i nekoliko zapaženih znanstvenih i stručnih skupova, brojne radionice, seminare te javna predavanja i promocije. Kroz internetsku stranicu www.icua.hr redovno se objavljuju najave i izvještaji o aktivnostima centra ali i o aktivnostima drugih institucija i stručnjaka u ovom polju. Za nadati se da će MCPA na te načine što više pridonijeti u povezivanju stručnjaka i razmjeni znanja.

Posebice je važan i ovaj godišnjak, koji kao tiskani medij sadržava kratak pregled najvažnijih projekata u podvodnoj arheologiji ne samo zadarskog centra, nego i drugih institucija širom Europe. Cilj je godišnjaka Potopljena baština svojim sadržajem pripomoći promociji podvodne baštine i biti svojevrsni most između stručne i šire javnosti. Jedino na taj način je moguće unaprijediti opći pristup podvodnoj baštini i razviti svijest o skrbi za njenom zaštitom.

Urednik



Predstavnici UNESCO-a, Rosatti, Koeller, Roudil te Mesić i Biškupić iz Ministarstva kulture i gradonačelnik Zadra Vrančić, na domjenku prilikom otvaranja MCPA 2009.g. / UNESCO representatives, Rosatti, Koeller and Roudil with Mesić and Biškupić from Ministry of culture and Zadar mayor Vrančić at the opening of the ICUA Zadar in 2009.g. (photo: L. Bekić)

Zadar hosts IKUWA 4, the 4th international congress on underwater archaeology

One of the world's premier international congresses on underwater archaeology closed on Saturday 1 October 2011 at the ceremonial hall of the University of Zadar. The congress was held under the supervision of a scientific committee composed of experts that have led previous IKUWA congresses and an organising



Dio predavanja održavan je u velikoj dvorani Sveučilišta u Zadru / Some of the lectures were held at the main auditorium of the University of Zadar (photo: L. Bekić)

committee composed of the hosts-representatives of a number of institutions based in Zadar. From what we heard from many of the participants the congress was a success in all aspects. The congress focused in the important theme of Managing the Underwater Cultural Heritage through various presentations targeting its diverse aspects. The participant turnout was excellent with over 200 people present from over forty countries on all continents. An exhibition on Zaton and a Manual on the conservation of underwater finds were presented during the congress. The following congresses, IKUWA 5 and IKUWA 6, are to be held in Cartagena in Spain and in Perth, Australia. You can find more information on the congress at a number of Internet portals and the official archive site www.icua.hr/ikuwa4.

Lecture on the application of radiation methods in conservation at ICUA Zadar

A series of lectures were staged on 6 October 2011 at ICUA Zadar by organisers the Ruđer Bošković Institute, the Croatian Conservation Institute and the International Centre for Underwater Archaeology on the topic of Radiation Methods in the Protection of Cultural Heritage. The lectures continued from the seminar held in Zagreb (4 and 5 October 2011) in the frame of the project on technical cooperation with the International Atomic Energy Agency (IAEA) under the title TC Project RER/8/015: "Using

U Zadru održan 4. međunarodni kongres o podvodnoj arheologiji IKUWA 4

U subotu 1.10.2011.g., u svečanoj dvorani Sveučilišta u Zadru, završio je jedan u nizu najvećih međunarodnih kongresa o podvodnoj arheologiji u svijetu. Kongres se odvijao pod nadzorom znanstvenog odbora sastavljenog od stručnjaka koji su vodili dosadašnje kongrese IKUWA-a te organizacij-



Nakon promocije Priručnika za restauriranje u MCPA Zadar je priređen domjenak / A reception following the restoration manual promo at ICUA Zadar (photo: L. Bekić)

skog odbora sastavljenog od domaćina - predstavnika više institucija smještenih u Zadru. Prema ono što se moglo čuti od brojnih sudionika, kongres je u potpunosti uspio, što znači da se važna tema "Upravljanje podvodnom kulturnom baštinom" razradila kroz različite prezentacije, koje su prikazale svakojake njene aspekte. Odaziv sudionika bio je odličan pa je zabilježeno preko 200 sudionika iz preko 40 zemalja sa svih kontinenata. Tijekom konferencije predstavljena je izložba Zaton te Priručnik o konzerviranju podvodnih nalaza. Slijedeće konferencije IKUWA 5 i IKUWA 6 održati će se u Cartageni u Španjolskoj i Perthu u Australiji. Više informacija o tijeku konferencije može se naći na različitim internetskim portalima i službenoj arhiviranoj stranici www.icua.hr/ikuwa4

Predavanja o primjeni radijacijskih metoda pri konzerviranju održana u MCPA Zadar

U organizaciji Instituta Ruđer Bošković, Hrvatskog restauratorskog zavoda i Međunarodnog centra za podvodnu arheologiju u Zadru u učionici MCPA Zadar održala su se 6.10.2011.g. predavanja na temu "Radijacijske metode u zaštiti kulturne baštine". Predavanja su se održavala u nastavku seminara u Zagrebu (4. i 5.10.2011.) u okviru projekta tehničke suradnje s Međunarodnom agencijom za atomsku energiju - IAEA pod nazivom TC Project RER/8/015: "Primjena nuklearnih tehnika



Predavanja su održana u predavaonici centra / The lectures were held at the Centre's lecture hall (photo: L. Bekić)

Nuclear Techniques for the Characterisation and Preservation of Cultural Heritage Artefacts in the European Region". The separate lectures in Zadar were organised in the frame of the Advanced Course on the Conservation and Restoration of Underwater Archaeological Finds organised by the International Centre for Underwater Archaeology in Zadar, a UNESCO category II centre. Mario Braun of the Croatian Conservation Institute and Dušan Ražem of the Ruđer Bošković Institute spoke of the methods of conservation that make use of nuclear radiation. Quoc Khoi Tran, an expert from ARC-Nucléart in Grenoble, France presented the wealth of results from the work of the laboratory he leads pertaining to the impregnation protection of wooden ship structures that originate from wet environments. The lectures and discussions were held in English and entry was open to all.

za karakterizaciju i očuvanje predmeta kulturne baštine na području Europe". Zasebna predavanja u Zadru organizirana su u sklopu održavanja Naprednog tečaja konzerviranja i restauriranja podvodnih arheoloških nalaza u organizaciji Međunarodnog centra za podvodnu arheologiju u Zadru - UNESCO-ovog centra II kategorije. Mario Braun iz Hrvatskog restauratorskog zavoda i Dušan Ražem s instituta "Ruđer Bošković" govorili su o metodama konzerviranja koje koriste nuklearno zračenje. Quoc Khoi Tran, stručnjak iz ARC-Nucléart, Grenoble, Francuska, predstavio je bogate rezultate rada svojeg laboratorija na impregnacijskoj zaštiti drvenih brodskih konstrukcija koje potječu iz mokrog okruženja. Predavanja i rasprave su se odvijale na engleskom jeziku, a ulaz je bio slobodan.



Professor Tran observes with interest the work on metal finds at the Centre / Profesor Tran je sa zanimanjem promotrio rad na metalnim nalazima u centru (photo: L. Bekić)



Veliki kavez na mjesto postavljanja preveo se brodom u jednom komadu / The large cage was transported by ship to the installation site in one piece (photo: L. Bekić)

Zamijenjen zaštitni kavez na arheološkom nalazištu pred uvalom Koromašna na otoku Žirju

Nakon što je gotovo 14 godina štutio brojne antičke amfore kod otoka Žirja, stari kavez zarastao je i ošteto se uslijed djelovanja mora. Na rimskom brodolomu s teretom od oko stotinjak amfora 8. prosinca 2011. postavljen je novi kavez dimenzija 17 x 9 metara. Ovaj kavez pripada u seriju tehnički usavršenijih kaveza koji su građeni s jačom konstrukcijom i od boljih materijala nego njihovi prethodnici. Stoga se njegov životni vijek na dnu

New protective cage at Koromašna Bay archaeological site on the island of Žirje

After protecting the many Roman period amphorae in the waters of the island of Žirje for almost fourteen years the old cage has become overgrown and damaged by the effects of the sea. A new cage of 17 by 9 metres was installed over the Roman period shipwreck and its cargo of about one hundred amphorae on 8 December 2011. This cage is from a series of technically improved cages built with a stronger structure and from better materials than previous models. Its life span on the seabed is thus expected to be from twenty to thirty



Na dnu je kavez zasjao novim sjajem / At the bottom the cage shines in new splendour (photo: M. Pešić)

years. This method of protecting underwater sites from looters has shown itself very effective and this valuable site has thus been saved for at least the coming thirty years. The campaign was organised and conducted by the Croatian Conservation Institute in collaboration with Neptun Sub and the Adriatic Diving Service (Jadranski ronilački servis) while the installation of the cage was covered by the International Centre for Underwater Archaeology and numerous media houses.

UNESCO stages international scientific colloquium and regional meeting in Brussels

On the occasion of the 10th anniversary of the adoption of the Convention on the Protection of the Underwater Cultural Heritage UNESCO organised a symposium on factors that effect underwater cultural heritage. The final day of the gathering also included a regional meeting of representatives of EU countries including membership candidate countries at which there was a discussion of the status of underwater heritage and the Convention. The symposium and regional meeting were staged at the hall of the Royal Library in Brussels from 13 to 15 December 2011. This event drew a large number of experts from European, American and Asian countries.



Skup se održao u dvorani Kraljevske knjižnice / The gathering was held at the hall of the Royal Library (photo: L. Bekić)

Close of a successful Advanced Course on Conservation and Restoration

Zadar was the venue from 26 September to 24 December 2011 of an Advanced Course on Conservation and Restoration of Underwater Archaeological Finds. The course was organised by the International Centre for Underwater Archaeology with the support of the UNESCO office in Venice. Six people participated in the advanced course from Southeast Europe and the Mediterranean Ana Dimčevska (Macedonia), Petra Zdravković (Montenegro), Maja Živković (Serbia), Marko Barišić (Bosnia-Herzegovina), Omayra Gorostidi Eibar (Spain), Antonija Vodanović (Croatia)

mora predviđati na 20 do 30 godina. Ovaj način zaštite podvodnih nalazišta od pljačkaša pokazao se kao vrlo učinkovit stoga je i ovo vrijedno nalazište tako spašeno bar za narednih tridesetak godina. Akciju je organizirao i provodio Hrvatski restauratorski zavod u suradnji s Neptun sub-om i Jadranskim ronilačkim servisom a samo postavljanje kaveza popratio je Međunarodni centar za podvodnu arheologiju u Zadru i brojni mediji.



I nakon službenog dijela sudionici su obavljali mnoge konzultacije / The participants engaged in numerous consultative meetings following the official part of the gathering (photo: L. Bekić)

Održan međunarodni znanstveni kolokvij i regionalni sastanak u organizaciji UNESCO-a u Bruselu

U organizaciji UNESCO-a je povodom 10-te godišnjice Konvencije o zaštiti podvodne kulturne baštine organiziran znanstveni skup o čimbenicima koji utječu na podvodnu kulturnu baštinu. Uz ovaj skup posljednji dan se održao i regionalni sastanak predstavnika zemalja EU uključujući i zemlje kandidate za članstvo na kojem se raspravljalo o stanju podvodne baštine i Konvenciji. Znanstveni skup i Regionalni sastanak su održani u dvorani Kraljevske knjižnice u Brusel-u od 13. do 15. prosinca 2011.g. Ovaj događaj privukao je mnoštvo stručnjaka iz raznih zemalja Europe i Amerike i Azije.

Uspješno završio Napredni tečaj konzerviranja i restauriranja

U razdoblju od 26.09.2011 do 24.12.2011. u Zadru je održan napredni tečaj za restauriranje i konzerviranje podvodnih arheoloških nalaza. Tečaj je održan u organizaciji Međunarodnog centra za podvodnu arheologiju uz potporu UNESCO-vog ureda u Veneciji. Na naprednom tromjesečnom tečaju sudjelovalo je šest sudionika iz područja jugoistočne Europe i Mediterana: Ana Dimčevska (Makedonija), Petra Zdravković (Crna Gora), Maja Živković (Srbija), Marko Barišić (Bosna i Hercegovina), Omayra Gorostidi Eibar (Španjolska), Antonija Vodanović (Hrvatska), te dvije sudionice iz Meksika i Namibije - Maria Teresa Ramirez Miranda i Fosy Kambombo. Svi polaznici su prošli praktični dio tečaja koji je u svakoj od specijaliziranih radionica za obradu metala, keramike i organskog materijala trajao po četiri tjedna. Uz stručno vodstvo iskusnih restauratora Hrvatskog restauratorskog zavoda upoznati su s različitim metodama restauracije podvodnih nalaza, te

joined by two participants from Mexico and Namibia - Maria Teresa Ramirez Miranda and Fousy Kambombo. All of the participants completed the practical segment of the course that included four-week segments in each of the specialised workshops for the processing of metal, ceramics and organic material. Under the expert guidance of the experienced restorers of the Croatian Conservation Institute they learned the various methods of restoring underwater finds - during the course they learned themselves how to conduct each of the phases applied in conservation-restoration work and their documentation. In the frame of the theoretical segment of the course the participants attended eleven lectures given by the



Fousy Kambombo polira restauriranu zdjelu / Fousy Kambombo polishes a restored bowl (photo: M. Ćurković)

course organisers and eminent visiting professors. An English language Conservation of Underwater Archaeological Finds Manual was printed for the course that served the participants of the course as core literature. After their three-month training all of the participants successfully passed the exam on the practical and theoretical segments of the course. The great interest for the Advanced Course on Conservation and Restoration of Underwater Archaeological Finds, which has received 26 applications from fifteen countries, will certainly be an incentive to continue staging this fascinating and beneficial course.

Cooperation, partnership and financing of Regional Centres for Cultural Heritage in Southeast Europe

The recent first meeting of regional centres for cultural heritage in Southeast Europe, staged at the International

su tijekom tečaja i sami naučili i odradili sve faze koje se primjenjuju prilikom konzervatorsko-restoratorskih radova i njihove dokumentacije. U sklopu teoretskog dijela polaznicima je održano 11 predavanja od strane organizatora tečaja, kao i uvažanih gostujućih profesora. Povodom održavanja tečaja tiskan je i "Priručnik za konzervaciju podvodnih arheoloških nalaza" na engleskom jeziku koji je polaznicima tečaja služio kao osnovna literatura prilikom održavanja tečaja. Nakon tromjesečne obuke svi polaznici su uspješno položili ispit iz



Omayra Gorostidi Eibar i María Teresa Ramírez Miranda očitavaju vrijednosti soli na titratoru / Omayra Gorostidi Eibar and María Teresa Ramírez Miranda taking readings of salt values from a titrator (photo: A. Jelić)

praktičnog i teoretskog dijela tečaja. Veliki interes za napredni tečaj konzervacije i restauracije podvodnih arheoloških nalaza, na koji se prijavilo 26 zainteresiranih iz 15 različitih država, zasigurno će potaći nastavak održavanja ovog zanimljivog i korisnog tečaja.

Suradnja, partnerstvo i financiranje Regionalnih centara za kulturnu baštinu u jugoistočnoj Europi

Završen je prvi sastanak Regionalnih centara za kulturnu baštinu u jugoistočnoj Europi s temom suradnja, partnerstva, financiranja koji se održao u Međunarodnom centru za podvodnu arheologiju. Sastanak su pozdravnim govorom otvorili zamjenik Ministricke kulture RH prof. Berislav Šipuš, voditelj odjela za kulturu UNESCO-vo ureda u Veneciji Antony Krause i ravnatelj MCPA dr. sc. Luka Bekić. Na prvom dijelu sastanka su svoj dosadašnji i budući rad predstavili UNESCO-vi regionalni centri iz Albanije, Bugarske, Crne Gore, Makedonije i Hrvatske. Njihova postignuća dokaz su da su ovakvi centri jedni od temeljnih ishodišta edukacije i suradnje na prostoru jugoistočne Europe. Ustanovljeno je



Sudjelovalo je 24 ljudi iz više od 7 zemalja te 5 međunarodnih organizacija / Twenty-four people from over seven countries and five international organisations participated (photo: M. Pešić)

Centre for Underwater Archaeology, focused on cooperation, partnership and finance. The meeting was opened by welcome addresses from Deputy Minister of Culture Berislav Šipuš, the head of the culture department at the UNESCO office in Venice Antony Krause and ICUA director Dr Luka Bekić. The first segment of the meeting saw the UNESCO regional centres in Albania, Bulgaria, Montenegro, Macedonia and Croatia present their work to date. Their achievements are proof that these centres are one of the core sources of education and cooperation in Southeast Europe. It was established that their development will continue to enjoy the support of competent state institutions and of UNESCO, among other ways via the Culture: A Bridge to Development European programme. The second half of the meeting was dedicated to a presentation of financing methods that could in the future contribute to the better development and sustainability of the UNESCO centres. Representatives of the World Bank, European Commission, the Regional Cooperation Council and the European Fund for the Balkans explained in detail the systems and methods of financing available through their institutions and spoke of the structures and possibilities to apply for projects at their addresses. Also contributing to the discussion were representatives of institutions from other countries such as

Sastanak je protekao u radnoj atmosferi okruglog stola / The meeting was conducted in a round table working atmosphere (photo: M. Pešić)

da će se njihov razvoj i dalje podržavati od strane nadležnih državnih institucija, kao i UNESCO-a, među ostalim i putem europskog programa Culture: A bridge to Development. Drugi dio sastanka bio je posvećen predstavljanju načina financiranja koji bi u budućnosti mogli pridonijeti boljem razvoju i održivosti UNESCO-ovih centara. Predstavnici Svjetske Banke, Europske komisije, Vijeća za regionalnu suradnju i Europskog fonda za Balkan pobliže su opisali sustave i načine financiranja putem svojih ustanova, te približili strukture i mogućnosti prijave projekata na njihove adrese. Raspravi su pridonijeli i predstavnici institucija iz drugih zemalja poput Turske i Italije. Savjeti i smjernice koje su dali zasigurno će pomoći centrima da se i dalje razvijaju uz pomoć europskih i međunarodnih fondova. Zajednički je zaključak da su ovakvi sastanci potrebni radi proširivanja regionalne suradnje i daljnjeg unapređenja brige o kulturnoj baštini.





Održano predavanje o istraživanju Sulejmanovog mosta

U MCPA Zadar je 24.4.2012. pred predstavnicima turskog Ministarstva kulture i turizma, Turske međunarodne agencije za suradnju i razvoj (TIKA), turskog veleposlanstva te hrvatskim stručnjacima održano predavanje o istraživanju Sulejmanovog mosta u Dardi. Istraživanje ovog značajnog arheološkog nalaza već nekoliko godina vodi Mladen Pešić iz MCPA Zadar, u suradnji s Hrvatskim restauratorskim zavodom. Tursko-hrvatska delegacija pregledala je i drvene dijelove mosta koji se nalaze na konzerviranju u Odjelu za konzerviranje i restauriranje podvodnih nalaza u Zadru. Osim toga, Anastazija Magaš-Mesić, pročelnica Konzervatorskog odjela u Zadru, održala je i prezentaciju istraživanja i obnove Maškovića hana u Vrani.

The archaeological research of Suleiman's bridge was presented by campaign head Mladen Pešić / Arheološka istraživanja Sulejmanova mosta predstavio je njihov voditelj, Mladen Pešić (photo: L. Bekić)

Turkey and Italy. The advice and guidelines they provided will certainly help the centres to continue developing with the help of European and international funds. The joint conclusion is that these kinds of meetings are necessary to broaden regional cooperation and the further development of care for cultural heritage.

Lecture on the research of Suleiman's bridge

A lecture was given on 24 April 2012 at ICUA Zadar on the research of Suleiman's bridge at Darda before representatives of the Turkish culture and tourism ministry, the Turkish International Cooperation and Development Agency (TIKA), the Turkish Embassy and Croatian experts. The research of this major archaeological find has been led for several years now by Mladen Pešić of ICUA Zadar in collaboration with the Croatian Conservation Institute. A Turko-Croatian delegation inspected the wooden segments of the bridge that are being conserved at the Department for Conservation and Restoration of Underwater Finds in Zadar. As part of the event Anastazija Magaš-Mesić, head of the Conservation Department in Zadar, held a presentation of the research and restoration of Mašković Han in Vrana.

First NAS Introduction and Part 1 Certificate in foreshore and underwater archeology course completed in Zadar

After the successful completion of the instructor's course this spring ICUA archaeologists Mladen Pešić and Luka Bekić have earned the status of tutors in the NAS training system. The Nautical Archaeology Society (NAS) of Portsmouth in Great Britain is one of the best-known international organisations engaged in marine archaeology in the world. The international NAS training programme has offered courses in nautical archaeology for



Voditelj restauratorske radionice Mladen Mustaćek pokazao je gostima ostatke mosta koji su u obradi / The head of the restoration workshop Mladen Mustaćek shows the guests the remains of the bridge under processing (photo: L. Bekić)

Završen prvi NAS Uvodni tečaj i tečaj I. stupnja u Zadru

Nakon uspješnog završetka instruktorskog tečaja u proljeće, arheolozi MCPA, Mladen Pešić i Luka Bekić postali su instruktori u NAS-ovu sustavu obuke. NAS, odnosno Nautical Archaeology Society iz Portsmoutha u Velikoj Britaniji jedna je od najpoznatijih međunarodnih organizacija koja se bavi pomorskom arheologijom u svijetu. Međunarodni NAS obučni program pruža tečajeve u nautičkoj arheologiji već više od 25 godina, a od 2012.g. NAS-ov obučni partner postao je i MCPA Zadar. Već od 15. do 17. listopada 2012.g. MCPA Zadar je proveo svoj prvi tečaj podvodne arheologije prema programu Nautical Archaeological Society i to NAS Uvod u priobalnu i podvodnu arheologiju i tečaj NAS I stupanj priobalne i podvodne arheologije. Tečajevi su se sastojali od teoretskih predavanja u učionici



**Nautical
Archaeology
Society**

Training partner

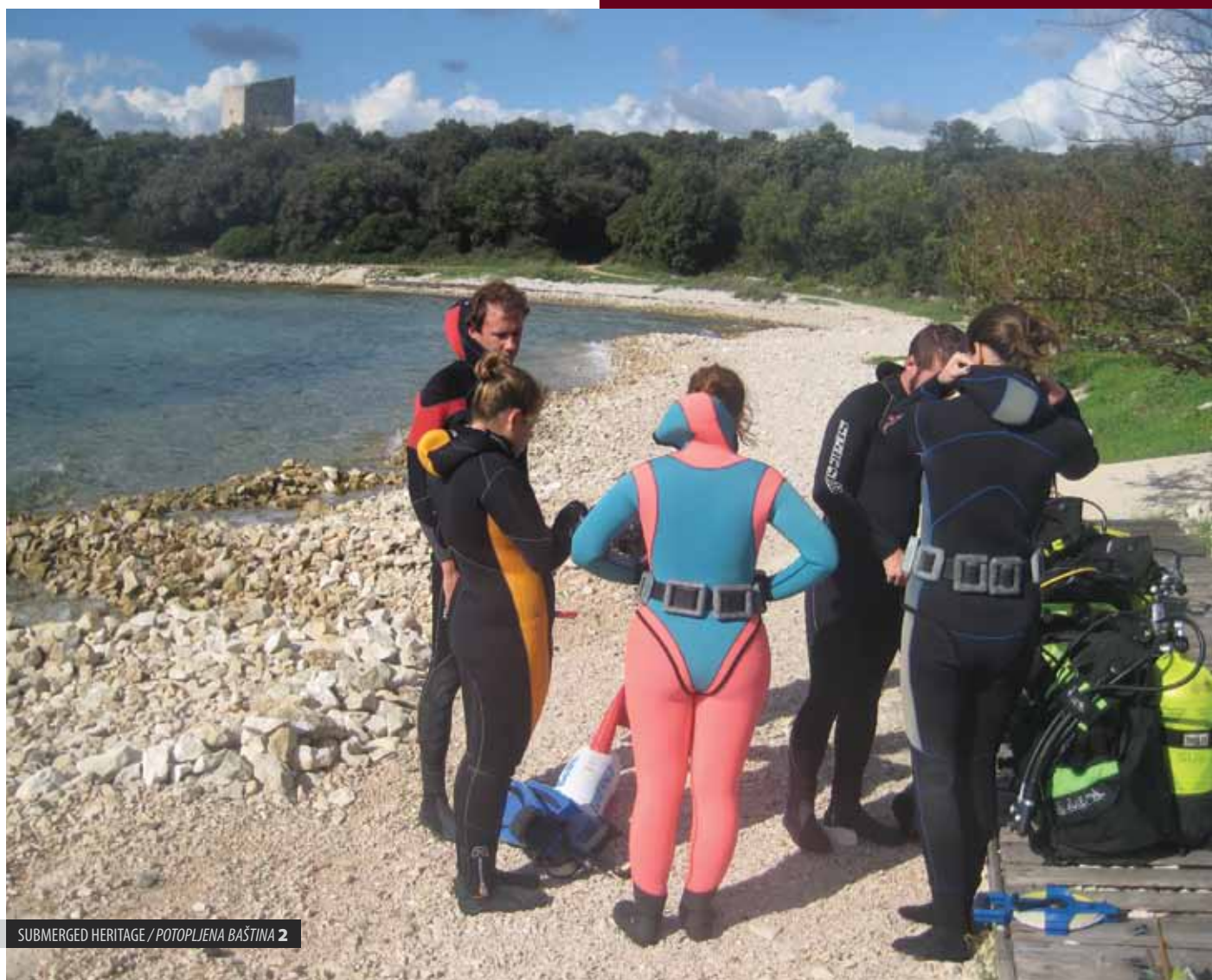


over twenty-five years, and as of 2012 ICUA Zadar has become a NAS training partner. By 15 to 17 October of 2012 ICUA Zadar had conducted its first underwater archaeology courses according to the Nautical Archaeological Society programme, these being the NAS Introduction to Foreshore and Underwater Archaeology course and the NAS Part 1 certificate in foreshore and underwater archaeology course. The courses consisted of theory lectures at the ICUA lecture hall in Zadar and hands-on underwater lessons at the Sveti Bartul archaeological site at Kožino near Zadar. The courses were successfully completed by four participants Nemanja Čavlović (Montenegro), Marina Mustać (Croatia), Tanya Mateeva (Bulgaria) and Maria Ktori (Cyprus).

Instruktor Pešić parovima je pokazivao vježbe / Instructor Pešić demonstrates the exercises to pairs (photo: L. Bekić)

MCPA u Zadru te praktičnih podvodnih lekcija na arheološkom nalazištu Sv.Bartul u Kožinu kod Zadra. Tečajevima je uspješno pristupilo četiri polaznika, Nemanja Čavlović (Crne Gora), Marina Mustać (Hrvatska), Tanya Mateeva (Bugarska) i Maria Ktori (Cipar).

Terenski dio tečaja odvijao se u lijepoj uvali Sv.Bartul u Kožinu / The field segment of the course was conducted at beautiful Sveti Bartul cove in Kožino (photo: L. Bekić)



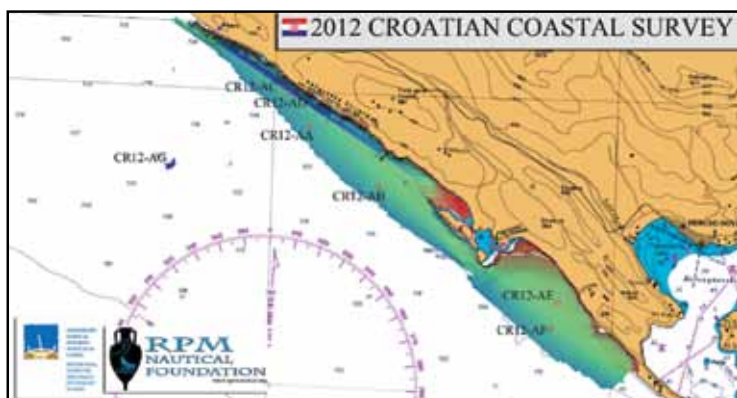


1. Research ship Hercules in Croatian waters / Istraživački brod Hercules u hrvatskim vodama (photo: L. Bekić)

DEEP-SEA SURVEY OFF KONAVLE, CROATIA

Jeffrey Royal, Luka Bekić
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In July and August of 2012 the International Centre for Underwater Archaeology and the RPM Nautical Foundation conducted a two-week survey of the seabed off the Konavle coast. This research campaign was conducted with funds from RPMN and the Ministry of Culture of the Republic of Croatia. The co-directors of the research campaign were Dr Luka Bekić and Dr Jeffrey Royal, with an expert team consisting of Mladen



DUBINSKO PRETRAŽIVANJE PODMORJA UZ KONAVLE, HRVATSKA

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Međunarodni centar za podvodnu arheologiju i RPM Nautical fundacija proveli su tijekom srpnja i kolovoza 2012.g. dvotjedno pretraživanje podmorja uz obalu Konavala. Ova istraživačka akcija provedena je sredstvima RPMN-a i Ministarstva kulture RH. Voditelji istraživanja bili su dr. Luka Bekić i dr. Jeffrey Royal, a u stručnoj ekipi su bili Mladen Pešić, Domagoj Perkić i George Robb. Uz njih su u projektu sudjelovali studenti arheologije iz Caroline, te posada i tehničko osoblje broda.

Istraživački brod (R/V) Hercules proveo je operaciju višesnimnim sonarom (multibeam sonar) tijekom srpnja. Cilj programa istraživanja bio je provesti istraživanje višesnimnim sonarom uzduž hrvatske obale do granice od 100 metara dubine u blizini Prevlake na jugu do rta Velikog Pača na sjeveru. Budući da je ovo bila prva sezona, određeno je jednostavno područje za istraživanje koje se moglo dovršiti tijekom dva tjedna.

2. Područje pregleda podmorja s nekim metama / The seabed area surveyed with some of the targets



Pešić, Domagoj Perkić and George Robb. Also participating in the project were archaeology students from Carolina, and the ship's crew and technical personnel.

Multibeam operations were undertaken during July by the R/V Hercules. The survey program aims to conduct multibeam survey along the coast of Croatia out to the 100-m depth contour from near Prevlaka in the south to Rt Veliki Pač in the north. As this was the inaugural season, the area designated for survey was kept manageable and easily completed in the two-week time frame.

The principal methods for this program of work were remote sensing with a multibeam echosounder and verification of anomalies with a Remote Operated Vehicle (ROV). Both survey and verification was carried out with RPMNF's research vessel Hercules, which is equipped with a hull-mounted multibeam echosounder sonar system¹ and can deploy its ROV. The R/V Hercules runs overlapping survey lanes along the contours of the seafloor to reach 200% coverage of the bottom. Data from the multibeam operations was processed during, and directly after, the collection phase to produce three-dimensional models of the seafloor, which was then analyzed for anomalies.² Anomalies were examined for association with either geologic formations or deposits consistent with shipwreck sites, the latter were plotted for verification. Once plotted in navigation and spatial recording software, the R/V Hercules was navigated and positioned over anomaly positions and the ROV equipped with a transponder was deployed.³ It was then possible to track both the R/V Hercules and the ROV within the three-dimensional seafloor models and obtain precise locations for sites and random finds. During verification operations, the locating of each anomaly, as well as stray material near anomalies and sites, was

3. Pripreme za spuštanje ROV-a / Preparations for a ROV descent (foto: D. Perkić)

Glavne su metode ovog programa rada bile daljinski pregled višesopnim sonarom i provjera anomalija daljinski upravljanom robot ronilicom (ROV - Remotely Operated Vehicle). Istraživanje i provjere obavljani su RPMNF-ovim istraživačkim brodom Hercules, koji je opremljenim višesopnim sonarom postavljenim na trup¹ i može otpuštati svoj ROV. Brod Hercules prolazi područja dvostrukim putanjama kako bi se pregledana područja na morskom dnu preklapila i tako postigla

4. George Robb upravlja rukama robota / George Robb controls the robot hands (foto: L. Bekić + ROV kamera)





facilitated by a sonar affixed to the ROV. Once cultural material was located and positions recorded, a visual investigation ensued through the use of still and video cameras. Whenever deemed necessary, representative material was collected from the surface of the site in order to ascertain provenience.

Sites discovered during the survey of the seabed

A sonar (multibeam) survey established 17 potential positions (targets), for verification. During the last week of the campaign a ROV was deployed to survey 12 of these sites, including one site at around 30 meters depth, that was also checked by divers. Out of these 12 sites, several are of interest both from the archaeological and historical aspect.

CR12-AA - Konavoske stijene

This disorganized site lying approximately 1.3 km offshore is a mound comprised of mud-sand, and from its surface appearance has been disturbed. Overall, the disturbance pattern appears

5. Domagoj Perkić sondira potencijalno nalaziste / Domagoj Perkić sounds a potential site (photo: L. Bekić)

200-postotna pokrivenost dna. Podaci dobiveni istraživanjem višesnopnim sonarom obrađivani su tijekom i neposredno poslije faze prikupljanja kako bi se izradili trodimenzionalni modeli podmorja koji su se zatim analizirali s obzirom na anomalije.² Anomalije su se testirale kako bi se odredilo odnose li se na geološke formacije ili ostatke potonulih brodova, koji se potom označavaju za provjeru. Nakon označavanja u softveru za navigaciju i prostorno snimanje, Hercules bi doplovio do mjesta anomalije i spustio ROV opremljen transponderom.³ To je omogućilo praćenje broda Hercules i ROV-a unutar trodimenzionalnih modela podmorja kako bi se ustanovile precizne lokacije nalazišta i slučajnih pronalazaka. Tijekom operacije provjeravanja, lociranje svih anomalija, kao i rasutog materijala u blizini anomalija i nalazišta, obavljeno je sonarom pričvršćenim na ROV. Poslije lociranja kulturnog materijala i bilježenja pozicija obavljen je vizualni pregled fotoaparatom i videokamerom. Kad je bilo potrebno, s površine nalazišta prikupio se uzorak materijala kako bi se utvrdilo podrijetlo.

¹ Model tip EM3002D proizvođača Kongsberg Maritime; emitira više od 500 zasebnih sonarnih snopova maksimalnom brzinom od 40 puta u sekundi. Navedeni se snopovi emitiraju na dvije frekvencije, s odašiljačima u dvije glave, od 297 i 303 MHz. Sustav ima razlučivost dubine od 1 cm. / Model type EM3002D from Kongsberg Maritime division; emits in excess of 500 individual sonar beams at a maximum rate of 40 times per second; these beams are emitted on the two frequencies, differentiated by head, of 297 and 303 MHz. The system has a depth resolution rating of 1 cm.

² Podaci dobiveni višesnopnim sonarom prikupljeni su Kongsbergovim softverom SIS, obrađeni CARIS HIPS/SIPS-om i modelirani softverom IVS Fledermaus za analizu anomalija. Istraživači angažirani od strane Highland Geo Solutions Inc. iz Frederictona, NB, Kanada, obavili su prikupljanje i obradu svih podataka. / Multibeam data was acquired through Kongsberg's SIS software, processed in CARIS HIPS/SIPS, and modeled in IVS Fledermaus software for anomaly analysis. All acquisition and processing of data was performed by surveyors contracted from Highland Geo Solutions Inc. of Fredericton, NB, Canada.

³ IVS je ljubazno ustupio modul prototipa softvera za praćenje svih brodova unutar 3D modela podmorja u Fledermausu. / IVS kindly provided a prototype software module that allowed the tracking of all vessels within the 3-D models of the seafloor in Fledermaus

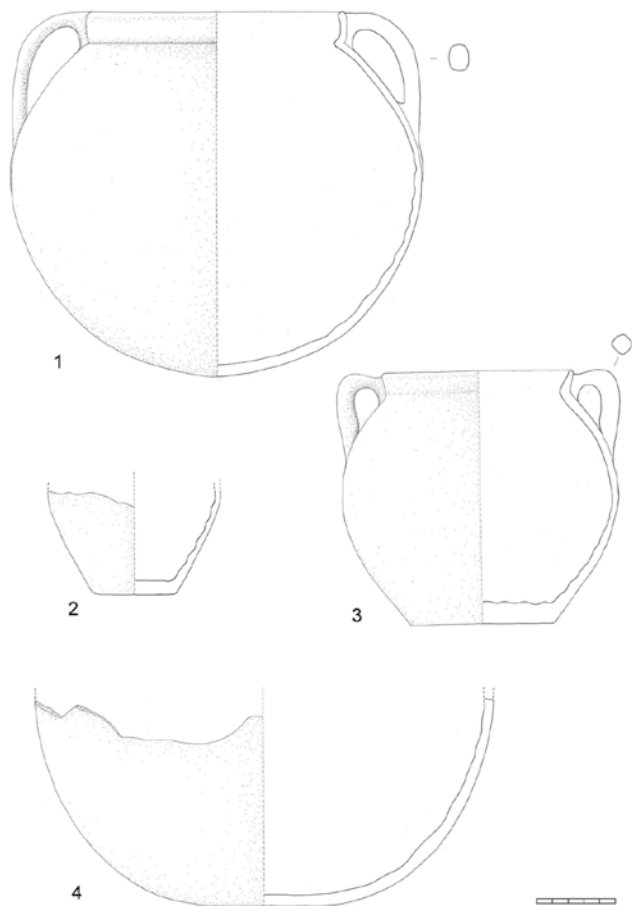


Tabla 1 - Crteži nalaza s Konavoskih stijena / Table 1 - Drawings of the finds at Konavoske stijene (author: L. Bekić)

to be caused from fishing dragnets. Most of the artifacts are ceramics, many are broken and scattered around the site. Material on the surface of the Konavoske stijene wreck has the shape forms of plates, bowls, and cups. One area has an approximately 1 x 1 meter concentration of what appears to be tableware. Several examples were collected from this concentration: a bottom of a bowl (T.1-2), a concretion that was partially buried (figure), and a portion of an amphora that had a small portion break off during recovery (T.1-4), a portion of an amphora full of mud (T.1-1), and a smaller bowl that had a portion of the rim break away during recovery (T.1-3). There were also indications that more pottery were buried in the mound.

The globular forms from this shipwreck are made of what appears to be the same, red not fully refined clay, and we can postulate that they were produced by a workshop for sale, i.e. part of the ship's cargo. We have not yet found any direct analogies for these pottery types, however they are, by all accounts, most closely related to Byzantine type ware. The bottom of the largest vessel (T.1-4) is very similar to the well-known LRA 13 type amphora, i.e. the Yassiada type I which are dated by the eponymous shipwreck to the first half of the 7th century.

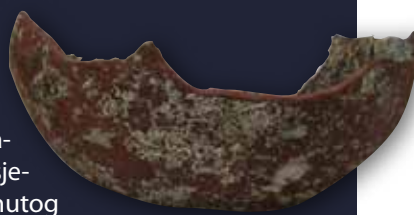
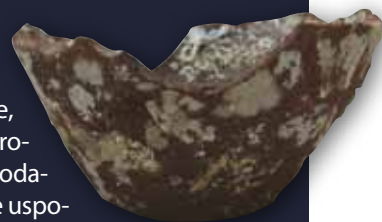
Two other globular vessels with small handles alongside the rim (T.1-1,3) are similar to cooking pots that can be dated from the 5th to 8th centuries. These are, for example, a pot from Tarragona from the late 5th century (Macias Sole 1998, fig. 2), pots from the 7th century from the well-known Crypta Balbi site (Ricci 1998, fig. 3,4), pots of the 71/72 forms from the 7th to 8th century found at Crecchio (Staffa 1998, fig. 20) and a 7th to 8th century pot from Otranto (Arthur, Patterson 1998, fig. 9-4). The forms of this ware are also reminiscent of the finds from the

Nalazišta otkrivena prilikom pregleda podmorja

Pregledom višesnopnim sonarom, određeno je 17 potencijalnih pozicija - meta, koje je valjalo provjeriti. Tijekom zadnjeg tjedna ROV-om ih je pregledano sveukupno 12, a jedna pozicija na tridesetak metara dubine i uz pomoć ronilaca. Od ovih 12 pozicija nekoliko je arheološki i povijesno zanimljivih.

CR12-AA - Konavoske stijene

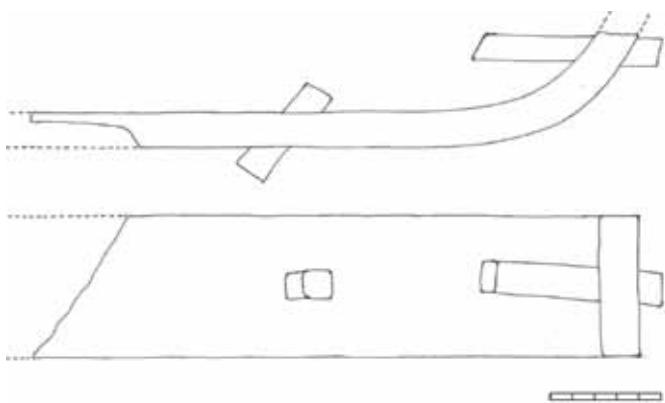
Ovo neorganizirano nalazište oko 1,3 km od obale je nakupina mulja i pijeska i čini se narušeno prema izgledu njegove površine. Uopće, obrazac narušavanja čini se da je uzrokovan ribarskim mrežama potegačama. Većina je predmeta keramička, a mnogi su razbijeni i razbacani oko nalazišta. U materijalu na površini olupine Konavoske stijene prepoznaju se oblici tanjura, posuda i šalice. Jedno područje ima koncentraciju od 1x1 m nečega što se čini kao posuđe. Nekoliko je primjeraka prikupljeno iz navedene koncentracije: dno posude (T.1-2), neprepoznatljiv zahrđali željezni predmet koji je bio djelomice zakopan (slika) dio amfore koji je zadobio manje oštećenje pri vađenju (T.1-4), dio amfore pune mulja (T.1-1) te manja posuda čiji se dio ruba slomio prilikom vađenja (T.1-3). Postoje naznake da je u nakupini zakopano još keramike.



Globularni oblici s ovog brodoloma izrađeni su iz naizgled iste, crvene nepotpuno pročišćene gline, pa možemo pretpostaviti kako su proizvod neke radionice namijenjeni prodaji, odnosno dio tereta broda. Izravne usporedbe za ove keramičke tipove zasada nismo pronašli, međutim, prema svemu sudeći najrodniji su bizantskim tipovima posuđa. Dno najveće posude, amfore (T.1-4) vrlo nalikuje poznatom tipu LRA 13 amfore odnosno Yassiada tip I koji se prema istoimenom brodolomu datira u prvu polovinu 7.st.

Druge dvije globularne posude s malim ruč-kicama uz obod (T.1-1,3), nalikuju oblicima lonaca za kuhanje koji se mogu datirati od 5. do 8.st. To su na primjer lonac iz Tarragone s kraja 5.st. (Macias Sole 1998, sl. 2), lonci 7.st. iz poznatog nalazišta Crypta Balbi (Ricci 1998, sl. 3,4), zatim lonaca forme 71/72 iz 7/8.st. pronađenih u Crecchiu (Staffa 1998, sl. 20) te lonac 7/8.st. iz Otranta (Arthur, Patterson 1998, sl. 9-4). Također, oblici ovog posuđa podsjećaju i na nalaze s već spomenutog brodoloma Yassiada. Sudeći prema tome, ovaj brodolom može se datirati u razdoblje od kraja 5. do 8.st.,

7. Prikupljeni nalazi s nalazišta CR12-AA Konavoske stijene / Collected artifacts from Site CR12-AA Konavoske stijene (photo: L. Bekić)



8. Rendgenske snimke i moguć izgled željeznog predmeta u skici / X-ray images and possible appearance of iron object (author: L. Bekić)

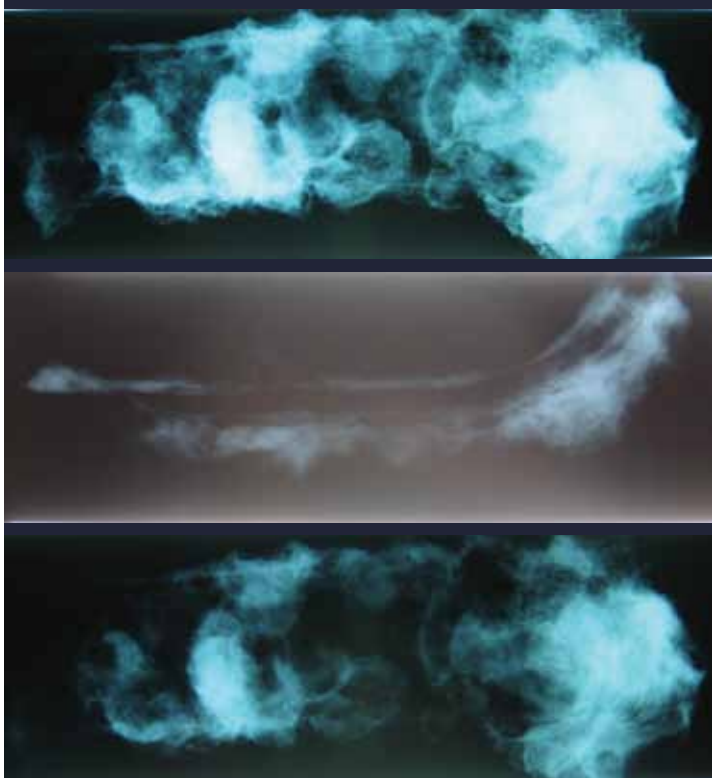
previously cited Yassiada shipwreck. Based on this the shipwreck can be dated to the period from the end of the 5th to the 8th century, but it should be noted that similar globular amphorae and pots remained in use, at least during the 9th century if not later.

The purpose of the massive corroded iron object found among the rubble on the shipwreck is still unclear. According to X-ray images, the elongated flat iron bar is gently curved on one side and at least two iron pegs of rectangular cross-section are noticeable in the concretion. At the moment it seems the object could have served as a sort of reinforcement.

CR12-AB - Rt Lokvica

A mound of mud-sand lying approximately 1.6 km offshore is oriented on a distinctly SE-NW axis; material extends from one end of the site to the other. At the SE end of the site there are at least three large iron anchors that lie in opposite directions next to one another. The pattern has the appearance of anchors stowed on deck. Each of the anchors has rings at the top of their shafts. One of the visible anchor shafts has a square in section and the arms form a slight 'V'. Another anchor has a more lunette overall shape to the arms along with a small peak at the crown; the flukes are clearly triangular. It is possible that wood remains are located beneath the anchors.

On the NW end of the site formation another two anchors are partially buried in the mound. One anchor has a ring at the top of its shaft and an apparently square shaft in section. The second anchor lies approximately 2 m from the first and has discernible triangular flukes. At the center of the site is a possible cast-iron *verso* (*falconetti*) that is highly concreted based on what appear



ali valja napomenuti kako se slične globularne amfore i lonci koriste i nadalje, barem još i tijekom 9.st. ako ne i kasnije. Zasadu nije jasna namjena masivnog korodiranog željeznog predmeta, koji je pronađen među kršem brodoloma. Prema rendgenskim slikama, izdužena plosnata željezna pologa je blago povijena na jednoj strani i vidljiva su barem dva željezna klina kvadratnog presjeka u sraslini. Zasadu je moguće da je predmet služio kao neko ojačanje.

CR12-AB - Rt Lokvica

Nakupina mulja i pijeska oko 1,6 km od obale jasno je orijentirana na os JI-SZ. Materijal se prostire od jednog do drugog kraja nalazišta. Na SI dijelu nalazišta najmanje su tri velika željezna sidra koja u suprotnim smjerovima leže blizu jedno drugoga. Položaj ukazuje na sidra držana na palubi. Sva sidra imaju prstene na vrhu. Struk jednog od vidljivih sidra djelomice je kvadratnog oblika, a krakovi pomalo tvore slovo 'V'. Drugo sidro je više u obliku lunete do krakova, s malim šiljkom na kruni, a lopate su jasno trokutaste. Moguće je da se ispod sidara nalaze ostaci drva.

9. Sidra sa olupine broda kod Rta Lokvica / Anchors from the cape Lokvica wreck (ROV camera)





10. Jeffrey Royal proučava nalaze / Jeffrey Royal studies the finds (photo: D. Perkić)

to be regularly-spaced reinforcement hoops. Additionally, there are four large (0.5-1.0 m) stones in this central area; these stones appear smooth and are aligned in two parallel rows.

Considering the material observed on the surface of the site, some preliminary hypotheses are possible for the provenience of the wrecksite. The presence of the small wrought-iron swivel guns places the wreck likely in the 16th century or later. By the late-15th century merchantmen in the Mediterranean were arming their vessels with wrought-iron swivel guns; this trend continued to become a common practice in the 16th century in light of the increased dangers of operating on a competitive and hostile sea (Royal, McManamon 2009, 110,111). For example, the early 16th-century Cattewater wreck was an armed merchantman that carried three wrought-iron swivel guns mounted in wooden stocks; the most complete example was 1.25 m long and had an outside diameter at the muzzle of ca. 7 cm (Redknap 1984, 39, 1997 49-63). These are dimensions similar to the gun on the Rt Lokvica wrecksite. Likewise, there is some information provided by the anchors. During the 14th and 15th centuries English anchors developed from curved to straight arms that initially had an angle of approximately 40° to the shaft, and by 1600 the arms had widened to c.60° (Curryer 1999, 41). Unlike the palm-shaped flukes characteristic of English anchors, most known Iberian anchors had triangular-shaped flukes (Smith 1993, 122). Typically, Venetian anchors also had triangular-shaped flukes. Anchor arms forming a more slightly bent form are typical of Spanish anchors, such as the two possibly-Spanish anchors found on the wreck of La Trinidad Valencera (1588) that have triangular flukes (Martin 1979, 31, 32; Curryer 1999, 38-40). Taken as a whole, this vessel probably operated in the 16th century. At this time the Republic of Ragusa (Dubrovnik) was a vibrant maritime trading center, which conducted trade throughout the Mediterranean and flourished particularly in the 16th century. Hence, a cultural association for the Rt Lokvica wreck of Venetian (or another Italian maritime city) or possibly Spanish is possible.

Na SZ strani nalazišta druga su dva sidra djelomice zakopana u nakupini. Jedno sidro ima prsten na vrhu struka i očit pravokutni presjek struka. Drugo je sidro oko 2 m od prvog i ima jasno vidljive trokutaste lopate. U središtu nalazišta vjerojatno se nalazi top od kovanog željeza *verso* (*falconetti*) gotovo srašten s nečime što se čini poput obruča za ojačanje postavljenim u pravilnim razmacima. Nadalje, tu su 4 velika kamena veličine 0,5 do 1 m u tom središnjem dijelu, koji se čine glatkima i koji su poredani u dva paralelna reda.

Razmatrajući materijal promatran na površini nalazišta, moguće su neke preliminarne hipoteze o podrijetlu olupine. Prisutnost malog obrtnog oružja od kovanog željeza smješta olupinu u 16. stoljeće ili kasnije. Od kraja 15. stoljeća trgovci na Mediteranu opremali su svoje brodove obrtnim oružjem od kovanog željeza. Taj se trend nastavio i postao uobičajena praksa u 16. stoljeću u svjetlu rastuće opasnosti poslovanja na kompetitivnom i neprijateljskom moru (Royal, McManamon 2009, 110, 111). Primjerice, olupina Cattewater iz ranog 16. stoljeća bio je naoružani trgovački brod s tri topa od kovanog željeza postavljena na drvenim postoljima. Najcjelovitiji je primjer dio dugačak 1,25 m i imao je vanjski promjer cijevi oko 7 cm (Redknap 1984, 39; 1997. 49-63). Navedene su dimenzije slične dimenzijama topa olupine kod rta Lokvice. Također, i sidra nude neke informacije. Tijekom 14. i 15. st. engleska su se sidra razvijala od zaobljenih do ravnih krakova koji su u početku imali kut od oko 40° u odnosu na struk, a do 1600.g. krakovi su se proširili na oko 60° (Curryer 1999, 41). Za razliku od lopata u obliku dlana karakterističnih za engleska sidra, najpoznatija su iberska sidra imala lopate u obliku trokuta (Smith 1993, 122). I venecijanska su sidra obično imala lopate u obliku trokuta. Krakovi sidra manje savinutog oblika tipični su za španjolska sidra, poput onih mogućih španjolskih sidara nađenih na olupini La Trinidad Valencera (1588.g.) s trokutastim lopatama (Martin 1979, 31, 32; Curryer 1999, 38-40). Gledajući u cjelini, ovaj je brod vjerojatno plovio u 16. stoljeću. U to je doba Dubrovačka Republika bila živo središte pomorske trgovine koje je trgovalo na cijelom Sredozemlju i posebno procvjetalo u 16. st. Stoga je moguća kulturna povezanost olupine kod rta Lokvice s Venecijom, nekim drugim talijanskim pomorskim gradom ili čak Španjolskom.

CR12-AC and CR12-AD - Landing craft

These two sites are considered part of a single event due to their both being formed by the deposition of specific and identical landing craft. A distance of 400 m separated the two sites. The landing craft are rectangular in shape due to their flat-bottom construction, vertical sides and stern, and vertical door at their bow. Both had tracked wheels and a small bridge at their stern. Each was intact and did not exhibit any significant damage; however, there were no vehicles in their bays. Some debris was found around each landing craft, along with some material between them that could be associated with the vehicles they carried or other material from the operation. CR12-AC also had a larger amount of debris about 40 m to the E; this debris was linear I-beam structures lying side-by-side and smaller metal objects scattered around it.



12. Desantni brod na morskom dnu / Landing craft on the sea bottom (ROV camera)



13. Američki desantni brod LCM-Mk2 sličan onima pronađenima na morskom dnu (izvor: <http://www.ibiblio.org/hyperwar/USN/ships/ships-lcm2.html>) / US Landing craft LCM-Mk2 similar to the ones discovered on sea bottom (source: <http://www.ibiblio.org/hyperwar/USN/ships/ships-lcm2.html>)

CR12-AE - Fishing vessel

This pile of modern debris lies approximately 1.1 km offshore. Most of what is noted on the surface is metal debris and fishing gear: nets, cables, and possibly a winch. However, there was also an anchor noted on the site. It had a lunette shape with flukes that appear triangular. It appears from initial inspection that this is the remains of a modern fishing vessel.

14. Pogled višesnopnim sonarom na olupinu podmornice južno od Molunata / Multibeam view of Submarine wreck south of Molunata



11. Kontrolna soba Herculesa, Robert Woods proučava nalaz desantnog broda na zaslonu / The control room on the Hercules: Robert Woods studies the find of a landing craft on screen (photo: L. Bekić)

CR12-AC i CR12-AD - Desantni brodovi

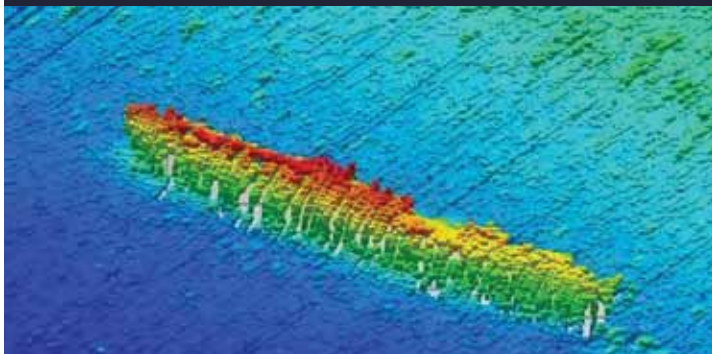
Navedena se dva nalazišta smatraju dijelom jednog događaja s obzirom na to da su oba nastala potapanjem specifičnih i identičnih desantnih brodova. Udaljenost od 400 m razdvaja dva nalazišta. Desantni su brodovi pravokutnog oblika zbog konstrukcije ravnog dna, okomitih stranica i krme te okomitih vrata na pramcu. Oba broda imaju gusjeničarske kotače i mali most na krmi. Oba su nedirnuta i nema znatnijih oštećenja. Međutim, u njima nije bilo vozila. Nešto je ostataka pronađeno oko svakog desantnog broda, kao i nešto materijala između njih koji se može povezati s vozilima koje su nosili i ostalim materijalom iz operacije. Oko 40 m istočno od CR12-AC također je pronađena veća količina ostataka ravnih greda položenih jedna uz drugu i manjih metalnih predmeta rasutih oko njih.

CR12-AE - Ribarica

Ova nakupina modernih ostataka nalazi se oko 1,1 km od obale. Većina onoga što se vidi na površini metalni su ostaci i ribarska oprema - mreže, užad i možda čekrk. Međutim, na nalazištu je također pronađeno i jedno sidro oblika lunete s lopatama koje se čine trokutastima. Nakon prvog pregleda čini se da je riječ o modernom ribarskom brodu.

CR12-AF - Podmornica

Ovo je otprije poznata olupina podmornice. Na temelju podataka dobivenih višesnopnim sonarom, njezine su dimenzije 54,7 x 8,8 m, a podmornica se uzdiže 5,2 m iznad morskog dna.

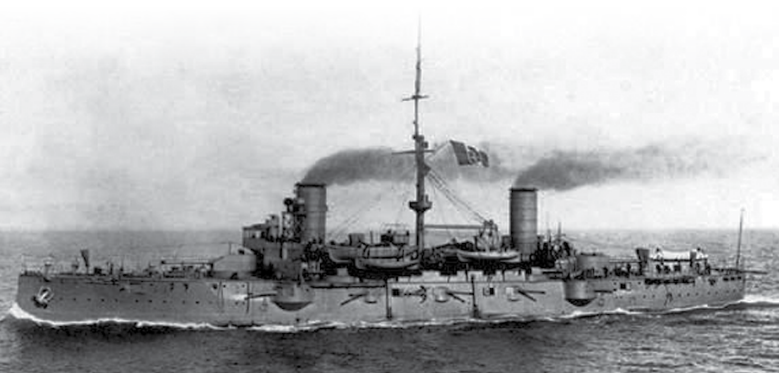


CR12-AF - Submarine

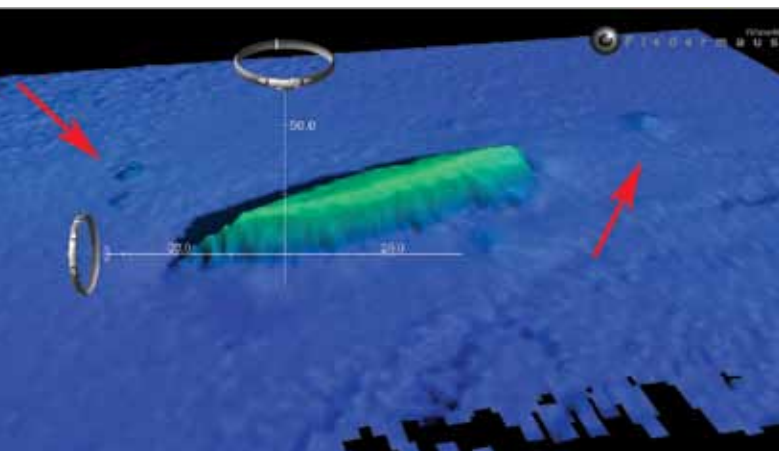
This is a known submarine wreck. Based on the multibeam data, its dimensions are 54.7 x 8.8 m, and it extends 5.2 m above the seafloor.

CR12-AG - Giuseppe Garibaldi

Although not in the survey area, this modern wrecksite of the Garibaldi was surveyed in order to calibrate the multibeam system. According to the multibeam data the main section of the Garibaldi is 87.0 x 18.3 m, and extends 14.8 m above the seafloor, lying inverted. Another section 47 m to the WSW measures 20 x 13 m; it is not clear, but seems that this is part of the Garibaldi.



15. *Giuseppe Garibaldi* u plovidbi tijekom I Svjetskog rata (izvor: www.diveststar.eu) / *Giuseppe Garibaldi* sailing during WWI (source: www.diveststar.eu)



16. *Strelice* označuju anomalije koje predstavljaju otpale dijelove broda / *Arrows* are marking anomalies which represent ship parts

The armoured cruiser Giuseppe Garibaldi was built in 1901 at the Italian shipyard in Genoa. She had a length of 111.6 and a breadth of 18.2 metres. The Garibaldi sailed into the waters of Konavle on 18 August 1915 with a mission to shell the railway near Cavtat. She sank upon being hit by a torpedo launched by the Austro-Hungarian Navy submarine U-4. Garibaldi had a crew of 578 at the time, fifty-three of who perished when she sunk (Frka, Mesić, 2012, 368-375). The first dives to this ship were made in 2009 by technical divers.

We can conclude that off the coast of Konavle we have discovered several interesting sites, and some of them are worth further investigation, despite the fact that they are at great depths. We hope that this project will continue in the years ahead, and it is planned to gradually expand the search area to the north.

CR12-AG - Giuseppe Garibaldi

Iako nije obuhvaćeno područjem istraživanja, ova moderna olupina Garibaldija pregledana je u svrhu kalibriranja višesnog sustava. Na temelju podataka dobivenih višesnopnim sonarom, glavni je dio Garibaldija veličine 87,0 x 18,3 m, uzdiže se 14,8 m iznad morskog dna i leži u okrenutom položaju. Na udaljenosti od 47 m prema ZJZ još je jedan dio dimenzija 20 x 13 m; nije posve jasno, ali čini se da je i to dio Garibaldija.

Oklopna krstarica Giuseppe Garibaldi izgrađena je 1901.g. u talijanskom brodogradilištu u Genovi. Bila je duga 111,6 a široka 18,2 metara. Garibaldi je pred obale Konavala doplovio u cilju napada na željezničku prugu kod Cavtata 18. kolovoza 1915.g. Potonuo je uslijed torpeda ispaljenih sa austrougarske podmornice U-4. U trenutku potapanja, na brodu je bilo 578 članova posade, od kojih su 53 poginula (Frka, Mesić, 2012, 368-375). Na ovaj brod su prvi zaronili tehnički ronionci 2009.g.

Na kraju možemo zaključiti kako se ispred obale Konavala pronašlo više zanimljivih nalazišta, a poneka od njih bi vrijedilo dalje istraživati, usprkos činjenici da se nalaze na velikim dubinama. Nadamo se kako će se ovaj projekt nastaviti i u godinama koje slijede, i planirano je područje pretraživanja postupno širiti prema sjeveru.

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1. Nadgrađe potonulog parobroda Baron Gautsch kod Rovinja /
Superstructure of sunken steamship Baron Gautsch near Rovinj
(photo: N. Starčić)

ONCE AGAIN ON THE COASTAL SURVEYS OF ISTRIA

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Constant underwater investigations are the only way of identifying new archaeological sites and of monitoring already known sites. The International Centre for Underwater Archaeology in Zadar (ICUA) and the Croatian Conservation Institute (HRZ) have conducted around one hundred dives in recent years. The result is the identification of some twenty new sites off Istrian peninsula's coastline, of which at least five are ancient shipwreck sites and two are sites of the modern era, unknown until now (Bekić 2011, 2012).¹

Despite the fact that these sites have been plundered, archaeological science can still draw precious data from them. After the discovery, general dating and evaluation of the state of preservation, some of these sites can and should be the subject of systematic archaeological investigations. It will therefore be possible to preserve this part of our underwater cultural heritage and at the same time advances in the scientific branch of archaeology will

¹ Rezultati rekognosciranja podmorja Istre objavljeni su u više navrata, a najopsežnija objava je izašla u zborniku *Histria Antiqua* 21. / Istrian coastline survey results were published on several occasions, most comprehensive in *Histria Antiqua* 21.

JOŠ JEDNOM O RE- KOGNOSCIRANJIMA ISTARSKOG PRIOBALJA

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Kontinuirani pregledi podmorja jedini su način da se ustanove nova arheološka nalazišta ali i da se prati stanje na već poznatima. Međunarodni centar za podvodnu arheologiju u Zadru (MCPA) i Hrvatski restauratorski zavod (HRZ) su kroz stotinjak urona tijekom ovih nekoliko godina u priobalju istarskog poluotoka ustanovili čak dvadesetak novih nalazišta od kojih najmanje pet antičkih i dva novovjekovna brodoloma za koje se dosada nije znalo (Bekić 2011, 2012).¹

Usprkos činjenici kako su ostaci ovih brodoloma opljačkani, arheološka znanost iz njih ipak može izvući vrlo dragocjene podatke. Nakon otkrivanja i okvirnog datiranja te procjene očuvanosti, moguće je, pa i poželjno, na određenim lokacijama provesti sustavna arheološka istraživanja. Osim napretka u arheološkoj znanstvenoj grani, potiče se i zaštita podvodnog kulturnog blaga. To vrijedi i za brodolome iz novije povijesti, koji datiraju iz razdoblja Svjetskih ratova, a koji su u sustavu zaštićenih zona sa kontroliranim posjetima turista. Takve lokacije također se obilazi i prati njihovo stanje. Upravo iz tog razloga, ova rekognosciranja obavljana su prema redovnim godišnjim programima zaštite kulturne baštine Ministarstva kulture RH.



2. Bekić i Pešić tijekom pregleda uvale Lone kod Rovinja / Bekić and Pešić during examination of Bay Lone near Rovinj (photo: M. Srećec)

be made. Same goes for shipwrecks from most recent history, dating back to the World Wars, and which are in protected zones with controlled tourists visits. These locations are also being visited and their condition monitored. For these reasons, the mentioned underwater investigations have been conducted according to the regular annual programmes of the Ministry of Culture

4. Mjerenje kamenog zida na Mučjim sikama kod Rovinja / Measuring stone walls at Mučje sike near Rovinj (photo: L. Bekić)



3. Primjeri amfora pronađenih prilikom rekognosciranja Istre / Examples of amphorae found during surveys in Istra (photo: L. Bekić), 1. Mučje sike, 2. Polari, 3. Piruzi, 4.-5. Guštinja, 6. Kuje, 7. Sv. Ivan



a osnovu rezultata i izvješća koja arheolozi predaju, konzervatori Ministarstva kulture mogu započeti proces zaštite nalazišta upisom u službeni Registar kulturnih dobara RH. Uz to, sva ova saznanja poslužiti će da se upotpuni i ispravi novoizrađena digitalna baza podataka podvodne kulturne baštine, MACHU. HR, koja se vodi pri Međunarodnom centru za podvodnu arheologiju u Zadru.

Kao posebno vrijedna nalazišta otkrivena ili potvrđena prilikom ovih rekognosciranja su ranoantički brodolomi kod rta Uljeva A i hridi Seka te kasnoantički brodolomi kod rta Uljeva B i otoka Sv.Ivana. Vrlo su značajni i novodokumentirani ostaci arhitektonskih sklopova u uvali Kolone i na Vilas Rubinu. Obje lokacije mogu se opisati kao sklop pomorskih i gospodarskih objekata koji su služili dosada nepoznatim obalnim vilama rustikama. Neobičan je veliki suhozid na Mučjim sikama čije je datacija zasaada ipak nejasna, poput pristaništa u uvali Vinjole. Oba objekta zasigurno su postojala u antičko doba, ali je moguće da su i stariji. Sve ovo su značajni arheološko - povijesni tragovi koje će trebati štititi od potencijalne devastacije a za nadati se je kako će se ovakvi pregledi podmorja nastaviti i u budućnosti.



5. Skica najbitnijih potopljenih građevina na Mučjim sikama / Sketch of the most important submerged constructions on the Mučje sike (Google Earth, M. Pešić)

of the Republic of Croatia for the protection of cultural heritage.

Based on the results and reports submitted by archaeologists, the conservators of the Ministry of Culture can start the process of the protection of the sites by entering the sites in the Register of Cultural Goods of the Republic of Croatia. Moreover, all the new insights will be used to complete and correct the recently made digital database of the underwater cultural heritage, MA-CHU.HR, maintained by the International Centre for Underwater Archaeology in Zadar.

Among the particularly valuable sites discovered or identified during the underwater investigations is an Early Antique shipwreck site at Uljeva A Cape and Seka Rock, and also Late Antique shipwreck sites at Uljeva B Cape and off the island of Sv. Ivan. Of particular importance are newly documented remains of architectural complexes in the Bay of Kolone and at Vilas Rubin. Both of these locations can be described as complexes of maritime buildings and production and storage facilities that were used by yet unknown coastal villae rusticae. A dry stone wall of large dimensions located at Mučje Sike is a curious find. Its dating is uncertain for now, as is the dating of the dock in the Bay of Vinjole. Both of these structures were certainly present in Antiquity, but it is possible that they are even older. These are all significant archaeological and historic traces that will have to be protected from potential devastation. Hopefully, underwater investigations will continue in the future.

6. Snimanje zidova na Mučjim sikama kod Rovinja totalnom stanicom s obale / Recording the walls of Mučje sike near Rovinj with total station from a shore (photo: L. Bekić)

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1. Καθαρισμός Χιακού αμφορέα © Πανεπιστήμιο Κύπρου, Ερευνητική Μονάδα Αρχαιολογίας / Cleaning a Chian amphora © University of Cyprus, Archaeological Research Unit

THE MAZOTOS SHIPWRECK PROJECT IN CYPRUS

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Cyprus, an island with a strategic geographical location, developed its maritime activity and nautical tradition from an early stage. Testimonies of these activities with wide archaeological interest, are located both in the region as well as in Cyprus. The discovery and excavation of five shipwrecks connected with Cypriot archaeology namely, Cape Gelidonya, Kyrenia, Uluburun, Cape Iria and Ma'agan Mikhael, revealed the importance of conducting underwater archaeological research on the island. In addition, the discovery of underwater archaeological remains around Cyprus (shipwreck remains, anchorages, anchors, harbor, architectural remains), underlined the necessity of developing the discipline. However, although one of the first and most important excavations in the history of underwater archaeology was conducted on the island, at the Kyrenia shipwreck (1967 - 1970, University of Pennsylvania), research carried out since then was limited to surface inspections of the sites with minimal Cypriot involvement.

This tendency altered its course during the last six years. The introduction of classes of underwater archaeology at the Department of History and Archaeology of the University of Cyprus

Η ΕΡΕΥΝΑ ΤΟΥ ΝΑΥ-ΑΓΙΟΥ ΤΟΥ ΜΑΖΩ-ΤΟΥ ΣΤΗΝ ΚΥΠΡΟ

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Η Κύπρος, που βρίσκεται σε στρατηγική γεωγραφική θέση, ανέπτυξε θαλάσσια δραστηριότητα και ναυτική παράδοση από πολύ νωρίς. Κατάλοιπα αυτών των επαφών, με έντονο αρχαιολογικό ενδιαφέρον, εντοπίζονται τόσο στη Μεσόγειο θάλασσα όσο και στην Κύπρο. Η ανακάλυψη και ανασκαφή πέντε ναυαγίων που σχετίζονται με την Κυπριακή αρχαιολογία, Cape Gelidonya, Κερύνεια, Uluburun, Ακρωτήρι των Ιρίων και Ma'agan Mikhael, αποκάλυψαν τη σημασία διεξαγωγής υποβρύχιας αρχαιολογικής έρευνας στο νησί. Επιπλέον, η ανακάλυψη υποβρύχιων αρχαιολογικών καταλοίπων στην Κύπρο (κατάλοιπα ναυαγίων, αγκυροβόλια, άγκυρες, λιμάνια, αρχιτεκτονικά κατάλοιπα), υπογράμμισαν την αναγκαιότητα για την ανάπτυξη της επιστήμης. Ωστόσο, παρά το γεγονός ότι στην Κύπρο πραγματοποιήθηκε μια από τις πρώτες και πιο σημαντικές ανασκαφές στην ιστορία της ενάλιας αρχαιολογίας, στο Ναυάγιο της Κερύνειας (1967 - 1970, Πανεπιστήμιο της Πενσυλβάνια), οι έρευνες που πραγματοποιήθηκαν στο νησί από τότε περιορίστηκαν στην επιφανειακή επισκόπηση των θέσεων, με πολύ περιορισμένη συμμετοχή Κυπρίων.

and the almost simultaneous accidental discovery of the shipwreck of a merchant ship dated back to the late classical period (third quarter of the 4th century B.C) at the sea area of Mazotos, on the southern coast of Cyprus, marked the beginning of the development of the field in Cyprus.

The Mazotos shipwreck was reported to the Department of Antiquities in 2006. Its scientific significance was apparent from the very beginning: it is the first shipwreck of the late classical period, found in the Southeast Mediterranean carrying Chian amphora, at a depth where divers can work. Its research could shed light on issues such as sea routes and trade relations among the peoples of the Aegean and South Eastern Mediterranean during this period.

Its importance triggered the launch of the first Cypriot underwater archaeological project in 2007, undertaken by the Archaeological Research Unit (ARU) of the University of Cyprus, under the direction of Dr Stella Demesticha, (Assistant Professor of Underwater Archaeology, Chair of THETIS Foundation). During the period 2007 - 2009, following authorization by the Department of Antiquities, four surface inspections of the site were conducted, aiming the detailed mapping of the surface finds of the shipwreck and its initial evaluation. To this end, the photogrammetric survey combined with the tape-measure triangulation was used (under the responsibility of the Hellenic Institute of Maritime Archaeology of Greece) while at the same time a high resolution photomosaic of the site was created. The first surveys demonstrated that the site comprises an assemblage of mainly Chian amphorae (at least 500 amphorae were counted on the surface) at a depth of 44 metres, stretching over an area of 17 x 7m on a sandy, almost flat seabed. The extent of the preservation of the amphorae was of particular interest: in the centre of the site at least four layers of amphorae seem to preserve their initial stowage position. It is therefore a shipwreck of noteworthy scientific significance as its good state of preservation indicates that its research could provide important information on amphorae stowage on ships, ship construction and site formation process.

3. Συλλογή μικρών καταλοίπων που βγήκαν από τον αναρροφητήρα © Πανεπιστήμιο Κύπρου, Ερευνητική Μονάδα Αρχαιολογίας / Collection of small remains extracted from the air lift © University of Cyprus, Archaeological Research Unit



2. Ανέλιξη Χιακού αμφορέα © Πανεπιστήμιο Κύπρου, Ερευνητική Μονάδα Αρχαιολογίας / Lifting a Chian amphora © University of Cyprus, Archaeological Research Unit

Αυτή η τάση διαφοροποιήθηκε τα τελευταία έξι χρόνια. Η εισαγωγή μαθημάτων ενάλιας αρχαιολογίας στο Τμήμα Ιστορίας και Αρχαιολογίας του Πανεπιστημίου Κύπρου και η σχεδόν ταυτόχρονη τυχαία ανακάλυψη του ναυαγίου ενός εμπορικού πλοίου που χρονολογείται στην ύστερη κλασική περίοδο (τρίτο τέταρτο του 4ου αιώνα π.Χ) στη θαλάσσια περιοχή του Μαζωτού, στη νότια ακτή της Κύπρου, αποτέλεσαν την αρχική ανάπτυξης του τομέα στο νησί.

Το Ναυάγιο του Μαζωτού αναφέρθηκε στο Τμήμα Αρχαιοτήτων το 2006. Η επιστημονική του σημασία ήταν εμφανής από την αρχή: αποτελούσε το πρώτο ναυάγιο που χρονολογείτο την ύστερη κλασική περίοδο που εντοπίστηκε στη Ν.Α Μεσόγειο να μεταφέρει Χιακούς αμφορείς, σε βάθος που μπορούν να εργαστούν δύτες. Η έρευνά του θα μπορούσε να απαντήσει σε ερωτήματα που αφορούν τις θαλάσσιες διαδρομές και το εμπόριο μεταξύ των λαών του Αιγαίου και της Ν.Α Μεσογείου αυτήν την περίοδο.

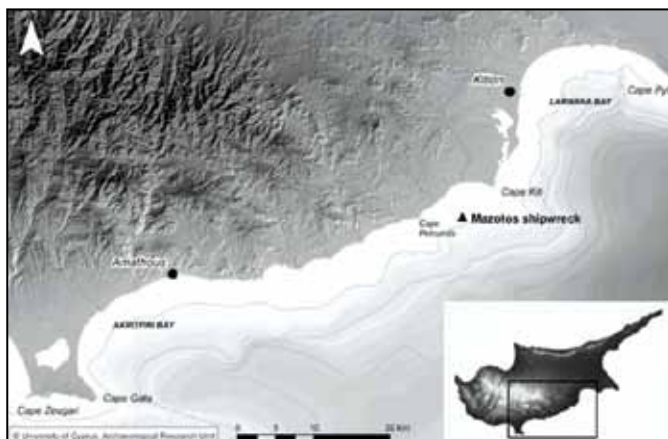
Η σημασία του ενεργοποίησε την έναρξη το 2007 της πρώτης υποβρύχιας αρχαιολογικής έρευνας που πραγματοποιήθηκε από κυπριακούς φορείς, από την Ερευνητική Μονάδα Αρχαιολογίας (EMA) του Πανεπιστημίου Κύπρου, υπό τη διεύθυνση της Δρος Στέλλας Δεμεστήχα (Επίκουρος Καθηγήτρια Ενάλιας Αρχαιολογίας, Έδρα Ιδρύματος ΘΕΤΙΣ). Κατά την περίοδο 2007 - 2009, μετά από σχετική άδεια από το Τμήμα Αρχαιοτήτων, πραγματοποιήθηκαν τέσσερις επιφανειακές επισκοπήσεις της θέσης με στόχο την αποτύπωση των επιφανειακών ευρημάτων του ναυαγίου και την εκτίμηση της σημασίας του. Για το σκοπό αυτό χρησιμοποιήθηκε η μέθοδος της φωτογραμμετρίας σε συνδιασμό με τις μετρήσεις με ταινία (υπό την ευθύνη του Ιδρύματος Ενάλιων Αρχαιολογικών Ερευνών



4. Συντήρηση των ευρημάτων που ανελκύστηκαν από το Ναυάγιο στο Εργαστήριο Συντήρησης Ενάλιων Αρχαιοτήτων του Τμήματος Αρχαιοτήτων © Πανεπιστήμιο Κύπρου, Ερευνητική Μονάδα Αρχαιολογίας / Conservation of the finds lifted from the shipwreck at the Laboratory of Conservation of Underwater Antiquities of the Department of Antiquities © University of Cyprus, Archaeological Research Unit

Following the completion of the photographic documentation and the mapping of the site, during the 2008 field seasons, characteristic types of amphora were lifted, all from the Aegean. During 2009 the ARU collaborated with the research team of the Laboratory of Marine Geology and Physical Oceanography of the University of Patras. The field season focused on the geophysical prospecting of the shipwreck area using proton magnetometer and sub-bottom profiler, aiming to investigate the extent of the shipwreck's non - visible sections.

The surface inspection of the shipwreck indicated its importance and the need to proceed to the excavation of the site. In 2010, the ARU began the systematic excavation of the shipwreck in collaboration with the Department of Antiquities and THETIS Foundation.



5. Χάρτης της Κύπρου (Α. Αγαπίου, © Πανεπιστήμιο Κύπρου, Ερευνητική Μονάδα Αρχαιολογίας. Τα δεδομένα συγκεντρώθηκαν από τη Γεωλογική Επισκόπηση της Κύπρου) /Map of Cyprus. (A. Agariou, © University of Cyprus, Archaeological Research Unit. Data compiled from the Geological Survey of Cyprus)

της Ελλάδας) ενώ παράλληλα δημιουργήθηκε ένα υψηλής ανάλυσης φωτομωσαϊκό της θέσης. Οι πρώτες έρευνες κατέδειξαν ότι η θέση αποτελείται από μια μεγάλη συγκέντρωση αμφορέων (καταμετρήθηκαν τουλάχιστον 500 επιφανειακοί αμφορείς, στην πλειοψηφία τους από τη Χίο) σε βάθος 44 μέτρων που καταλαμβάνει έκταση 17 x 7 μέτρων σε αμμώδη, σχεδόν επίπεδο βυθό. Ιδιαίτερο ενδιαφέρον παρουσίασε ο τρόπος διατήρησης των αμφορέων στο βυθό: στο κέντρο της θέσης τουλάχιστον τέσσερις σειρές αμφορέων φαίνονται να διατηρούν την αρχική τους θέση τοποθέτησης. Πρόκειται συνεπώς για ένα ναυάγιο αξιοσημείωτης επιστημονικής σημασίας καθώς το υψηλό ποσοστό διατήρησης του καταδεικνύει ότι η έρευνα μπορεί να δώσει σημαντικά στοιχεία για τον τρόπο στίβαξης των αμφορέων στο πλοίο, τον τρόπο ναυπηγικής και στοιχεία για τη διαδικασία δημιουργίας της θέσης του ναυαγίου (Δεμέστιχα 2010).

Μετά την ολοκλήρωση της φωτογραφικής και σχεδιαστικής αποτύπωσης του ναυαγίου, κατά τις ερευνητικές περιόδους του 2008, πραγματοποιήθηκε δειγματοληπτική ανέλκυση χαρακτηριστικών τύπων αμφορέων, όλοι από το Αιγαίο. Κατά την τελευταία επιφανειακή επισκόπηση της θέσης, η ΕΜΑ συνεργάστηκε με το Εργαστήριο Θαλάσσιας Γεωλογίας και Φυσικής Ωκεανογραφίας του Πανεπιστημίου της Πάτρας. Η έρευνα επικεντρώθηκε στη γεωφυσική διασκόπηση στην περιοχή του Ναυαγίου με τη χρήση πρωτονιακού μαγνητόμετρου και τομογράφου υποδομής πυθμένα, στοχεύοντας στη διερεύνηση των μη ορατών τμημάτων του ναυαγίου.

Οι επιφανειακές επισκοπήσεις του ναυαγίου κατέδειξαν τη σημασία του και την ανάγκη ανασκαφής του. Το 2010 η ΕΜΑ, σε συνεργασία με το Τμήμα Αρχαιοτήτων και το Ίδρυμα ΘΕΤΙΣ, ξεκίνησε συστηματική ανασκαφή του ναυαγίου. Μέχρι σήμερα πραγματοποιήθηκαν τρεις ανασκαφικές περιόδους, οι οποίες έφεραν στο φως σημαντικά ευρήματα που ενισχύουν τη σημασία του ναυαγίου. Οι πρώτες δύο ανασκαφικές περιόδους (2010 και 2011) επικεντρώθηκαν στο νότιο άκρο του ναυαγίου που, όπως είχε υποδειχθεί από τις γεωφυσικές έρευνες, είχε ιδιαίτερο ενδιαφέρον. Πέρα από τους Χιακούς αμφορείς, η ανασκαφή στην περιοχή αυτή (όπου σύμφωνα με τα πρώτα συμπεράσματα βρίσκεται η πλώρη του πλοίου) αποκάλυψε και ένα αμφορέα, εκτός της κύριας συγκέντρωσης, από την Κω που πιθανόν

Since then, three excavation field seasons were conducted on the site which brought to light a number of significant finds, enhancing the importance of the shipwreck.

The first two excavation seasons (2010 and 2011) focused on the southern part of the assemblage which the geophysical survey ranked of particular interest. Apart from the Chian amphorae assemblage, excavation in this area - where according to the first evaluation lies the bow of the vessel - revealed an amphora from the island of Kos, which probably formed part of the supplies of the crew. Also lead stocks, part of the remains of three anchors, were revealed as well as a large number of olive pits. Additionally, of particular interest was the discovery of part of the hull and the planking of the ship which raised hopes that an important part of the keel of the vessel may be preserved under the amphorae concentration.

The most recent field season (2012) which focused on the northern side of the assemblage, confirmed these expectations. The excavation revealed the keel and important part of the ship's planking also at the stern of the shipwreck which indicates that the keel is preserved at a length of at least 15 metres. This discovery is of exceptional importance as the Mazotos shipwreck is ranked among the very few shipwrecks in the Mediterranean region that can provide data regarding shipbuilding during the classical period. What is more, excavation brought to the surface among the amphorae of the stern of the vessel, its secondary cargo which consisted of wine jugs. Also small fine ware pottery were revealed in the cabin of the vessel, probably belonging to the crew or the passengers. One of them bears an inscription of two letters, most probably the initials of the owner.

The results of the three excavation field seasons demonstrated that further research of the shipwreck will shed light on issues concerning trade of the times, the living conditions on the vessel, seafaring and shipbuilding. However, the project's significance extends to another level as it provides fertile ground for the development of scientific research in various disciplines and for the training of students on the field.

From the beginning of the excavation ARU is collaborating with the Department of Civil Engineering and Geomatics at the Cyprus

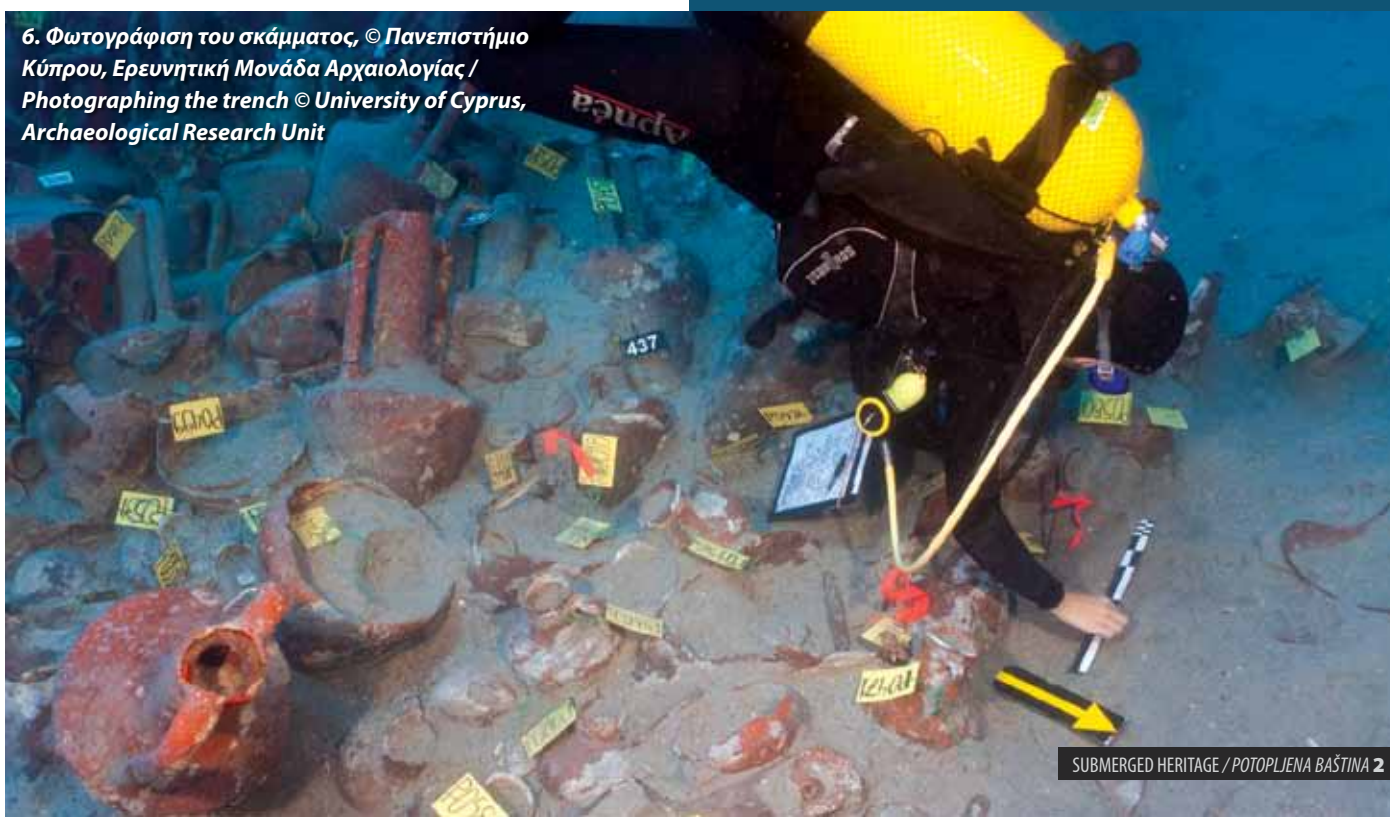
να αποτελούσε μέρος των προμηθειών του πληρώματος. Αποκαλύφθηκαν επίσης μολύβδινοι στύπποι, τμήματα από συνολικά τρεις άγκυρες του πλοίου καθώς και πλήθος ελαιοπυρήνων. Ιδιαίτερο ενδιαφέρον είχε και η αποκάλυψη τμήματος της καρίνας και του πετώματος του πλοίου γεγονός που έδωσε ελπίδες για τη διατήρηση σημαντικού τμήματος του σκαριού κάτω από τη συγκέντρωση των αμφορέων.

Η πρόσφατη ερευνητική περίοδος (2012) που επικεντρώθηκε στο βόρειο άκρο της συγκέντρωσης των αμφορέων, επιβεβαίωσε αυτές τις προσδοκίες. Η ανασκαφή αποκάλυψε την καρίνα και σημαντικό τμήμα του πετώματος του πλοίου και στο πρυμναίο άκρο του ναυαγίου γεγονός που υποδεικνύει ότι αυτή σώζεται σε μήκος τουλάχιστον 15 μέτρων. Η αποκάλυψη είναι εξαιρετικής σημασίας αφού καθιστά το ναυάγιο του Μαζωτού ένα από τα λίγα ναυάγια στην περιοχή της Μεσογείου που μπορούν να δώσουν στοιχεία για τη ναυπηγική των κλασικών χρόνων. Επιπλέον, η έρευνα έφερε στο φως, ανάμεσα στους αμφορείς της πρύμνης του πλοίου, και το δευτερεύον του φορτίο το οποίο αποτελείται από πρόχους (επιτραπέζια αγγεία για το σερβίρισμα κρασιού). Τέλος, στην περιοχή της καμπίνας της πρύμνης εντοπίστηκαν αγγεία λεπτής κεραμεικής που πιθανότατα να αποτελούσαν μέρος του προσωπικού εξοπλισμού του πληρώματος ή άλλων επιβαιόντων του πλοίου. Σε ένα από αυτά είναι χαραγμένα αρχικά, πιθανότατα του ονοματος του ιδιοκτήτη.

Τα αποτελέσματα των τριών ανασκαφικών περιόδων έδειξαν ότι η περαιτέρω έρευνα του ναυαγίου θα ρίξει φως σε ζητήματα που αφορούν το εμπόριο της εποχής, τις συνθήκες διαβίωσης πάνω στο πλοίο, τη ναυσιπλοΐα και τη ναυπηγική. Η σημασία όμως της έρευνας δεν περιορίζεται εδώ καθώς προσφέρει παράλληλα πρόσφορο έδαφος για την ανάπτυξη διαφορετικών επιστημονικών ερευνών σε διαφορετικούς κλάδους και για την εκπαίδευση φοιτητών στο πεδίο.

Από την αρχή της ανασκαφής η EMA συνεργάζεται με το Τμήμα Πολιτικών Μηχανικών και Μηχανικών Γεωπληροφορικής του Τεχνολογικού Πανεπιστημίου της Κύπρου (ΤΕΠΑΚ). Το ΤΕΠΑΚ, υπό την επίβλεψη του Δρα Δημήτρη Σαρλάτου, είναι υπεύθυνο για την αποτύπωση της θέσης τόσο σε ό,τι αφορά το σύνολο του ναυαγίου όσο και την καθημερινή αποτύπωση του σκάμματος.

6. Φωτογράφιση του σκάμματος, © Πανεπιστήμιο Κύπρου, Ερευνητική Μονάδα Αρχαιολογίας / Photographing the trench © University of Cyprus, Archaeological Research Unit





7. Ενημέρωση πριν από την κατάδυση © Πανεπιστήμιο Κύπρου, Ερευνητική Μονάδα Αρχαιολογίας / Briefing before the dive © University of Cyprus, Archaeological Research Unit

University of Technology (CUT). CUT, under the direction of Dr Demetris Skarlatos is responsible for the mapping of the whole site, as well as the daily mapping of the trench. The aim of this research is the development of a methodology and software which would make possible the automated data processing obtained from photographic underwater sites.

Moreover, biological research is being conducted by the non-governmental organization Enalia Phisis aiming to document the biodiversity of the shipwreck and mainly of the organisms that settled on the amphorae which constitute a datable evidence of change in the environment.

Finally, the first attempt has been made at Mazotos shipwreck to create a comparative model for the examination of the site formation process of ancient shipwreck sites. The research, which is funded by the British School of Athens and conducted by Dr. Chryssanthi Papadopoulou, focuses on the identification and study of the natural and cultural processes of the shipwreck site formation process, incorporating different disciplines (archaeology, topography, oceanography and marine biology).

Στόχος της έρευνας του ΤΕΠΑΚ είναι η ανάπτυξη μεθοδολογίας και λογισμικού ούτως ώστε να καταστεί εφικτή η αυτοματοποιημένη επεξεργασία των δεδομένων που συγκεντρώνονται από τη φωτογράφιση υποβρύχιων θέσεων.

Παράλληλα, στη θέση πραγματοποιείται βιολογική έρευνα από τον Μη Κυβερνητικό οργανισμό Ενάλια Φύση με στόχο την καταγραφή της βιοποικιλότητας του ναυαγίου και κυρίως των οργανισμών που έχουν εδραιωθεί στους αμφορείς και αποτελούν χρονολογημένο τεκμήριο αλλαγών στο περιβάλλον.

Τέλος, στο Ναυάγιο του Μαζωτού έχει ξεκινήσει η πρώτη προσπάθεια δημιουργίας συγκριτικού μοντέλου για τη μελέτη των διαδικασιών δημιουργίας των θέσεων αρχαίων ναυαγίων. Η έρευνα, που χορηγείται από το British School of Athens και πραγματοποιείται από τη Δρα Χρυσάνθη Παπαδοπούλου, επικεντρώνεται στην αναγνώριση και έρευνα των φυσικών και πολιτιστικών διαδικασιών διαμόρφωσης της θέσης του ναυαγίου ενσωματώνοντας διαφορετικές ειδικότητες (αρχαιολογία, τοπογραφία, ωκεανογραφία και θαλάσσια βιολογία).

Παράλληλα, η έρευνα λειτούργησε ως πυρήνας εκπαίδευσης τόσο Κύπριων όσο και ξένων εθελοντών διαφορετικών ειδικοτήτων. Είναι χαρακτηριστικό ότι κάθε χρόνο συμμετέχουν στην έρευνα προπτυχιακοί και μεταπτυχιακοί φοιτητές από το Πανεπιστήμιο Κύπρου καθώς και από Πανεπιστήμια του εξωτερικού, καθιστώντας την έρευνα κέντρο ανταλλαγής γνώσεων και εμπειριών πάνω στον τομέα.

Η σημασία όμως της έρευνας εκτείνεται και σε ένα άλλο επίπεδο καθώς αποτέλεσε το έναυσμα για την σταδιακή ανάπτυξη της απαραίτητης υποδομής για τη στήριξη ανάλογων ερευνών στο νησί. Καθώς είναι η πρώτη υποβρύχια αρχαιολογική έρευνα που πραγματοποιείται από κυπριακούς φορείς, έφερε στην επιφάνεια από τα πρώτα κιάλας στάδια, βασικά ζητήματα που σχετίζονται με το ανθρώπινο δυναμικό και την υποδομή, που έπρεπε να αντιμετωπιστούν. Για το σκοπό αυτό αποκτήθηκε ο απαραίτητος εξοπλισμός για τη στήριξη υποβρύχιων αρχαιολογικών ερευνών. Επιπλέον, το Τμήμα Αρχαιοτήτων, το οποίο είναι υπεύθυνο για τη



8. Το φωτομωσαϊκό του ναυαγίου © Πανεπιστήμιο Κύπρου, Ερευνητική Μονάδα Αρχαιολογίας / The photomosaic of the wreck, assembled by Bruce Hartzler, © University of Cyprus, Archaeological Research Unit

The Mazotos Shipwreck Project also served as a training centre for Cypriots as well as foreigners volunteers of different specialties. It is worth mentioning that every year a growing number of under graduate and graduate students from the University of Cyprus as well as from Universities of other countries participate, rendering the project a hub for the exchange of knowledge and experience on the field.

The project's significance however extends to another level since it triggered the development of the necessary infrastructure for the support of relevant research on the island. Being the first underwater archaeological project ever conducted by Cypriot institutions, it brought to the surface at its very early stages, basic issues concerning human resources, and infrastructure which had to be confronted. To that end, the necessary equipment was acquired for the support of underwater archaeological projects. Moreover, the Department of Antiquities, which is responsible for the conservation of the finds of the Mazotos Shipwreck, set up the Laboratory of Conservation of Underwater Antiquities which aims at servicing the needs of accidental finds and underwater excavations.

The multi leveled significance of the Mazotos Shipwreck project is now indisputable. Apart from its archaeological importance, the project is equally significant for its contribution in the establishment of Maritime Archaeology in Cyprus since it functions as the springboard for innovative applications promoting scientific collaborations and encouraging training in underwater archaeology and related disciplines while at the same time setting the bases for the development of the necessary infrastructure.

Apart from the THETIS Foundation, the project is supported by the following institutions: Cyprus Telecommunication Authorities, Frederic University, the Bishop of Kykkos, Greek Forces of Cyprus, Navy of Cyprus, Cyprus Port Authority, Council of Mazotos, Cyprus Federation of Underwater Activities, and the companies Archirodon, Nautilus Trading, Petrolina Ltd, A. Charalampous, Maragkos Bakeries, Bakandys Delicacies, Pirillos Bakeries.

συντήρηση των ευρημάτων του Ναυαγίου του Μαζωτού, οργάνωσε το Εργαστήριο Συντήρησης Ενάλιων Αρχαιοτήτων που στόχο έχει την εξυπηρέτηση των αναγκών συντήρησης που προκύπτουν είτε από τυχαίες ανακαλύψεις είτε από ενάλιες ανασκαφές.

Η πολυδιάστατη σημασία της έρευνας του Ναυαγίου του Μαζωτού είναι πλέον αδιαμφισβήτητη. Πέρα από την αρχαιολογική της σημασία, η έρευνα είναι παράλληλα σημαντική για τη συμβολή της στην εγκαθίδρυση και ανάπτυξη της Ενάλιας Αρχαιολογίας στην Κύπρο καθώς λειτουργεί ως εφαλτήριο για καινοτόμες εφαρμογές, προωθεί τις επιστημονικές συνεργασίες και ενθαρρύνει την εκπαίδευση στην υποβρύχια αρχαιολογία και σε άλλους σχετικούς κλάδους ενώ ταυτόχρονα θέτει τις βάσεις για την ανάπτυξη της απαραίτητης υποδομής.

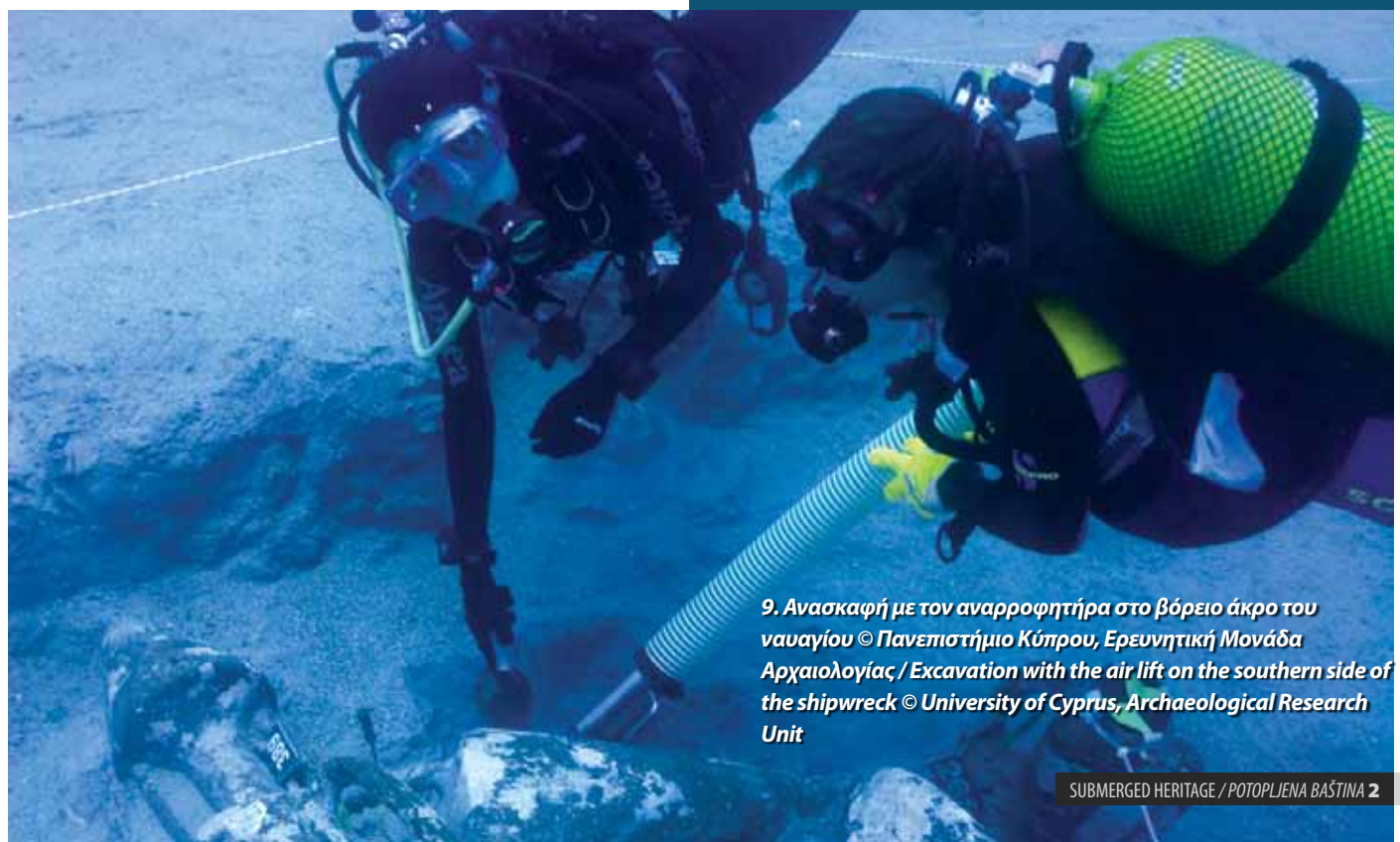
Πέρα από το Ίδρυμα ΘΕΤΙΣ, την έρευνα στηρίζουν οι ακόλουθοι φορείς: Αρχή Τηλεπικοινωνιών Κύπρου, Πανεπιστήμιο Frederic, Μητροπολίτης Κύκκου και Τυλληρίας Νικηφόρος, Ελληνική Δύναμη Κύπρου, Κυπριακός Οργανισμός Τουρισμού και οι εταιρείες Αρχιρόδον, Nautilus Trading, Petrolina Ltd, A. Χαράλαμπος, Αρτοποιία Μαραγκός, Bakandys Delicacies, και Αρτοποιία Πίριλλος.

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9. Ανασκαφή με τον αναρροφητήρα στο βόρειο άκρο του ναυαγίου © Πανεπιστήμιο Κύπρου, Ερευνητική Μονάδα Αρχαιολογίας / Excavation with the air lift on the southern side of the shipwreck © University of Cyprus, Archaeological Research Unit

NEW HARBOUR STRUCTURES AT VEŠTAR

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This year again saw the continuation of the now traditional underwater archaeological research at Veštar Cove to the south of Rovinj, a town on the western coast of the Istrian peninsula. Unfortunately this year, for incomprehensible reasons, we did not have the support of the Conservation Department in Pula, and the research campaign was conducted in a reduced scope, with the help of the Tourism Board of the City of Rovinj. Joining the underwater archaeologists of the International Centre for Underwater Archaeology again were the experienced divers of the Bavarian Society for Underwater Archaeology (Bayerische Gesellschaft für Unterwasserarchäologie), which is a great help in conducting this research. In past years the research effort also included the Croatian Conservation Institute and the City of Rovinj Heritage Museum. Participating in the research at Veštar this year were Luka Bekić DSc (head of research campaign) and Mladen Pešić of the International Centre for Underwater Archaeology in Zadar, Nenad Starčić and Dr Tobias Pflederer, Axel Sabisch, Mario Bloier and Marcus Thier of the Bavarian Society for Underwater Archaeology.

2. Rubno kamenje mola 3 / Boundary stones of pier 3
(photo: M. Thier)



1. Bekić pregledava ruševinu na obali /
Bekić surveys the ruins on the shore (photo: M. Pešić)



NOVI LUČKI OBJEKTI U VEŠTRU

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I ove godine nastavljena su već tradicionalna podvodna arheološka istraživanja u uvali Veštar južno od Rovinja, na zapadnoj obali istarskog poluotoka. Nažalost, ove godine je iz nerazumljivih razloga izostala podrška Konzervatorskog odjela u Puli, pa su istraživanja provedena u smanjenom obujmu, uz pomoć Turističke zajednice grada Rovinja. Uz podvodne arheologe Međunarodnog centra za podvodnu arheologiju, u ovom projektu ponovno su sudjelovali i iskusni ronionci Bavorskog društva za podvodnu arheologiju (Bayerische Gesellschaft für Unterwasserarchäologie) što je velika pomoć u istraživanju. U istraživanjima proteklih godina sudjelovao je i Hrvatski restauratorski zavod kao i Zavičajni muzej grada Rovinja. Ove godine u istraživanjima Veštra su sudjelovali dr.sc.Luka Bekić (voditelj istraživanja) i Mladen Pešić iz Međunarodnog centra za podvodnu arheologiju Zadar, Nenad Starčić te dr.Tobias Pflederer, Axel Sabisch, Mario Bloier i Marcus Thier iz Bayerischen Gesellschaft für Unterwasserarchäologie.

Organised underwater research at Veštar was launched in 2008 when the cove was surveyed for the organisation of future excavations. 2009 saw the beginning of research of the long Roman pier to the south side of the cove. The pier was researched through two archaeological trenches and the results of the research were regularly published in previous reports (Bekić, L., 2010, 2011a, 2011b; Miholjek 2009) analyses of archaeological finds (Bekić in print; Benjamin, Bekić, Komšo, Koncani Uhač, Bonsall, 2011) and in monograph editions (Bekić, Višnjic, Pešić, Bloier 2011). During the research it was established that the pier, built of stone blocks with bulk fill, was constructed in the late 1st century BC, and fell out of use in the early 2nd century. By the 17th century it had collapsed and its blocks were later removed.

Besides early Roman finds the cove has also yielded numerous late Roman and Byzantine finds, and finds from the late Medieval and early post Medieval period. On old maps Veštar is almost always cited as a harbour, and it is therefore evident that it must have had a pier or other type of landing area during later periods. From surveys of the terrain and old maps it was concluded that two such positions could be at the head of the cove, in the northeastern section and in the southeastern section. A survey of the potential pier sites was the goal of this year's campaign.

Potential pier No. 2 in the northeastern section was surveyed first. What appears to be an unnatural concentration of scattered stone blocks was observed at the site: one old map clearly shows a pier at this location. Dives at this position, among the scattered blocks, did not offer a clear conclusion as to where a trench could be situated, and research of pier No. 2 has for the moment been suspended.

4. Bloier, Thier i Pfloderer crtaju skicu mola 3 / Bloier, Thier and Pfloderer draw a sketch of pier 3 (photo: M. Pešić)

Organizirana podvodna istraživanja u Veštru su počela još 2008.g. kada je uvala pretraživana zbog organizacije budućih iskopavanja. Već 2009.g. započeto je istraživanje dugog rimskog mola na južnoj strani uvale. Mol je istražen kroz dvije arheološke sonde a rezultati istraživanja su redovno objavljivani u prethodnim pripćenjima (Bekić, L., 2010, 2011a, 2011b; Miholjek 2009) analizama arheoloških nalaza (Bekić u tisku; Benjamin, Bekić, Komšo, Koncani Uhač, Bonsall, 2011) kao i u monografskom izdanju (Bekić, Višnjic, Pešić, Bloier 2011). Tijekom istraživanja ustanovljeno je kako je mol, sagrađen od kamenih blokova s rasutom zapunom, bio sagrađen krajem 1.st. prije Krista, a prestao se koristiti početkom 2.st. U 17.st. je već urušen, a i njegovi blokovi su kasnije odneseni.

3. Staklena boca iz okolice mola 3 / A glass bottle from the area of pier 3 (photo: L. Bekić)

No osim ranorimskih nalaza, u uvali se pronalazi i mnoštvo kasnoantičkih i bizantskih nalaza, te nalaza kasnog srednjeg vijeka te ranog novog vijeka. Osim toga, na starim kartama se Veštar gotovo redovito spominje kao luka, pa je jasno da je i u kasnijim vremenima morao imati neki mol ili drugačije pristanište. Pregledima terena, starih karata, zaključeno je kako bi takve dvije pozicije mogle biti u dnu uvale, na sjeveroistočnom dijelu te na jugoistočnom dijelu. Pregled ovih potencijalnih molova bio je i cilj ovogodišnje kampanje.





This focused the attention of the research team on pier No. 3, situated in the southeast of the cove. Here, at low tide, one can very well make out large irregular boundary stones protruding from the shore and covered by small stones. An attempt was made to determine the further extent of the pier by clearing the area around these stones, but without success as the array of stones ends without any further trace after about ten metres. Nevertheless, in the terrain profile underwater the continuation of the pier is very easily discerned in the form of a large pile of small stones. The stone blocks were then sketched, photographed and geodetically documented. An exploratory trench was made at the location where we expected to find the structure of the end of the pier, but excavations were halted due to a lack of funds. The surface layer, which can be described as the

6. Geodetsko mjerenje mola 3 za magle / Geodetic survey of pier 3 during fog (photo: M. Thier)

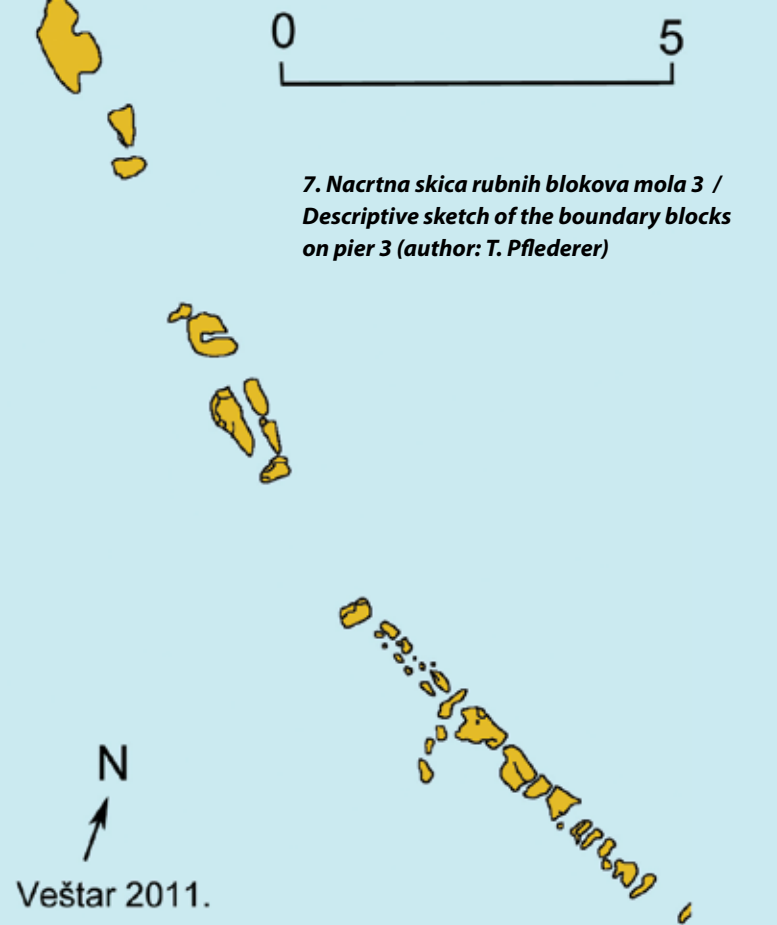


5. Ekipa Veštar 2012, slijeva / Veštar 2012 team, from left to right: Mladen Pešić, Mario Bloier, Tobias Pflederer, Luka Bekić, Nenad Starčić, Axel Sabisch, Marcus Thier (photo: L. Bekić)

Prvo je pregledan potencijalni mol broj 2 na sjeveroistočnom dijelu. Na tom mjestu je uočena naizgled neprirodna koncentracija razbacanih kamenih blokova, a na jednom starijem kartografskom prikazu na ovom mjestu se razvidno prikazuje mol. Ronjenjem na toj poziciji, među razbacanim blokovima, bilo je teško odlučiti gdje postaviti sondu, pa se od istraživanja mola broj 2 zasad odustalo.

Tako je pažnja istraživačke ekipe prebačena na mol broj 3, koji se nalazi na jugoistoku uvale. Ovdje se za oseke vrlo dobro vide rubni veći nepravilni kamenovi koji izviruju iz obale prekrivene sitnim kamenom. Čišćenjem prostora oko tih kamenova pokušalo se odrediti daljnje širenje mola, ali neuspješno, jer se niz nakon desetak metara prekida bez traga. Ipak, u profilu terena pod morem, lako je uočljiv nastavak mola, u vidu veće gomile sitnog kamena. Kameni blokovi su potom nacrtano i fotografski i geodetski dokumentirani. Postavljena je i probna sonda na mjesto gdje smo očekivalo pronaći strukturu čela mola, ali su iskopavanja prekinuta zbog nedostatka sredstava. U površinskom sloju koje se može opisati kao urušenje mola, pronalaze se samo keramički nalazi ranog novog vijeka, otprilike od 16. do 18.st. Slijedeće godine valja nastaviti s iskopavanjem ove sonde, ali i postavljanjem druge uz unutrašnju stranu mola.

Prema svemu sudeći ovaj mol bi se mogao datirati u rani novi vijek, a njegovoj funkciji možda je odgovarao i stari urušeni kameni objekt na obali. Za njega se za sada smatra kako je mogao služiti kao svojevrsna carinarnica ili lučka uprava iz koje se nadziralo prekrcavanje robe. Za ovo postoje i neke indicije u arhivskim izvorima, no to će se naknadno potanko istražiti. Slijedeće godine bi svakako bilo vrlo korisno sondirati i na molu broj 2 kako bi se njegov postanak potvrdio i uspješno datirao.



7. Nacrtna skica rubnih blokova mola 3 / Descriptive sketch of the boundary blocks on pier 3 (author: T. Pflederer)

Veštar 2011.

collapsed pier, yielded only ceramic finds from the early post medieval period, from about the 16th to 18th century. Next year should see a continuation of the excavation of this trench and the excavation of another along the inside of the pier.

By all accounts this pier can be dated to the early post Medieval period and the old collapsed stone structure on the shore may have formed a functional part of it. For the moment we can postulate that it served as a sort of customs house or harbour authority structure from which the loading and offloading of goods was overseen. There are some indications of this in archival sources, but this remains to be studied in detail. In the following year it would certainly be a very good idea to also open a trench at pier No. 2 with the aim of confirming its existence and undertaking its successful dating.

9. Čišćenje mola 3 / Clearing the area around pier 3 (photo: L. Bekić)



8. Kameni blokovi mola 2 / The stone blocks of pier 2 (photo: T. Pflederer)

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1. Hridi Uljeve A i B vrlo su opasne za plovidbu po buri / Rocks at Uljeva A and B are very dangerous for navigation when the bora is blowing (photo: L. Bekić)

LAUNCH OF SYSTEMATIC RESEARCH OF ROMAN PERIOD SHIPWRECKS AT CAPE ULJEVA

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Evidence was found in the area of Rt Uljeva—a cape near the town of Ližnjan that shelters the broad and long Kuje Cove to the south—indicating the existence of Roman period shipwrecks. For the past several years archaeologists of the International Centre for Underwater Archaeology and of the Croatian Conservation Institute have established the existence of at least two shipwrecks at the northern section of Cape Uljeva. The first-designated Uljeva A—can be dated to the Early Roman period while the second is from the Late Roman period. The results of these preliminary surveys have been published in specialised literature (Bekić 2011, 2012, in print; Mihajlović, Čule 2010; Miholjek 2009).

This year saw the launch of parallel systematic research of both shipwrecks with the support of the Municipality of Ližnjan. An underwater archaeology course is held in the frame of this research campaign under the auspices of UNESCO Venice Office.

POČETAK SUSTAVNIH ISTRAŽIVANJA ANTIČKIH BRODOLOMA NA RTU ULJEVA

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Na području rta Uljeva koji s južne strane zatvara prostranu i dugu uvalu Kuje kod Ližnjana, pronađeni su tragovi koji upućuju na postojanje antičkih brodoloma. Posljednjih nekoliko godina arheolozi Međunarodnog centra za podvodnu arheologiju i Hrvatskog restauratorskog zavoda ustanovili su postojanje barem dva brodoloma na sjevernom dijelu rta Uljeva. Prvi, nazvan Uljeva A, može se datirati u ranorimsko doba dok je drugi iz kasnoantičkog doba. Rezultati ovih prethodnih pregleda objavljeni su u stručnoj literaturi (Bekić 2011, 2012, u tisku; Mihajlović, Čule 2010; Miholjek 2009).

Ove godine konačno su započela sustavna istraživanja paralelno na oba brodoloma, uz podršku Općine Ližnjan. Uz sklopu ovih istraživanja, odvija se i međunarodna škola podvodne arheologije pod pokroviteljstvom UNESCO-ovog ureda u Veneciji.



2. Ronilac nad razlomljenim amforama na Uljevi A / A diver over shattered amphorae at Uljeva A (photo: M. Pešić)

The preliminary underwater survey has shown that both of the sunken ships hit the reef during a storm and that their respective cargos were strewn among the cavities between the rocks. A special excavation methodology has therefore been developed for this research campaign that aims to collect data on the basis of which both ships could be identified with regard to their size, tonnage and the routes they navigated. The ships sunk to a rocky seabed, interspersed with crevices

3. Erič i Jelić mjere udaljenosti između fiksnih točaka / Erič and Jelić measure the distance between fixed points (photo: L. Bekić)



4. Amfore tipa Keay 3B i jedna tipa Keay 26 s Uljeve B / Amphorae of the Keay 3B type and one of the Keay 26 type from Uljeva B (photo: L. Bekić)

Prethodna podvodna pretraživanja pokazala su kako su oba potopljena broda za vrijeme oluje udarila u greben, a njihov teret se rasuo se po rupama između stijena. Stoga je za potrebe istraživanja razvijena posebna metodologija iskopavanja, kojom bi se prikupili podatci na osnovu kojih bi se mogla identificirati oba broda, u pogledu njihove veličine i nosivosti kao i njihove rute.



Brodovi su potonuli na kamenitom dnu, koje je prošarano pukotinama i jamama ispunjenih pijeskom. Postavljanjem fiksne mjerne mreže na oba brodoloma, započelo se sa crtanjem većih i manjih pukotina i jama koje se pri istraživanju dokumentiraju kao zasebne cjeline. Iskopavanje jama obavlja se pomoću vodene pumpe, i pritom se prikupljaju svi nalazi. Ronioci potom nalaze vade iz mora na plovilo, gdje ih druga ekipa važe i prebrojava. Tada se nalazi i sortiraju prema vrstama. Svi tipološki relevantni nalazi se pakiraju za transport u radionicu, dok se masa amorfnih ulomaka pakira u mreže kojima se vraćaju u jame iz kojih su potekli. Na taj način se nalazište može u potpunosti istražiti, a većim dijelom se ostaci amfora i drugih posuda ostavljaju na dnu, i to točno na mjestima gdje su bili pronađeni.



Na Uljevi A teret se sastojao u velikoj većini od amfora tipa Lamboglia II, koje su vrlo vjerojatno bile pune prilikom havarije jer je pronađen i velik broj pločastih čepova za amfore. Prema količini ulomaka amfora na mjestu potonuća moglo bi se zaključiti kako je riječ o velikom brodu, ali o tome će se preciznije moći reći tek nakon završetka istraživanja. Uz amfore, pronađena je i druga keramika te staklo, i to pojedinačni primjerci koji nam svjedoče o postojanju brodske kuhinje i posuđa koje su upotrebljavali sami mornari. Zasad su od tih posuda izdvojena dva lonca za kuhanje, poveći tanjur i pladanj te dijelovi vrča i staklene boce. Za sada nas specifični nalazi pronađeni među ostacima tereta broda upućuju kako se brodolom Uljeva A može se datirati u 1.st. prije Krista ili u 1.st.



Na Uljevi B potopio se brod s drugačijim teretom. Ovaj brod je čini se prevozio prvenstveno posuđe egejskog tipa - keramičke čaše i lonce različitih veličina s ručicama te pripadajuće čepove. No uz njih prevozio je i određenu količinu



7. Meshini undertakes the demanding excavation of pit 3 at Uljeva B / Meshini iskopava zahtjevnu jamu 3 na Uljevi B (photo: L. Bekić)

and pits filled with sand. With the installation of fixed grid marks on both shipwrecks work began with the sketching of large and smaller crevices and pits that are documented during research as separate contexts. Excavation of the pits was conducted using a water dredge, with all finds collected in the process. Divers then extract the finds from the sea onto a vessel where a second team weighs and tallies them. Finds are also sorted by type at this stage. All typologically relevant finds are packed for transport to a workshop while the mass of amorphous fragments are packed in a net and restored to the pit from which they originated. This allows for complete research of the site with the majority of remains of amphorae and other vessels left on the seabed at the precise location in which they were found.

On Uljeva A the cargo consisted for the most part of amphorae of the Lamboglia II type, very likely full at the moment of the shipwreck given the large number of disc-shaped amphorae plugs found. By the quantity of amphorae sherds at the wreck site it could be concluded that the sunken vessel was a large one, but this will only be established with

8. Predavanja u sklopu tečaja podvodne arheologije održavala su se u Općini Ližnjan / Lectures in the frame of the underwater archaeology course were held at the Municipality of Ližnjan town hall (photo: M. Pešić)



5. Nalaz tri čaše s Uljeve B / A find of three cups from Uljeva B (photo: L. Bekić)



6. Čepovi amfora s Uljeve A / Amphorae plugs from Uljeva A (photo: L. Bekić)

amfora, od kojih najveći broj pripada afričkim tipovima, Keay 26, tzv. Spatheion amforama, te Keay 3B amforama. Vrlo zanimljiv je i nalaz tri ulomka staklenih čaša, od kojih je svaka zaseban, različiti komad, ali koje sve pripadaju srodnom tipu čaša s odrezanim obodom koje se uglavnom datiraju u 4.st. Moguće je da su i ove čaše zapravo bile dio brodskog tereta. Prema brodskom teretu koji je zasad pronađen može se otprilike i datirati ovaj brodolom. Mada se posuđe egejskog tipa može datirati i u 2. i 3.st., na osnovu staklenih čaša i amfora, Uljevu B bolje je datirati u 4.st, čime je ovaj brodolom dosta mlađi od Uljeve A.

Istraživanja Uljeve predvodili su dr.sc.Luka Bekić (voditelj istraživanja) i Mladen Pešić iz Međunarodnog centra za podvodnu arheologiju Zadar, a u ekipi su bili i mr.sc.Miran Erić iz Zavoda za varstvo kulturne dediščine Slovenije te Borna Krstulović. U istraživanju su također sudjelovali i polaznici međunarodnog Naprednog tečaja podvodne arheologije iz nekoliko zemalja. To su Nemanja Čavlović (Crna gora), Anita Jelić (Hrvatska), Anna Demetriou (Cipar), Rok Kovačić (Slovenija), Mariglen Meshini (Albanija) i Borjana Lutzkanova (Bugarska). Polaznici tečaja su po dolasku u Hrvatsku usavršavali svoje ronilačke kompetencije prema programu škole SSI u ronilačkom centru KL-Sub u Banjolama kod Pule. Nakon





9. All finds in the pits were collected / Svi nalazi u jamama su se prikupljali (photo: L. Bekić)

certainty upon the conclusion of the research campaign. Other pottery and glass was also found along with the amphorae, these being individual specimens that bear witness to the existence of a ship's galley and ware used by the mariners themselves. So far two cooking pots, a large plate and platter and parts of a jug and glass bottle have been isolated from this ware. For now the specific finds discovered among the remains of the ship's cargo indicate that shipwreck Uljeva A can be dated to the 1st century BC or to the 1st century AD.

Sunken vessel Uljeva B has a different cargo. It appears that this ship was transporting for the most part vessels of the Aegean type-ceramic cups and pots of various sizes with small handles and the attendant plugs. Along with these it also transported a quantity of amphorae, most of which are of the African types; Keay 26, also known as Spatheion amphorae, and Keay 3B amphorae. There is also a very interesting find of three fragments of glass cups, each of which is a separate, different piece, but all of which belong to a related type of cup with truncated rim that are for the most part dated to the 4th century. It is possible that these cups may have also been part of the ship's cargo. Based on the cargo found thus far we can also make an approximate

10. Čavlović i Demetriou važu i sortiraju nalaze / Čavlović and Demetriou weigh and sort the finds (photo: M. Pešić)

toga su se priključili arheološkom timu u istraživanju te su svaki dan nakon teoretskih predavanja u dvorani Općine Ližnjan sudjelovali u terenskim istraživanjima na rtu Uljeva. Tijekom ova dva tjedna istraživanja imali su prilike korisno upotrijebiti mnoga znanja sa prethodno položenog osnovnog tečaja ali i skupiti mnoge nove vještine ovom prilikom.





dating of this shipwreck. Although ware of the Aegean type can be dated to the 2nd and 3rd centuries, on the basis of the glass cups and amphorae, Uljeva B is more appropriately dated to the 4th century, making this shipwreck significantly more recent than Uljeva A.

The research at Uljeva was led by Luka Bekić DSc (head of research campaign) and Mladen Pešić of the International Centre for Underwater Archaeology in Zadar. Also on the team were Miran Erič MSc of the Institute for the Protection of Cultural Heritage of Slovenia and Borna Krstulović. Also participating in the research were participants of the international Advanced Underwater Archaeology Course from several countries. These are Nemanja Čavlović (Montenegro), Anita Jelić (Croatia), Anna Demetriou (Cyprus), Rok Kovačić (Slovenia), Mariglen Meshini (Albania) and Borjana Lutzkanova (Bulgaria). Upon their arrival in Croatia the course participants underwent diver training as per the SSI school programme at the KL-Sub diving centre in Banjole near Pula. They then joined the archaeological team in the research campaign and every day, following lectures on theory at the auditorium of the Municipality of Ližnjan, participated in field research at Cape Uljeva. Over these two weeks of research they had an opportunity to make beneficial use of much of the knowledge they had acquired in the previously completed basic course and to acquire many new skills.

The research at Uljeva will continue next year, and this project is scheduled for completion within five years. A monograph will be published then featuring the complete analysis of all finds and a final interpretation of these shipwrecks.

11. Radna ekipa projekta Uljeva 2012, s lijeva: Mladen Pešić, Nemanja Čavlović, Anita Jelić, Mariglen Meshini, Rok Kovačić, Borjana Lutzkanova, Borna Krstulović, Anna Demetriou, Luka Bekić, nedostaje Miran Erič / The team of the Uljeva 2012 project, left to right: Mladen Pešić, Nemanja Čavlović, Anita Jelić, Mariglen Meshini, Rok Kovačić, Borjana Lutzkanova, Borna Krstulović, Anna Demetriou, Luka Bekić, Miran Erič missing (photo: L. Bekić)

Istraživanja na Uljevi nastaviti će se i slijedeće godine, a kraj ovog projekta predviđa se u roku od 5 godina. Tada će se monografski objaviti cjelokupna analiza svih nalaza i dati konačno tumačenje ovih brodoloma.

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UNDERWATER ARCHAEOLOGICAL RESEARCH AT THE JANICE SITE IN PAKOŠTANE

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The International Centre for Underwater Archaeology continued its research campaign at the Janice site in Pakoštane this year. After last year's successful research effort we were once again witness to the great archaeological potential in the waters off Pakoštane. Two international teams participated in the research from 30 May to 19 June of 2012-their interest was focused on the research of two spatially proximate but temporally distant sites. The research campaign was led by Luka Bekić DSc (International Centre for Underwater Archaeology), deputy head Mato Ilkić DSc (a senior lecturer at the University of Zadar) and joined by research experts Mate Parica and professor Zdenko Brusić DSc (University of Zadar), Marko Meštrov (Han-Vrana Agency), Anita Jelić (Croatian Conservation Institute), Mladen Pešić (International Centre for Underwater

1. Priprema studenata za rad - Bekić demonstrira način podvodnog iskopavanja na kopnu / Preparing students for work-Bekić demonstrates the method of underwater excavation on land (photo: M. Pešić)

POD Vodna ARHEOLOŠKA ISTRAŽIVANJA NALAZIŠTA JANICE - PAKOŠTANE

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Međunarodni centar za podvodnu arheologiju u Zadru i ove je godine nastavio provoditi istraživanja na prostoru nalazišta Janice u Pakoštanima. Nakon prošlogodišnjeg uspješnog istraživanja, opet se pokazao veliki arheološki potencijal koji se skriva u podmorju Pakoštana. Dvije međunarodne ekipe sudjelovale su u istraživanjima od 30. svibnja do 19. lipnja 2012.g., a njihov interes bio je usmjeren na istraživanje dvaju prostorno bliskih, ali vremenski potpuno različitih nalazišta. Voditelj istraživanja bio je dr.sc.Luka Bekić (Međunarodni centar za podvodnu arheologiju), zamjenik voditelja doc.dr.sc.Mato Ilkić (Sveučilište u Zadru), a s njima su kao stručnjaci u istraživanju sudjelovali i Mate Parica i prof.dr.sc. Zdenko Brusić (Sveučilište u Zadru), Marko Meštrov (Han-Vrana), Anita Jelić (Hrvatski restauratorski zavod), Mladen Pešić (Međunarodni centar za podvodnu arheologiju) te Roman Scholz, Andreas Grundmann, Dominic Hosner (Deutsche Archäologische Institut - DAI). Također su u radu sudjelovali ronioci Nenad Starčić, Borna Krstulović, te apsolvantica Eva Buća. Istraživanja je i ove godine financirala Turistička zajednica općine Pakoštane, a tečaj podvodne arheologije UNESCO-ov ured u Veneciji.





2. Cjelovita posuda s antičkog mola / An integral vessel from the Roman period pier (photo: M. Pešić)

Archaeology) and Roman Scholz, Andreas Grundmann and Dominic Hosner (Deutsche Archäologische Institut - DAI). Also participating in the campaign were divers Nenad Starčić and Borna Krstulović, and undergraduate student Eva Buća. The research was again financed by the Tourism Board of the Municipality of Pakoštane and the underwater archaeology course by the UNESCO office in Venice.

The research of the Roman period harbour continues from last year's archaeological campaign that saw the completion of the excavation of trenches within the harbour area (Bekić et al. 2011, 26-27). The relatively shallow layer of sand with archaeological material of only about 70 centimetres contained a diverse range of objects used by the Roman period population of Pakoštane and the mariners who anchored in this harbour. Fragments of amphorae, Aegean kitchen ware, pottery of coarse fabric, sigillata vessels, tegulae, glass cups and a large quantity of organic material (bone, olive pits, walnuts, vine branches, wood) bear witness to the distant areas from which goods were shipped for sale by sea and that found their ultimate destination here.



1. Abby Minett, 2. Tanja Šufalj, 3. Boryana Lyutskanova, 4. Maria Ktori, 5. Sarita Karpuzova, 6. Mladen Pešić, 7. Nenad Starčić

Istraživanja antičke luke predstavljala su nastavak prošlogodišnje arheološke kampanje u kojoj se dovršavalo iskopavanje sonde unutar lučkog prostora (Bekić et al. 2011, 26-27). Relativno plitak sloj pijeska koji sadrži arheološki materijal, od svega 70-ak centimetara, skrivao je šarenu paletu predmeta koju su koristili antički stanovnici Pakoštana i moreplovci koji su se sidrili u ovu luku. Fragmenti amfora, egejskog kuhinjskog posuđa, keramike grube izrade, sigilatnog posuđa, tegula, staklenih čaša, te velika količina organskog materijala (kosti, sjemenke maslina, ora-ha, grančice loze, drvo) svjedoče nam o dalekim prostorima odakle se morskim putem dopremala roba za prodaju i koja je svoj krajnji cilj našla upravo na ovom mjestu.



3. Dio tegule s pečatom C CAESARE (PANSIANA) / Part of tegulae bearing the seal C CAESARE (PANSIANA) (photo: M. Pešić)

Zanimljivi su i nalazi drvenih elemenata koji se javljaju u slojevima luke, a koji nam daju naznake da su služili kao osnovna konstrukcija koja je držala kamenu strukturu ispune mola. Na osnovu do sada pronađenih arheoloških nalaza vrhunac upotrebe ove luke se vremenski može smjestiti u period 1. - 2. st. (Ilkić, Parica, Meštrov 2008, 213-214), doba kada se morskim putem kroz ovu luku uvozila roba za širi prostor oko Pakoštana (prvenstveno



4. Sudionici tečaja podvodne arheologije / The participants of the underwater archaeology course (photo: M. Pešić)

antičku Blandonu i Aseriju). Sigurno se dio tereta koji se prevozio morskim putem i izvezio s ovog prostora, za što se nadamo da će se moći i dokazati analizama arheološkog materijala koji je nađen tijekom istraživanja.

Osim djelatnika Međunarodnog centra za podvodnu arheologiju koji su vodili ova istraživanja, u njima su sudjelovali i mladi podvodni arheolozi Boryana Lyutskanova (Bugarska), Maria Ktori (Cipar), Sarita Karpuzova (Makedonija), Tanja Šufalj (Hrvatska) i Abby Minett (Ujedinjeno Kraljevstvo). Oni su u sklopu tečaja UNESCO-a i MCPA sudjelovali u ronilačkoj i arheološkoj izobrazbi na Početnom tečaju podvodne arheologije, te su svoja praktična iskustva stjecali upravo na ovom bogatom i zanimljivom nalazištu.

There are also interesting finds of wooden elements that appear in levels of the harbour and that may have been used as the basic structure that contained the stone fill of the pier. Based on the archaeological finds discovered to date the peak period of use for this harbour can be placed from the 1st to 2nd century (Ilkić, Parica, Meštrov 2008, 213-214), a period when goods were transported by sea through this harbour for the wider area around Pakoštane (primarily Roman period settlements Blandona and Asseria). It is certain that a part of the cargo transported by sea was exported from this area, which we hope to prove through analysis of the archaeological material discovered during the research campaign.

The staff of the International Centre for Underwater Archaeology leading this research campaign were also joined by participating young underwater archaeologists Boryana Lyutskanova (Bulgaria), Maria Ktori (Cyprus), Sarita Karpuzova (Macedonia), Tanja Šufalj (Croatia) and Abby Minett (United Kingdom). They took part in diver and archaeology education in the frame of the UNESCO and ICUA beginner level underwater archaeology course and in their hands-on experience at this rich and fascinating site.

This year's archaeological research follows on last year's intensive surface survey of the terrain between Janice beach and Sveta Justina island. There is a prehistoric site at a depth of about 4.5 metres, and three positions were surveyed in 2011 at which an abundance of prehistoric archaeological material was discovered, primarily small potsherds and flint tools (Bekić et al. 2011, 27, 29). Trench exploration was undertaken in 2012 at two of the three previously surveyed positions, with the aim of establishing their precise dating, characteristics of settlement and the layering of the site. With the help of a team of archaeological experts from Germany, who participated throughout the entire research campaign, it was decided that the first trench at this site would be excavated at the position that was last year designated as Position 1. The trench is 2 by 1 metres in size, with each metre further divided into sub-quadrants of 0.5 by 0.5 metres. Another trench of the same dimensions was placed at Position 2 following the same principles.

Along with the material extracted from the trench by divers during the research, a fine mesh netting was installed at the end of the airlift dredger used for the excavation into which all material in the trench was collected. After each day's diving was completed the contents of this netting was sifted on land and inspected for very small archaeological, in particular organic, finds found in the layers. At Position 1 wooden elements appeared soon after the beginning of excavation work on the first layer and the trench was cleaned to a depth of about 10 cm. Excavation was halted and a procedure initiated to raise the wooden elements to the surface. Because of the very high level of fragility of the wooden finds a wooden structure was fabricated onto which the wood would be transferred prior to extraction from the seabed. Once the wood was transferred to the structure everything was carefully wrapped in foil and immobilised and was then transported to the conservation workshop for further processing and analysis.

6. Iskopavanje prapovijesne sonde / Excavation of the prehistoric trench (photo: A. Grundmann)



5. Meštrov i njemačka ekipa - Hosner, Grundmann i Scholz spremaju se na uron / Meštrov and the German team of Hosner, Grundmann and Scholz prepare for a dive (photo: L. Bekić)

Nakon prošlogodišnjeg intenzivnog površinskog pregleda terena na prostoru između plaže Janice i otočića Sv. Juština ove godine su se nastavila arheološka istraživanja. Prapovijesno nalazište nalazi se na oko 4,5 metara dubine, a tijekom 2011.g. su pregledane tri pozicije na kojima je otkriveno mnoštvo prapovijesnog arheološkog materijala, ponajviše sitnijih keramičkih fragmenata i kremenih alatki (Bekić et al. 2011, 27, 29). Tijekom 2012.g. krenulo se u sondažna istraživanja na dvije od tri dosada pregledane pozicije, radi utvrđivanja točne datacije i osobina naselja, te utvrđivanja slojevitosti nalazišta. Uz pomoć stručne arheološke ekipe iz Njemačke, koja je sudjelovala tijekom cjelokupnih istraživanja, odlučeno je da će se na poziciji koja je prošle godine imenovana nazivom Pozicija 1 postaviti prva sonda na ovom nalazištu. Sonda je bila dimenzije 2x1 metar, s tim da se svaki metar podijelio na daljnja četiri podkvadranta dimenzija 0,5x0,5 metara. Po istom principu postavljena je još jedna takva sonda na Poziciji 2.



At Position 2 a total of five layers were excavated to a depth of over 1 metre when a problem was encountered in the form of the caving-in of the lateral profiles of the trench as a re-



7. Pogled na bogati sloj u prapovijesnoj sondi / A view of the rich layer in the prehistoric trench (photo: A. Grundmann)

sult of its relatively great depth, whereupon further excavation was discontinued. The most frequent of the prehistoric finds from the trench are potsherds of various sizes most of which have been, unfortunately, worn on the walls and edges. This is a result of the effects of natural processes in the sea. Irrespective, these fragments, by their composition and manufacture may be characterised as products of the Neolithic period. The pottery is for the most part of coarse texture with a large quantity of temper in the form of small white pebbles and quartzite.

Along with the ceramic objects we also found a large number of flint tools. For the most part these are scrapers, blades, blades and end scrapers, and we also collected a large number of cores and flakes that bear witness to manufacture *in situ*. The tools were manufactured from various types of flint-yellowish, reddish, white and grey. Further analysis of the origin of this material will offer us insight into the movement and origin of products from this site. Along with the above cited we also found a quantity of finds of organic origin-primarily we should note fragments of bone, seeds, pieces of wood and charcoal. These finds we also sent for further analysis using the ¹⁴C method, which will provide us with precise data on the time of their creation. The large quantity of flint tools, pottery and organic material, and the developed layering of the site is evidence of the long-term settlement of this area. As a small

Osim što su ronioci prilikom istraživanja prikupljali materijal iz sonde, na izlazu mamut sisaljke s kojom su se vršila iskopavanja bila je zakvačena mreža sa sitnim rupicama u koju se prikupljao sav materijal koji se nalazio u sondi. Svakodnevno se nakon završenog ronjenja sadržaj ovih mreža na kopnu prosijavao i pregledavao radi prikupljanja sitnih arheoloških, a osobito organskih nalaza koji su se nalazili u slojevima. Na Poziciji 1 su se ubrzo nakon početka iskopavanja prvog sloja pojavili drveni elementi, tako da je sonda očišćena do dubine od oko 10 cm. Iskopavanje je zaustavljeno te se krenulo u postupak podizanja drvenog elementa na površinu. Radi izrazite krhkosti drvenog nalaza morala se izraditi drvena konstrukcija na koju će se drvo prebaciti prije podizanja s morskog dna. Nakon prebacivanja drva na konstrukciju, sve je pomno zamotano u folije i imobilizirano, te se na taj način prenijelo u konzervatorsku radionicu na daljnju obradu i analizu.

Na poziciji broj 2 ukupno se iskopalo 5 slojeva do dubine preko 1 metar, kada se počeo pojavljivati i problem vezan uz urušavanje bočnih profila sonde radi njene relativno velike dubine, te su radovi zaustavljeni. Među prapovijesnim nalazima unutar sonde najbrojniji su keramički fragmenti različitih veličina, od kojih na žalost, većina ima izluzane stijenke i rubove. To je posljedica rada prirodnih procesa u moru. Bez obzira na to, ovi fragmenti se prema svom sastavu i izradi mogu okarakterizirati kao proizvod iz vremena neolitika. Keramika je uglavnom grube fature sa velikom količinom primjesa u obliku sitnih bijelih kamenčića i primjesa kvarcita.

Osim keramičkih predmeta, pronađen je i velik broj rožnjačkih alatki. Uglavnom su to strugala, noževi, nožići i grebala, a prikupljen je i velik broj jezgri i odbitaka koje svjedoče o izradi *in situ*. Alatke su izrađene od različitih vrsta kremenca, žućkastog, crvenkastog, bijelog, sivog. Daljnja analiza porijekla materijala dati će

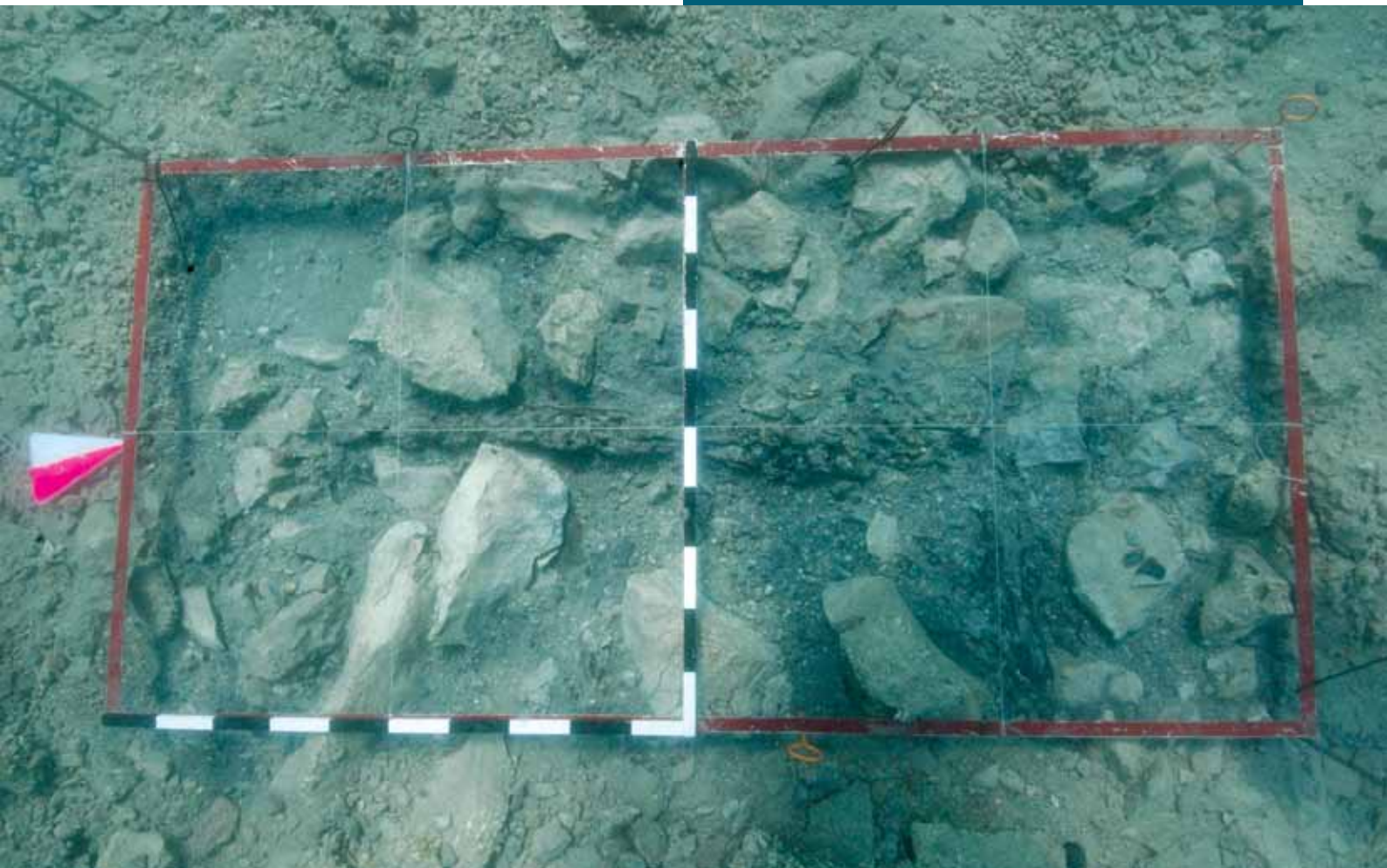


8. Kremenecne alatke iz sonde na Poziciji 2 / Flint tools from the trench at Position 2 (photo: E. Buća)

nam uvid u kretanje i porijeklo proizvoda sa ovog nalazišta. Uz navedeno, nađena je i određena količina nalaza organskog porijekla - prvenstveno treba spomenuti fragmente kostiju, zatim sjemenke, komadiće drva i ugljena. I ovi nalazi su poslani na daljnje analize metodom ¹⁴C, koji će nam dati točne podatke o vremenu njihovog nastanka. Velika količina kremenih alatki, keramike i organskog materijala, te razvijena slojevitost nalazišta, dokaz su dugogodišnje naseljenosti ovog područja. Budući da je ove

surface area was opened this year, we have yet to find parts of residential structures, but this site is undoubtedly a habitation area that was settled over an extended period of time.

godine otvorena mala površina, još uvijek nismo pronašli dijelove stambenih struktura, ali ovo nalazište nesumnjivo predstavlja naseobinski prostor koji je bio naseljen kroz duži vremenski period.



To date only a very small number of habitation sites have been found in Croatia that have been submerged as a result of changes in sea level, and research conducted at these locations is very rare. It is for this reason precisely that the experience in documenting and method of exploration and the results we have achieved during this campaign in collaboration with the German archaeological institute - DAI represents a major step forward for underwater archaeology in Croatia. Once again, during the 2012 campaign, the potential of the Janice site was demonstrated, and we look forward to the continuation of research in cooperation with the local community in Pakoštane, which has so generously supported our research to date.

10. Hosner i Scholz detaljno pregledavaju materijal iz sonde / Hosner and Scholz make a thorough inspection of the material from the trench (photo: A. Grundmann)



9. Drveni elementi iz prapovijesne sonde / Wooden elements from the prehistoric trench (photo: A. Grundmann)

Do danas je u Hrvatskoj pronađen mali broj prapovijesnih naseobinskih nalazišta koja su potopljena uslijed promjena razine mora, a istraživanja koja su provođena na takvim lokacijama su prava iznimka. Upravo zato iskustva u dokumentaciji i načinu istraživanja, te rezultati koje smo ostvarili tijekom ove kampanje u suradnji s Njemačkim arheološkim institutom - DAI predstavljaju veliki napredak za podvodnu arheologiju u nas. I tijekom kampanje 2012.g. dokazan je potencijal koji pruža nalazište Janice, te se veselimo budućem nastavku istraživanja u suradnji s lokalnom zajednicom iz Pakoštane koja je do sada svojim nesebičnim zalaganjem podupirala naša istraživanja.

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SURVEY OF THE SEABED OF ZADAR COUNTY

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It is a common observation nowadays that it is hard to find a piece of the earth on which human foot has never set, and that people know every corner of the planet. We most certainly cannot apply this fact to the broad maritime expanses in which people daily make new and interesting discoveries. This precisely is the mission of underwater archaeology-to discover and research new archaeological finds, a mission often achieved through a survey of the seabed that humans are relatively infrequent visitors of.

In October and November of 2012 staffers at the International Centre for Underwater Archaeology conducted a survey of the seabed in the Zadar County area. The reconnaissance, led by Mladen Pešić and Luka Bekić of ICUA Zadar, also included the efforts of outside associate divers Marko Meštrov, Jerko Macura, Rok Kovačić from Slovenia and Petar Dobrović providing technical support. The investigation was conducted by traditional means-diving, but we also employed Side Imaging Sonar of the seabed during our survey of the area.

Unfortunately, we must note that at the locations we surveyed-which once certainly contained an abundance of archaeological material-the majority of these finds have been either destroyed

1. Balastno kamenje s brodoloma na otoku Kozina / Ballast stones from the shipwreck at the island of Kozina (photo: R. Kovačić)

REKOGNOSCIRANJE PODMORJA ZADARSKE ŽUPANIJE

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U današnje vrijeme često se kaže da je teško naći komad zemlje na koji nije kročila ljudska noga i da je ljudima poznat svaki kutak naše planete. Ovu činjenicu zasigurno ne možemo primijeniti i na široka morska prostranstva u kojima ljudi svakodnevno otkrivaju nove i zanimljive stvari. Zadatak podvodnih arheologa je upravo takav, otkriti i istražiti neka nova arheološka nalazišta i to se često ostvaruje pregledom podmorja u kojem su ljudski posjetioci relativno rijetki.

Tijekom listopada i studenog 2012.g. djelatnici Međunarodnog centra za podvodnu arheologiju obavljali su pretraživanja podmorja na prostoru Zadarske županije. U rekognosciranjima su uz voditelja Mladena Pešića te Luku Bekića iz MCPA Zadar, sudjelovali i vanjski suradnici ronioci Marko Meštrov, Jerko Macura, Rok Kovačić iz Slovenije te Petar Dobrović kao tehnička podrška. Istraživanja smo obavljali na tradicionalan način - ronjenjem, ali smo se prilikom pregleda terena koristili i skeniranjem dna uz pomoć *Side Imaging Sonara*.

Na žalost, moramo primijetiti da je na položajima koje smo pregledali i koja su nekada davno sigurno sadržavala mnoštvo arheološko materijala, ljudska ruka uništila ili otuđila većinu takvih nalaza. Brodolomi koje mi danas nalazimo uglavnom se uočavaju prema hrpama balastnog kamenja koje se koristilo za održavanje stabilnosti brodova. Dva brodoloma koja su locirana





2. Novovjekovni brodolom na Velom školju / Post Medieval shipwreck on Veli školj (photo R. Kovačić)

or removed by human activity. The shipwrecks we now find are for the most part recognised as a pile of ballast stones used to maintain the stability of these vessels. Two located shipwrecks were identified precisely by these piles of stone. One of these is located to the southwest of the island of Kozina near the island of Vrgada-its pile of fragmented ballast stones covers an area of about 15 by 5 metres. Based on very small finds of Aegean kitchenware, fragments of tegulae and the body of an amphora, the ship was dated to the Roman period from the 1st to 3rd century. The second shipwreck near the islet of Veli Školj not far from Pakoštane, which on the surface appears to be much like the cited Roman period shipwreck, actually belongs to a much later period. A pile of 5 by 6 metres including ballast stone mixed with brick and heaps of roof tiles of various size. It appears that this was a smaller vessel that perhaps conducted local transport of construction material. The finds of ware among the construction material can approximately date the shipwreck to the 16th century (Meštrov 2008, 21).

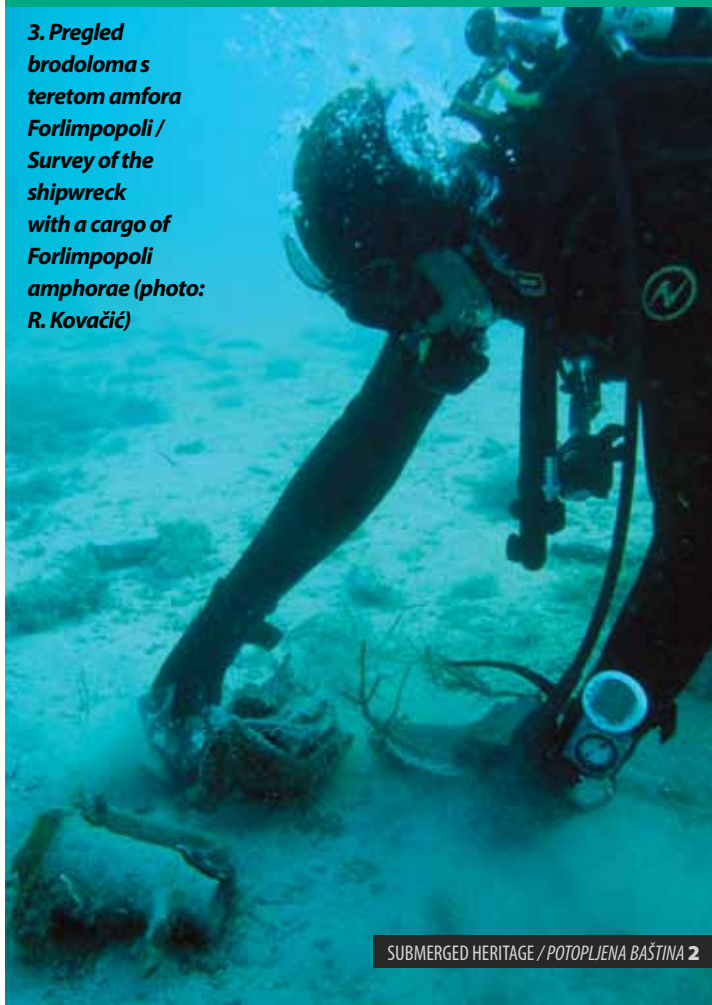
At times shipwreck can be identified on the basis of finds of fragmented ceramic material scattered on the seabed. Although



4. Keramički nalazi s afričkog brodoloma / Pottery finds from an African shipwreck (photo: R. Kovačić)

prepoznata su upravo prema takvim hrpama kamenja. Jedan od njih nalazi se na jugozapadnom dijelu otoka Kozina kod Vrgade i njegova hrpa lomljenog balastnog kamenja prostire se na području od 15x5 metara. Na osnovu sitnih nalaza egejskog kuhinjskog posuđa i dijelova tegula i tijela amfora brodolom se datira u antički period od 1. - 3. st. Drugi brodolom kod otočića Veli Školj nedaleko Pakoštana, koji površinski izgleda slično kao i spomenuti antički, pripada dosta kasnijem periodu. Na dubini od svega 5 metra nalazi se hrpa dimenzija 5x6 metara,

3. Pregled brodoloma s teretom amfora Forlimpopoli / Survey of the shipwreck with a cargo of Forlimpopoli amphorae (photo: R. Kovačić)

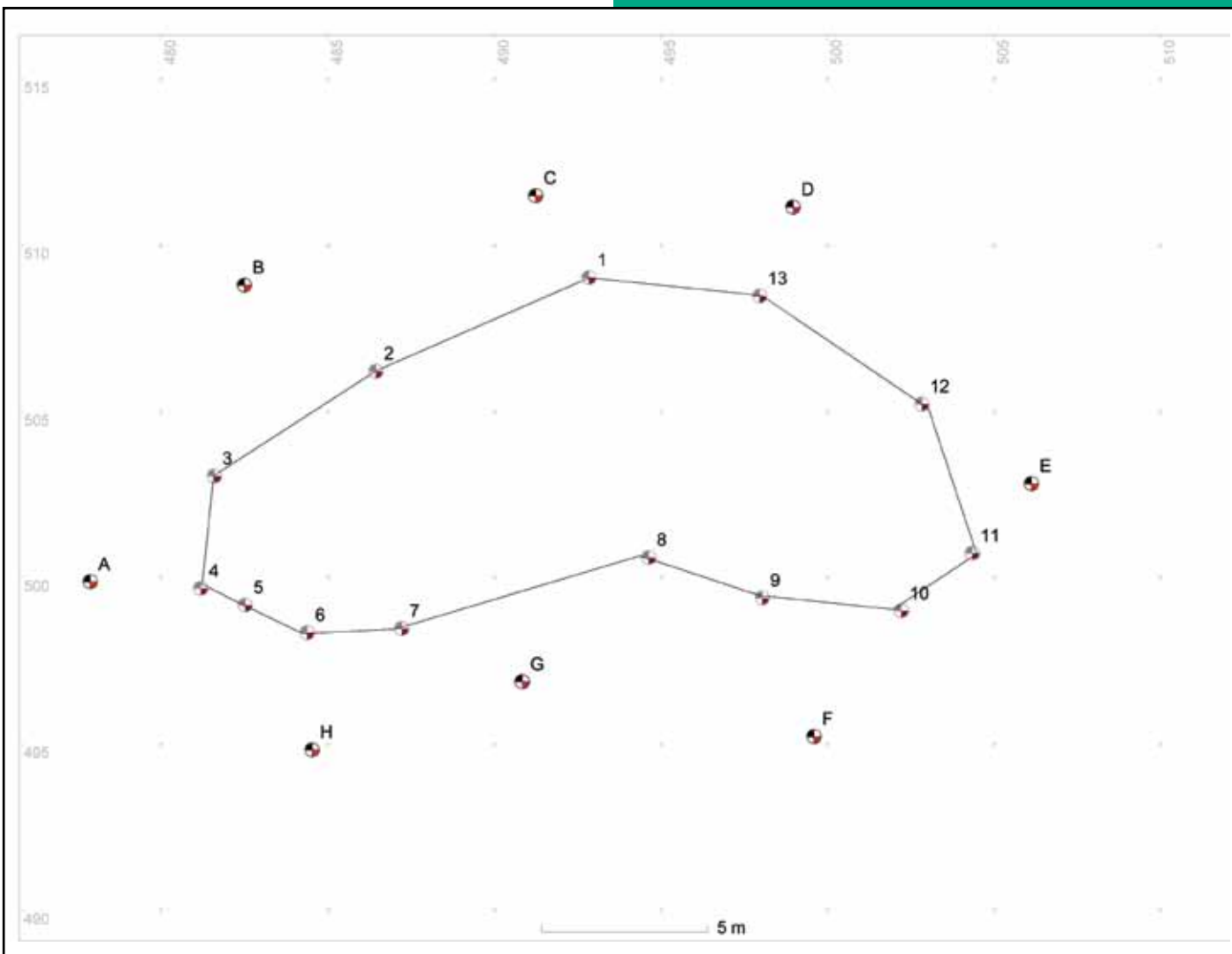




5. Antički brodolom na otoku Babuljašu / A Roman period shipwreck off the island of Babuljaš (photo: R. Kovačić)

the quantity of data we can collect from research of these types of sites is reduced, they are archaeologically valuable for several reasons. The sites are not entirely devastated and, as a result, the period in which the vessel sank can be identified on the basis of a limited number of finds, as can a part of the cargo it was carrying and the routes these ships navigated, all of which supplements our knowledge of the commercial links and routes in the Adriatic throughout history. One such site is located to the east of the island

7. Nacrt lukobrana iz Petrčana u Site Recorderu / Sketch of the breakwater at Petrčane in Site Recorder (author: M. Pešić)



koja sadrži balastno kamenje pomiješano s opekama i kupama kanalicama različitih dimenzija. Izgleda da se ovdje radi o manjem brodu, koji je možda na lokalnom prostoru prevozio građevinski materijal. Nalazi posuđa koje se pronalazi između građevinskog materijala mogu brodolom okvirno smjestiti u period 16. st. (Meštrov 2008, 21).



6. Novovjekovni tanjur s brodoloma na Velom školju / A Post-Medieval plate from the shipwreck at Veli Školj (photo: M. Meštrov)

Ponekad se brodolomi mogu definirati i prema nalazima polmljenog keramičkog materijala razasutog po morskome dnu. Iako je na ovakvim nalazištima količina podataka koju možemo dobiti iz istraživanja bitno reducirana, ona su arheolozima vrijedna iz više razloga. Nalazišta uglavnom nisu devastirana u potpunosti, pa se i na osnovu male količine nalaza može definirati period kada je brod potopljen, dio tereta koji je nosio, te rute na kojima su se takvi brodovi kretali, čime se upotpunjuje slika trgovačkih veza i putova na Jadranu kroz povijest. Jedno takvo nalazište nalazi se i na istočnom dijelu otoka Kozine. Iako je nađeno tek nekoliko fragmenata amfora ravnog dna poznatih pod nazivom Forlimpopoli, radi uvjeta pod kojima su nađeni - na udaljenosti od sigurne luke ili sidrišta, ovo nalazište bi mogli okarakterizirati kao devastirani brodolom. Amfore nađenog tipa datiraju se u period 1. - 2.st., a



8. Fotografiranje devastiranog nalazišta / Photographing a devastated site (photo: L. Bekić)

of Kozina. Although only a few fragments of flat-bottomed amphorae known as Forlimpopoli were found, by the conditions at which they were discovered-far from a safe harbour or anchorage-this site may be characterised as a devastated shipwreck. The amphorae of the type found are dated to the period from the 1st to 2nd century and were manufactured at several Roman period centres in Italia, Hispania, Gaul, the Aegean area, and in Croatia at Loron, Fažana and Crikvenica (Starac 2006, 97,98).

We can also identify a devastated shipwreck off the small islet of Babuljaš near Pakoštane. In the broader seabed in the waters off this islet we find a scattered cargo of a ship carrying large cylindrical amphorae. Besides the few finds of the bases and rims of amphorae, the wreck is characterised by a large quantity of fragmented body sections scattered across the seabed, and we find evidence of the African origin of the vessel in the form of several plates manufactured of red clay-known as *terra sigillata chiara*-which can be approximately dated to the 3rd to 4th century (Gandolfi 2005).

To this day we can find very small archaeological finds at anchorages used by ships on their journeys-often, because of the shallow areas in which they are located, the target of divers who claim these finds as souvenirs. Three such positions off the islands of Ošljak, Vrgada and off Petrčane were inspected in the frame of the reconnaissance. Surveys in the waters of the islands resulted in finds of several types of amphorae necks, which bear witness to the diverse cargos plying the Adriatic in the Roman period.

The cove at Petrčane near the small church of Sveti Bartul (St Bartholomew), which has its origins in the 12th and 13th centuries, revealed a small breakwater. A survey established that material could be found around it from the Post-Medieval period and that this structure can be interpreted as a safe harbour and shelter for mariners who were in the area of the monastery and surrounding structures throughout history.

This survey once again demonstrated that the wealth of the seabed continues to surprise us and holds many new secrets waiting to be discovered. The search for new finds draws us to the depths of the sea in the hope of finding yet another link in the data that we can incorporate into our picture of the past and to add yet another piece to the historical mosaic.

proizvodile su se u više antičkih centara u Italiji, Hispaniji, Galiji, egejskom prostoru, ali i kod nas - u Loronu, Fažani, Crikvenici (Starac 2006, 97,98).

Devastirani brodolom možemo prepoznati i na malom otočiću Babuljašu nedaleko Pakoštana. Na širem prostoru u pod-



9. Fragmentirana amfora tipa Forlimpopoli s Kozine/ Fragmented amphora of the Forlimpopoli type from Kozina (photo: R. Kovačić)

morju ovog otočića pronalazimo rasuti teret broda koji je prenosio velike cilindrične amfore. Osim rijetkih nalaza dna i oboda amfora, karakterizira ga velika količina fragmentiranih tijela koji se nalaze razasuti pod dnu, a dokaz o afričkom porijeklu broda dokazuje nam i nekoliko tanjura izrađenih od crvene gline, poznatih pod nazivom *terra sigillata chiara*, koji se mogu okvirno datirati u 3. - 4.st. (Gandolfi 2005).

Na sidrištima koja su koristili brodovi tijekom svojih putovanja i danas se nalaze sitni arheološki nalazi, koji su najčešće radi svoje male dubine u kojima su potopljeni bili česta meta ronionaca koji su te nalaze uzimali kao suvenire. U sklopu rekonstrukcije pregledane su tri takve pozicije na otoku Ošljaku, otoku Vrgadi i Petrčanima. Pretrage otoka su rezultirale pronalaskom nekoliko različitih tipova grla amfora što nam svjedoči o šarolikom teretu koji je morskim putem putovao preko Jadrana u antičko doba.



10. Amfore s brodskih sidrišta kod Vrgade i Ošljaka / Amphorae from ship anchorages from Vrgada and Ošljak (photo: R. Kovačić)

Uvala u Petrčanima uz crkvicu sv. Bartula koja porijeklo vuče iz 12.-13. stoljeća skrivala je jedan manji lukobran. Njegovim pregledom ustanovljeno je da je oko njega moguće pronaći materijal iz razdoblja novog vijeka, te se ova struktura može interpretirati kao sigurna luka i utočište za pomorce koji su tijekom povijesti boravili u prostoru samostana i okolnih objekata.

I tijekom ovih pretraživanja se pokazalo da nas bogatstvo podmorja uvijek iznova iznenađuje i uporno skriva tajne koje se moraju otkriti. Potraga za novim nalazištima nas vuče da zaronimo u morske dubine u nadi da ćemo otkriti još neki novi podatak koji možemo uklopiti u sliku naše prošlosti i složiti još jednu kockicu u povijesnom mozaiku.

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UNDERWATER SURVEY IN ŠIBENIK-KNIN COUNTY

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Underwater research and preliminary surveying in Šibenik-Knin County has been ongoing since the 1960s. It was then—at the initiative of archaeologists, above all Zlatko Gunjača and Zdenko Brusić, with the help of diver Dalibor Martinović—that the search for underwater sites was launched, already the target of various looters. This reconnaissance resulted in the discovery of a number of key underwater sites that were researched over the years that followed, such as the shipwreck off Cape Plavac on Zlarin with a cargo of Dressel 2-4 amphorae and Arretine pottery or at Gušteranski near Žirje with its 2nd century shipwreck, and many others (Jurišić 2000, 64, 71). Afterwards, underwater research in Šibenik-Knin County was conducted for the most part under the leadership of Mario Jurišić, Igor Miholjek and other professionals with the Croatian Conservation Institute, and in recent times by the professionals at the International Centre for Underwater Archaeology in Zadar.

Joining campaign leader Mladen Pešić and Luka Bekić of ICUA Zadar in this year's preliminary surveys were outside associate divers Marko Meštrov, Jerko Macura, Rok Kovačić of Slovenia and technician Petar Dobrović. During the reconnaissance we concentrated on two locations we deemed to be of interest and to

PODVODNO REKOGNOSCIRANJE ŠIBENSKO-KNINSKE ŽUPANIJE

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Podvodna istraživanja i rekognosciranja na prostoru šibensko-kninske županije započeta su još tijekom 1960-ih. Tada se na inicijativu arheologa, prvenstveno Zlatka Gunjače i Zdenka Brusića uz pomoć ronioca Dalibora Martinovića, pokrenulo pretraživanje podvodnih nalazišta koja su već i tada bila na meti raznih pljačkaša. Ova rekognosciranja rezultirala su otkrićem niza bitnih podvodnih nalazišta koja su kasnijih godina bila i istraživana, primjerice brodolom kod rta Plavac na Zlarinu s teretom Dressel 2-4 amfora i aretinskom keramikom ili Gušteranski kod Žirja s brodolomom iz 2.st., ali i mnogi drugi (Jurišić 2000, 64, 71). Nakon toga podvodna istraživanja šibensko-kninske županije nastavljena su prvenstveno pod vodstvom Marija Jurišića, Igora Miholjeka i drugih djelatnika Hrvatskog restauratorskog zavoda, a u novije vrijeme i djelatnika Međunarodnog centra za podvodnu arheologiju u Zadru.

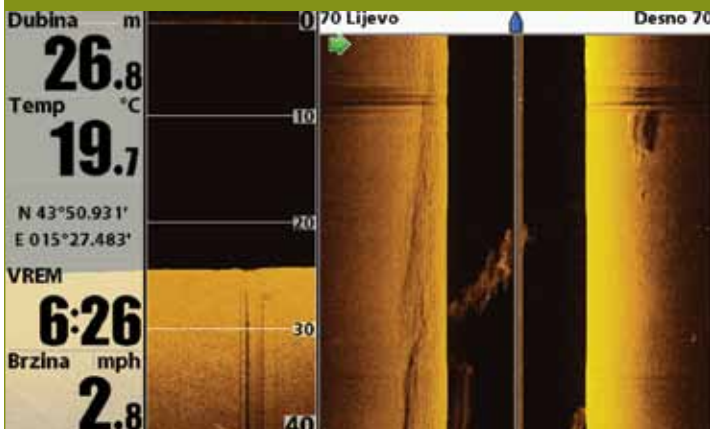
U ovogodišnjim rekognosciranjima su uz voditelja Mladena Pešića te Luke Bekića iz MCPA Zadar, sudjelovali i vanjski suradnici ronionci Marko Meštrov, Jerko Macura, Rok Kovačić iz Slovenije te tehničar Petar Dobrović. Tijekom rekognosciranja smo se koncentrirali na dvije lokacije koje smo smatrali zanimljivima i do sada nedovoljno istraženima - područje oko Skradina na rijeci Krki i

date insufficiently investigated-the area around Skradin on the Krka River and the area around the island Arta Velika. Also investigated were several positions we felt were archaeologically interesting because of their location, which may have served as potential anchorages or sites where shipwrecks may have occurred. The search was conducted with the aid of Side Imaging Sonar, a device with which we have identified the positions of old shipwrecks, and some modern wrecks. One such vessel is the Teta Šara, which was used prior to its sinking as a work vessel in diving campaigns conducted in the territory of Šibenik-Knin County. In the frame of on-land reconnaissance of the area around Skradin, a well-known port and centre of commerce in Roman Dalmatia, professor Željko Miletić DSc and professor Miroslav Glavičić DSc identified the remains of a wharf that may have been a part of a Roman period harbour (Glavičić, Miletić 2008,



3. Struktura rimske operativne obale u Skradinu / The structure of the Roman wharf at Skradin (photo: M. Pešić)

144-148). Based on this information we conducted underwater reconnaissance of the area of Lenovac, downstream of the ACI Marina in Skradin and discovered interesting finds that undoubtedly testify to the existence of structures that were once



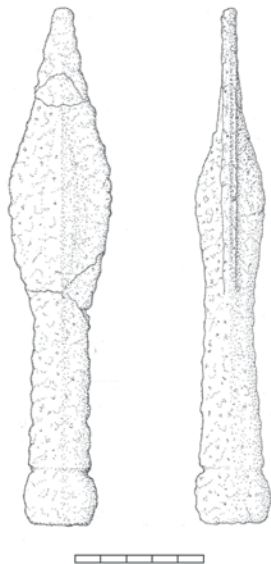
2. Skeniranje broda Teta Šara / Scanning the Teta Šara wreck

prostor oko otoka Arta Velika. Uz to je pregledano i nekoliko pozicija koje su nam se činile arheološki zanimljive radi svoje lokacije koja je mogla služiti kao potencijalno sidrište ili mjesto gdje su se mogle dogoditi brodske havarije. Pretraživanje se vršilo i uz pomoć *Side Imaging Sonara*, uređaja s kojim smo otkrivali pozicije starih brodoloma, ali i neke moderne olupine. Primjerice brod Teta Šara koji je prije svoje nesreće služio kao radni brod u ronilačkim akcijama koje su se obavljale na teritoriju Šibensko-kninske županije.

U sklopu kopnenih rekognosciranja prostora oko Skradina, poznatog lučkog i trgovačkog središta na teritoriju rimske provincije Dalmacije, prof.dr.sc.Željko Miletić i prof.dr.sc. Miroslav Glavičić uočili su ostatke operativne obale koji bi mogli pripadati antičkoj luci (Glavičić, Miletić 2008, 144-148). Na osnovu tih informacija proveli smo podvodno rekognosciranje područja Lenovac, nizvodno od ACI Marina u Skradinu, te otkrili zanimljive nalaze koji nedvojbeno svjedoče o postojanju konstrukcija koje su nekada bile dio operativne obale. Njihovi ostaci vidljivi su već na 10-ak

4. Kasnoantička amfora srasla s nasipom u Skradinu / A Late Roman amphora encrusted into the embankment at Skradin (photo: M. Pešić)





5. Crtež rimskog legionarskog koplja u vrlo korodiranom stanju / Drawing of the very corroded Roman legionary's spearhead (author: L. Bekić)

part of a wharf. Their remains are visible just some ten centimetres under the surface of the water and at places reach a depth of almost two metres. Much of the stone structure of the wharf and of the embankment created when it collapsed is covered in the silt and tufa formations created by the Krka River over time and there is a deep layer of silt on the bottom of the river channel at a depth of from 7 to 12 metres. If we also consider the factor of poor visibility it is evident that the identification of very small archaeological finds on the riverbed is a difficult task. Nevertheless, the survey of the area provided evidence of the remains of human activity during the Roman period. Parts of tegulae, pithos and amphorae undeniably indicate the lengthy habitation and commerce that took place here, and fragments of African and eastern Mediterranean amphorae bear witness to the distant lands from which foodstuffs were delivered. Certainly the most interesting find is a Roman legionary's spear with a shaft socket. It was found encrusted and firmly adhered to the rock of the embankment under the wharf. This find testifies to the presence of the Roman army, based in the 1st century at the military camp at Burnum that was certainly supplied with the provisions necessary for its operations primarily by way of the port at Skradin. Similar spearheads were found at the Roman camp at Vindonissa where the XI Legion was based after Burnum (Unz, Deschler-Erb 1997, 8, T. 18 276, T. 19 319, 320).

The island of Arta Velika is located in the area between Drage, Murter and Vrgada at a strategically interesting position for ships plying the waters of the Pašman canal in the past. The island is mentioned in the 7th century Ravenna Cosmography of an anonymous author that, in listing settlements, cites this island under the name of *Artion* (Čače 1995, 21). During our reconnaissance we were based in the area of the islets of Artica and Artica Mala, located to the northwest of the island of Arta Velika. The diverse finds of amphorae and Post-Medieval material we discovered scattered around the islet bear witness to many years of navigation in this area and to the fact that this was a place where ships sought refuge during storms or overnight shelter and anchorage. Based on the types of amphorae originating from the Late Roman period we can conclude that the period of most intensive traffic was in the 3rd

7. Meštrov s novovjekovnim tanjurom na Artici / Meštrov with a Post-Medieval plate at Artica Mala (photo: J. Macura)



6. Rimsko legionarsko koplje in situ na Lenovcu u Skradinu / A Roman legionary's spearhead in situ on Lenovac in Skradin (photo: M. Pešić)

centimetara ispod razine vode, a na nekim mjestima se protežu do dubine od gotovo 2 metra. Veći dio kamene strukture obale i nasipa koji je nastao njenim urušavanjem prekriven je ostacima mulja i sedrenim formacijama koje je rijeka Krka stvarala tijekom prošlosti, a na dnu riječnog korita na dubini od 7-12 metara pojavljuje se i debeli sloj mulja. Kad tome pridružimo i slabiju vidljivost, jasno je da je u takvim uvjetima vrlo teško registrirati sitne arheološke nalaze na dnu. Ipak se tijekom pregleda terena moglo posvjedočiti o ostacima ljudskih djelatnosti tijekom antičkog razdoblja. Dijelovi tegula, pitosa i amfora nedvojbeno dokazuju dugogodišnji život i trgovačku razmjenu koja se događala na ovom prostoru, a fragmenti afričkih i istočno mediteranskih amfora svjedoče o dalekim krajevima odakle su se dopremali prehrambeni proizvodi. Najzanimljiviji nalaz je svakako željezno rimsko legionarsko koplje s tuljcem za nasad. Nađeno je inkrustrirano i čvrsto zaraslo za stijene nasipa ispod operativne obala. Ovaj nalaz nam svjedoči o prisutnosti rimske vojske koja je tijekom 1. st. boravila u vojnom logoru u Burnumu, a za koju se zasigurno prvenstveno preko luke u Skradinu obavljalo dopremanje namirnica nužnih za





8. Nalazi brodoloma s teretom Lamboglia 2 amfora / Find of a shipwreck with a cargo of Lamboglia 2 amphorae (photo: J. Macura)

and 7th centuries. This is borne out by a large number of amphorae with external ribbing, the Late Roman 1 and 2 types, manufactured in the area of the Greek islands. For one of the ships that passed this part of the Adriatic coast this area was the end of the line. A ship with a cargo of Lamboglia 2 amphorae used in the period of the 2nd century BC to the 1st century AD ended its navigation in the waters of the islet of Artica, and their remains are today visible scattered over a wide area between the patches of Neptune Grass covering the seabed.

This programme continues a reconnaissance project the chief aim of which is to supplement the database on underwater archaeological sites in Croatia. All of the data collected in past and future research campaigns will be logged into the MACHU.HR database, which will contribute to advancing the registration and protection system being developed at the International Centre for Underwater Archaeology in Zadar.

10. Ronilac s amforom Lamboglia 2 kod otočića Artica/ Diver with a Lamboglia 2 amphora near Artica islet (photo: J. Macura)



njeno funkcioniranje. Slična koplja su nađena i u rimskom logoru u Vindonissa gdje je XI. legija boravila nakon Burnuma (Unz, Deschler-Erb 1997, 8, T. 18 276, T. 19 319,320).

Otok Arta Velika nalazi se na prostoru između Draga, Murtera i Vrgade na zanimljivom strateškom položaju za brodove koji su tijekom povijesti plovili Pašmanskim kanalom. Sam otok spominje se i u djelu Anonima Ravenjanina *Cosmographia* iz 7.st., koji nabrajajući naselje navodi ovaj otok pod imenom Artion (Čače 1995, 21). Tijekom našeg rekognosciranja bazirali smo se na prostor otočića Artice i



9. Fragmentirana novovjekovna zdjelica nađena u uvali Sovlje tijekom rekognosciranja / A fragmented Post-Medieval small bowl found in Sovlje bay during the reconnaissance (photo: R. Kovačić)

Artice Male koji se nalaze sjeverozapadno od otoka Arte Velike. Različiti nalazi amfora i novovjekovnog materijala koje smo otkrili raštrkane uokolo otočića svjedoče o dugogodišnjoj plovidbi na ovom prostoru, i predstavljaju mjesta na kojima su brodovi tražili utočište za lošeg vremena ili samo zaklon i sidrište za vrijeme noćnih odmora. Prema tipovima amfora koje potječu iz kasnoantičkog razdoblja može se zaključiti da je najintenzivniji promet bio upravo u periodu 4. i 7.st. O tome svjedoči veći broj amfora s narebrnim vanjskim dijelom tijela - Late Roman 1 i 2 koje su se proizvodile na području grčkih otoka. Za jedan od brodova koji su prolazili ovim dijelom jadranske obale u antici ovo područje označilo je i kraj plovidbe. Brod s teretom amfora Lamboglia 2, koje su se upotrebljavale u periodu 2.st. prije Krista do 1.st. nakon Krista okončao je svoju plovidbu u podmorju otočića Artice, te su danas tu vidljivi njihovi ostaci razasuti na širokom prostoru između trave posidonije koja prekriva morsko dno.



11. Kasnoantičke amfore s Artice i Artice Male / Late Roman amphorae from Artica and Artica Mala (photo: M. Pešić)

Ostvarenjem ovog programa nastavlja se projekt rekognosciranja čija je glavna svrha nadopunjavanje baze podataka s podacima o podvodnim arheološkim nalazištima na tlu Hrvatske. Sve informacija koje su rezultat prošlih i budućih istraživanja biti će unijeti u bazu MACHU.HR, što će doprinijeti unapređenju sustava bilježenja i zaštite koji se razvija u Međunarodnom centru za podvodnu arheologiju u Zadru.

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1. Predmet in-situ / The object in-situ (photo: R. Mosковиć)

CONSERVATION- RESTORATION WORK ON A POST- MEDIEVAL COPPER CAULDRON

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Archaeological research of a post-medieval shipwreck at the Sveti Pavao underwater site off the island of Mljet has been underway since 2007. Several elements of a ship's structure have been found at this site, along with eight bronze cannon and an abundance of other archaeological finds, including a copper cauldron. The 43 by 27 centimetre copper cauldron was forged from two copper plates joined by rivets. There are four rivets each on diametrically opposite sides of the rim of the cauldron that affix the handle attachments and missing handles. The cauldron was covered in limestone and corrosion encrustations on its interior and exterior sides. A metal surface of 20 by 5 cm on a part of the bottom towards the belly of the cauldron has entirely decayed and is missing.

Upon extraction from the sea the cauldron was transported to the restoration workshop where, after the condition as found was recorded and documented, it was cleansed of algae, seaweed and sand before being prepared for desalination. The

KONZERVATORSKO- RESTAURATORSKI RADOVI NA NOVOVJE- KOVNOM BAKRENOM KOTLU

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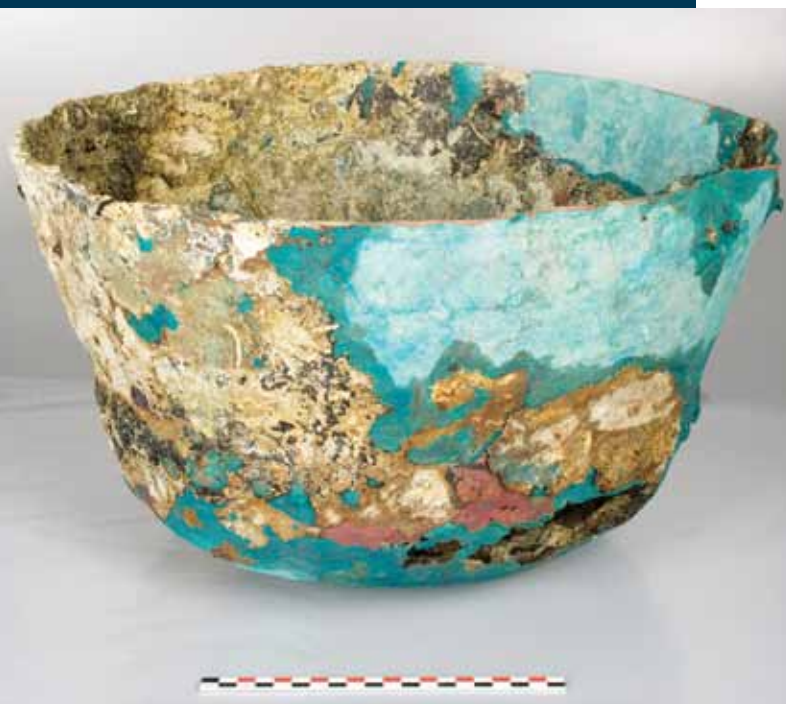
Arheološko istraživanje novovjekovnog brodoloma na pod-morskom lokalitetu Mljet, Sv. Pavao provodi se od 2007.g. Na ovom lokalitetu pronađeno je više elemenata brodskih struktura, osam brončanih topova kao i mnoštvo drugih arheoloških nalaza među kojima i bakreni kotao. Bakreni kotao dimenzija 43 X 27 cm iskovan je od dvije bakrene ploče međusobno pričvršćene zakovicama. Na dijametralno suprotnim stranama oboda kotla nalaze se po četiri zakovice pomoću kojih je bio pričvršćen ataše i ručke koje nedostaju. S vanjske i unutarnje strane kotao je bio prekriven vapnenačkim i korozivnim naslagama. Na dijelu od dna prema truhu kotla metalna površina dimenzije 20 X 5 cm u potpunosti je propala i nedostaje.

Nakon što je izvađen iz mora, kotao je dopremljen u restauratorsku radionicu, gdje je nakon evidentiranja i dokumentiranja zatečenog stanja očišćen od algi, trava i pijeska, nakon čega je pripremljen za desalinizaciju. Desalinizacija je

desalination process was conducted by immersing the object in a tap water bath. The process was monitored monthly with instrument measurements of salinity. The desalination process lasted twelve months whereupon the object was taken out of the water bath and dried. The desalination of the object was followed by the removal of surface accumulations from the object. The calcification deposits and limestone were removed from the surface of the metal by the mechanical use of various hand tools. The removal of large calcite and limestone deposits from the surface of the metal exposed the products of corrosion, covering the entire object. Mechanical cleansing trials showed that the corrosion deposits on the surface of the object were unstable and present in a very thin layer, with the original metal appearing upon their removal. Given the lack of a firm and stable patina we undertook the removal of the corrosion layer from the surface of the metal using the mechanical method of micro-sandblasting.

As the original metal surface was revealed on sections of the cauldron during the removal of the corrosion layer, an artificial patina was applied to these sections. Patination trials were conducted on a small section of the metal using several chemical substances that create an artificial patina on metal. Patination with liver of sulphur yielded the most natural appearance, and this substance was used for the patination of the original metal surface. The missing segment of

provedena potapanjem predmeta u kadu s vodovodnom vodom, dok se praćenje procesa obavljalo mjesečno, instrumentalnim mjerenjem saliniteta. Proces desalinizacije trajao je 12 mjeseci nakon čega je predmet izvađen iz vode i posušen. Nakon što je predmet desaliniziran, uslijedilo je



2. Zatečeno stanje predmeta / The state of the object as found
(photo: R. Mosković)

uklanjanje naslaga s površine predmeta. Nakupine kalcifikata i vapnenca uklonjene su s površine metala mehanički upotrebom raznog ručnog alata. Nakon uklanjanja većih kalcitnih i vapnenačkih nakupina na površini metala postali su vidljivi produkti korozije koji su prekrivali cijeli predmet. Mehaničke probe čišćenja pokazale su da su korozivni slojevi na površini predmeta nestabilni te da su prisutni u vrlo tankom sloju nakon čijeg se uklanjanja ispod njih pojavljuje izvorni metal. S obzirom na nepostojanje čvrste i stabilne patine, pristupilo se uklanjanju korozivnog sloja s površine metala mehaničkom metodom mikropjeskarenja.

Budući da je prilikom uklanjanja korozivnog sloja, na dijelovima kotla otkrivena izvorna površina metala, na tim je

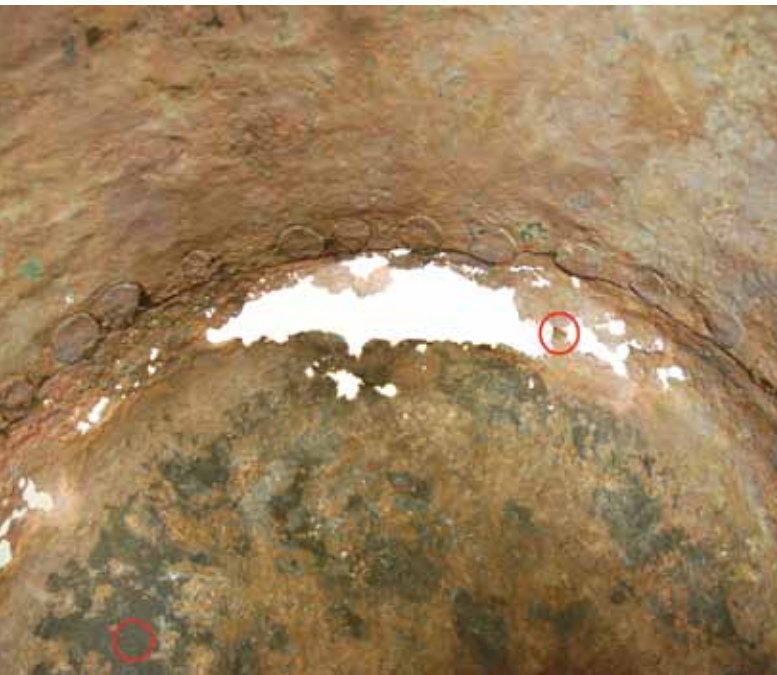
4. Nanašanje epoksidne smole / Application of epoxy resin
(photo: M. Mustaček)

3. Mikropjeskarenje korozivnih slojeva / Micro-sandblasting of corrosion layers
(photo: M. Mustaček)

the cauldron was reconstructed and integrated using epoxy resin with the addition of pigment whereupon the integration was shaped using a micro-motor. A barrier coat of Paravax consisting of a mixture of Paraloid B-72 and microcrystalline wax in toluene was applied to the object to protect it from atmospheric effects.

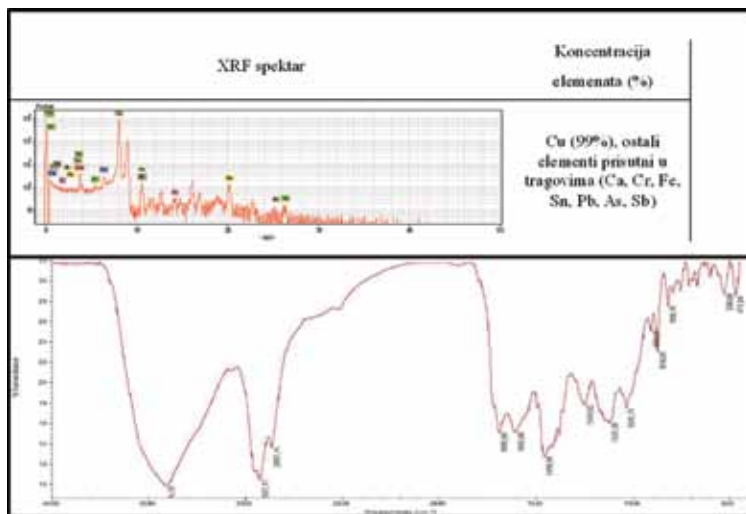
Laboratory analysis was conducted on a sample of the metal and a sample of black deposit from the bottom of the cauldron. The metal sample was analysed using the x-ray fluorescence method (XRF). The result of the metal analysis showed a 99% copper presence in the sample. The black





5. Pozicije analiziranih uzoraka / The positions of analysed samples (photo: M. Mustaček)

deposit sample was analysed by FT-IR spectroscopy. The result of the analysis of the deposit sample showed the presence of elements that originate from compounds of organic materials and soil substances, silicates and clay.



7. Rezultati analize metala i uzorka taloga / The results of the analysis of the metal and deposit sample (author: M. Mustaček)

The conservation-restoration operations saw the removal of deposits of limestone and corrosion from the object and its stabilisation and restoration. No adverse changes were observed on the object following the restoration work-its further decay has been prevented and the object has been preserved for the long term.

dijelovima nanese umjetna patina. Na manjem dijelu metala napravljene su probe patiniranja upotrebom više kemijskih sredstava koje na metalu stvaraju umjetnu patinu. Patiniranjem sumpornom jetrom dobiven je najprirodniji izgled, pa je s tim sredstvom patinirana izvorna površina metala. Nedostajući dio kotla rekonstruiran je i integriran pomoću epoksidne smole uz dodatak pigmenata nakon čega je integracija pomoću mikromotora i oblikovana. Kako bi se predmet zaštitio od atmosferskih utjecaja, na predmet je nanese zaštitna prevlaka Paravaxa načinjenog od mješavine Paraloida B-72 i mikrokristalinskog voska u Toluenu.

Laboratorijska istraživanja provedena su na uzorku metala i uzorku crnog taloga s dna kotla. Uzorak metala analiziran je metodom rendgenske fluorescencije (XRF). Rezultat analize metala pokazuje 99 % prisutnost bakra u uzorku. Uzorak crnog taloga analiziran je FT-IR spektroskopijom. Rezultat analize uzorka taloga pokazuje prisutnost elemenata koji potječu od spojeva organskog materijala te zemljanih supstanci, silikata i glina.



6. Nadomješteni dio predmeta / The replaced section of the object (photo: M. Mustaček)

Provedenim konzervatorsko-restauratorskim zahvatima predmet je očišćen od naslaga vapnenca i korozije te je stabiliziran i restauriran. Nakon provedenih restauratorskih radova, na predmetu nisu vidljive nikakve štetne promjene čime je spriječeno njegovo daljnje propadanje a predmet je dugotrajno očuvan

8. Predmet nakon izvedenih konzervatorsko-restauratorskih radova / The object following conservation-restoration work (photo: M. Mustaček)



MONTENEGRIN MARITIME ARCHAEOLOGICAL RESCUE PROJECT

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MMARP (The Montenegrin Maritime Archaeological Rescue Project) successfully conducted three seasons of maritime and terrestrial research along the coast north and south of the port of Bar in southern Montenegro. The five dive sites - Bigovica Bay, Maljevik Beach, Valdanos Bay, Volujica and Stari Ulcinj - are ideal for training as they are shallow, the visibility is generally excellent and the archaeology is rich and fascinating.

MMARP was initiated following the discovery in August 2009 of a number of large stone blocks, apparently intended from an ancient or medieval monumental building, on the sea floor in c.4m of water in Maljevik Bay, c.7km north of the port of Bar in southern Montenegro. At the beginning MMARP was primarily focused on research in Maljevik Bay. However, during this research we came to the conclusion that the coastal area surrounding Bar had incredible potential regarding maritime archaeology. By focusing on bays such as Maljevik and Bigovica, we are trying to perceive a bigger picture in order to get an idea about what was happening during the past centuries in this precise area, and hopefully the wider region.

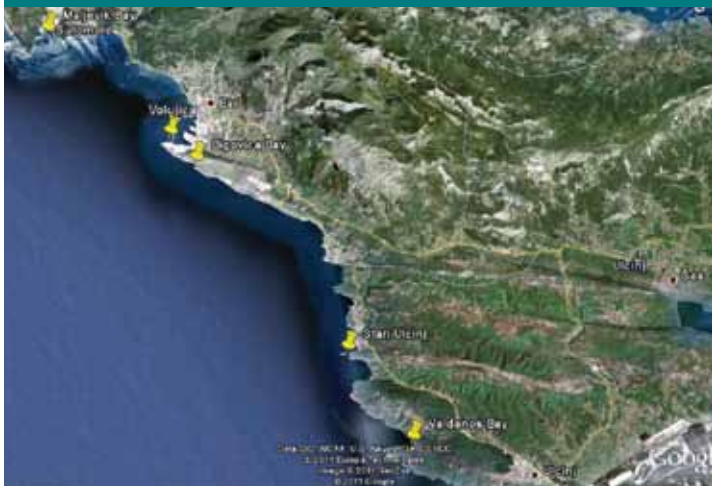
Following this discovery, with in collaboration between the Museum of Bar and the University of Southampton, carried out the with financial and other support from the Headley

2. Fotomozaik brodoloma u uvali Bigovica / Photomosaic of shipwreck at the Bigovica Bay (author: M. Dames)



CRNOGORŠKI PROJEKAT ZA ZAŠTITU PODVODNE KULTURNE BAŠTINE

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1. Lokacije uvala koje su bile predmet istraživanja / Locations of research area (© google maps)

MMARP (The Montenegrin Maritime Archaeological Rescue Project) sproveo je tri uspješne kampanje podvodnih i terenskih istraživanja duž obale sjeverno i južno od luke Bar na području južne obale Crne Gore. Pet podvodnih lokaliteta - uvala Bigovica, uvala Maljevik, uvala Valdanos, Volujica i Stari Ulcinj predstavljali su idealne lokacije za obuku domaćih i inostranih arheologa iz razloga što su relativno plitke, sa generalno dobrom vidljivošću te bogatim i fascinantnim arheološkim ostacima.

Projekat MMARP pokrenut je nakon slučajnog otkrića u avgustu 2009. godine niza kamenih blokova većih dimenzija,

Trust, the Montenegrin Ministry of Culture, the Municipality of Bar, project was formed under the name of Montenegrin Maritime Archaeology Research Project. Since this was the first systematic underwater archaeological research carried out in Montenegro, goals of the project were not set only on archaeological excavations, but it also aims to build capacity by training a core group of Montenegrin maritime archaeologists in maritime survey and documentation techniques, to support and encourage, through co-operation and collaboration with institutions with regional neighbors, to continue and extend maritime and terrestrial survey and excavation along the coast of the Municipality of Bar, in order to develop a clearer understanding on the date, nature, extent and condition of the underwater archaeological resource in the area, to create a digital GIS inventory of underwater and coastal archaeological sites of particular importance and sensitivity and to develop a conservation management plan for Bigovica Bay and Maljevik Bay.

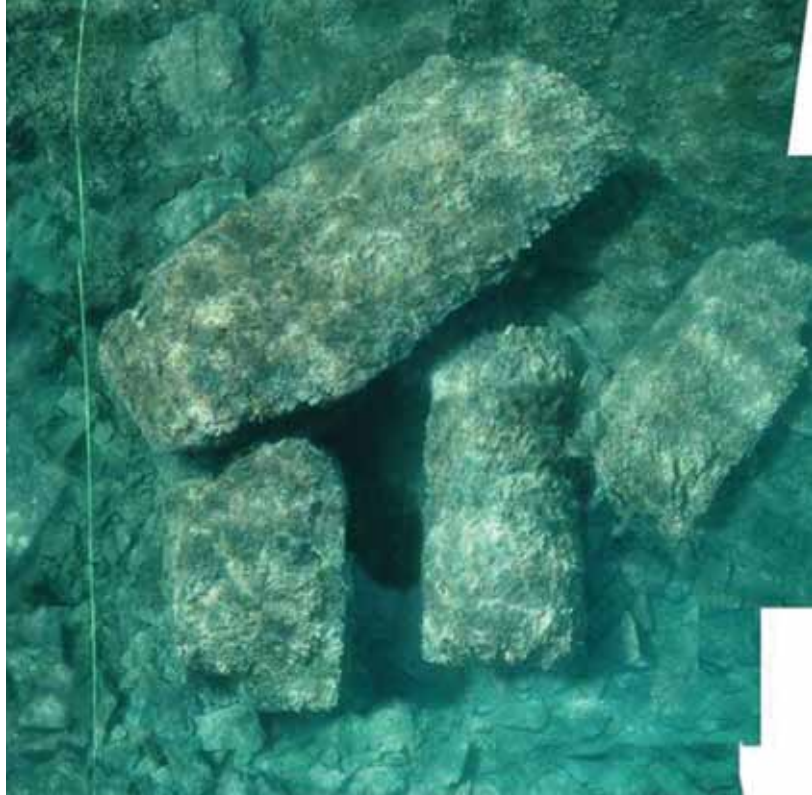
The 2010 season demonstrated the potential of archaeological survey along the coast, with a number of prehistoric, classical and medieval sites having been identified around the fringe of Maljevik Bay. Understanding of the coastal landscape is essential to provide an environmental context within which to interpret the cultural material.

During this season, some initial surveys were also conducted in Bigovica Bay, and these led us to the conclusion that more time and energy should be invested at this site in the future. After a preliminary survey in Bigovica Bay in 2011, with a few test trenches opened, it was decided that the bay needed in-depth excavation in 2012. In addition, a survey of key points of the surrounding coastline in the Bar region was also to be investigated.

In 2012 season research was carried in two directions, survey of wider area of shallow waters and opening trenches with in the area of Bigovica Bay. The preliminary methodology of the survey conducted was visual reconnaissance by scuba divers, supplemented with using a water dredge. Underwater documentation included setting up datum points and baselines, taking measurements, making drawings, and taking photographs. At the Bigovica Bay, seven trenches were established at key positions where the nature of the stratigraphy, the vertical extent of archaeological remains and the site formation process in the bay could be investigated in a more thorough manner. A further aim was to establish if there is any logical chronological pattern to the distribution of artifacts both horizontally (as determined by the earlier survey data from 2011) and vertically (as determined by the excavation data from 2011).

Bigovica Bay contains exceptional quantities of ancient material, particularly ceramics, dating from at least the third century BC into the post-medieval period. The results gathered during the last three seasons of investigation by the MMARP thus imply that Bigovica Bay might have been used as an anchorage for over two thousand years, with amongst other finds, huge quantities of pottery scattered all around the southern part of the bay.

Further analysis will focus on examining the geographical origins of the deposits from 2011 and 2012, in order to establish if there is a correlation in this respect. Analysis



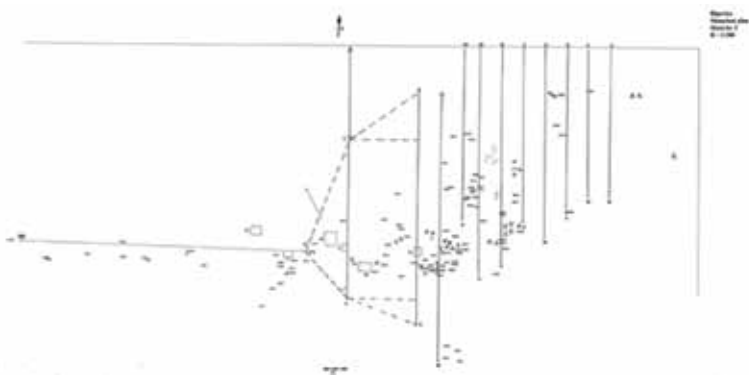
3. Fotomosaik kamenih blokova u uvali Maljevik / Photomosaic of stone blocks at the Maljevik Bay (author: M. Dames)

vjerovatno namijenjenih za izgradnju nekog monumentalnog objekta, u uvali Maljevik, nekih 7 km severno od luke Bar. Inicijalno, MMARP je bio fokusiran prvenstveno na istraživanja u ovoj uvali. Međutim, tokom istraživanja Maljevika i njegove okoline došlo se do zaključka da širi primorski pojas akvatorija Bara pruža neverovatne arheološke potencijale. Fokusirajući se na uvale kao što su Maljevik i Bigovica, cilj je bio da se sagleda opšta slika i dobije ideja o dešavanjima u prošlosti na ovom području, i možda širem regionu.

Nakon navedenih otkrića, u okviru saradnje Zavičajnog muzeja u Baru i Univerziteta Southampton, a sprovedeno uz finansijsku podršku Headley Trust-a, Ministarstva kulture Crne Gore i Opštine Bar, oformljen je višegodišnji projekat pod nazivom MMARP, odnosno "Crnogorski projekat za zaštitu

4. Mjerenje kamenih blokova u uvali Maljevik / Measuring stone blocks at the Maljevik bay (photo: D. Varda)

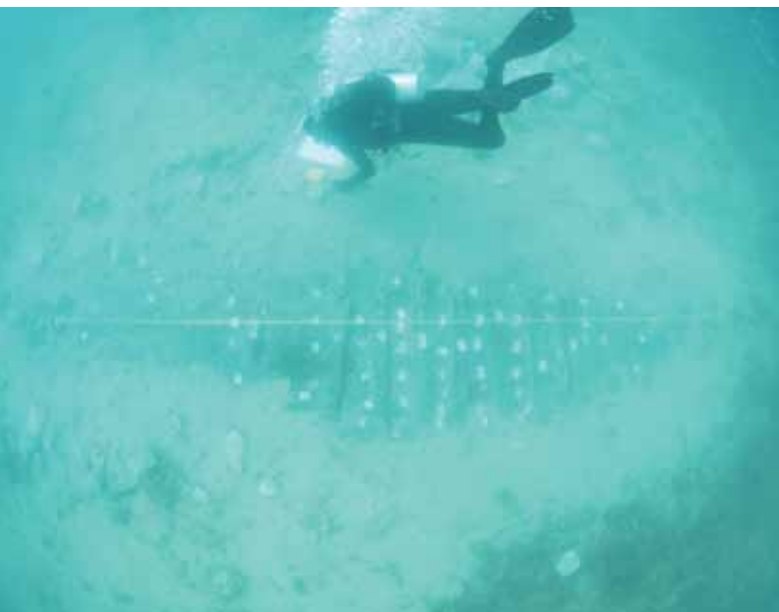




5. Situacioni plan uvala Bigovica / Site plan of the Bigovica Bay
(source: MMARP)

will also include an examination of other assemblages in the region, to determine if local trading networks can be established.

Limited observation at the site at Volujica point has shown a great deal of potential for future investigations, including a possible shipwreck dating to the 1st century BC. Finds at



6. Snimanje brodoloma u uvali Bigovica / Recording of shipwreck at the Bigovica Bay (photo: M. Dames)

the location Stari Ulcinj indicate the remains of building stone and 6th century AD ceramics that may be the result of a shipwreck but future research is necessary at this site to confirm our findings. As for the site at Valdanos, this year the conditions for diving did not allow us to conduct any specific conclusions, but the fact is that it is locally known as a place with many shipwrecks, so we hope to undertake a more comprehensive geophysical survey of the area in forthcoming years.

It can be concluded that this collaborative side of the work between Montenegrin and UK and Denmark archaeologists went extremely well, and that MMARP didn't only bring new discoveries with in the field of underwater archaeology, but also help to build human capacity in Montenegro in the field of underwater archaeology, which will provide continuity in of further researches along the Montenegrin coast.

podvodne kulturne baštine". Kako su u pitanju prva sistematska podvodna arheološka istraživanja u Crnoj Gori, cilj projekta nije bio baziran isključivo na arheološkim istraživanjima i rezultatima te vrste, već i na izgradnji kapaciteta, obuci grupe crnogorskih arheologa u podvodnim istraživanjima, dokumentacionim tehnikama, te razvoju saradnje sa srodnim institucijama iz regiona. Takođe, želja je bila da se omogući jasnije razumevanje prirode, hronologije i stanja podvodnog arheološkog resursa, kroz stvaranje GIS inventara podvodnih arheoloških lokaliteta.

Tokom kampanje 2010. godine, uočen je potencijal arheoloških istraživanja duž obale barskog akvatorija, gde je konstatovan veći broj praistorijskih, antičkih i srednjevekovnih lokaliteta. Takođe, razumevanje primorskog reljefa bilo je od suštinskog značaja za shvatanje ekološkog konteksta u okviru kojeg se tumače ovi lokaliteti.

Tokom ove kampanje, pored glavnog fokusa na uvalu Maljevik, početna istraživanja sprovedena su u uvali Bigovica, što je dovelo do zaključka da je potrebno da se više vremena i istraživanja treba posvetiti ovom lokalitetu u budućnosti. 2011. godine, izvršena su preliminarna istraživanja na lokalitetu Bigovica, sa nekoliko probnih sondi, na osnovu čega se utvrdilo da naredne godine treba pristupiti ozbiljnijim, sistematskim iskopavanjima.

U okviru kampanje 2012. godine, istraživanja su sprovedena u dva pravca: sistematska iskopavanja u uvali Bigovica i rekognosciranje šireg područja Opštine Bar, sa ciljem determinisanja prostiranja podvodnih lokaliteta. Preliminarna metodologija rekognosciranja obuhvatala je vizuelnu prospekciju, dok su se iskopavanja vršila uz pomoć mamut pumpe. Dokumentovanje je obuhvatalo postavljanje fiksni tačaka, crtanje i fotografisanje. U uvali Bigovica tokom ove kampanje otvoreno je šest sondi, na ključnim pozicijama, što je omogućilo dobijanje detaljnijih informacija o prirodi stratigrafije i rasprostranju nalaza na samom lokalitetu. Sledeći cilj bio je utvrđivanje prisutnosti hronološkog obrasca rasprostranja materijala kako horizontalno tako i vertikalno.

Kako uvala Bigovica sadrži ogromnu količinu rasutog materijala, prvenstveno keramike, okvirno datovanog od III veka p.n.e. do kasnog srednjeg veka, tako su i rezultati istraživanja u protekle tri godine doveli do zaključka da je ova uvala vjerovatno bila korišćena kao sidrište kroz duži vremenski period.

Dalja istraživanja i analize fokusiraće se na geografsko porijeklo materijala konstatovanog na ovom lokalitetu, a obuhvatiće i primjere ove vrste u regionu, kako bi se utvrdilo kakvu je funkciju Bigovica imala u lokalnim trgovinskim mrežama.

Rekognosciranje izvršeno na lokalitetu Volujica ukazalo je na veliki potencijal ove lokacije za buduća istraživanja, uključujući i mogući brodolom iz perioda 1. veka p.n.e. Istraživanjima na lokalitetu Stari Ulcinj konstatovani su ostaci obrađenog kamena, te keramike koja je datovana iz 6 vek n.e., koja bi mogla biti posledica brodoloma, ali buduća istraživanja će dati više informacija. Što se lokacije Valdanos tiče, prilikom rekognosciranja 2011. i 2012. godine, zbog loših uslova za ronjenje, nije konstatovan neki značajniji nalaz, ali je ovaj lokalitet kroz ranija rekognosciranja prepoznat kao moguća srednjevekovna luka.

DOCUMENTING A ROMAN VESSEL AT SINJA GORICA

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The mid-19th century saw the beginning of clay extraction between Verd and Sinja Gorica near Vrhnika for the production of brick along the Ljubljanica River. Demand for construction material rose following the earthquake in Ljubljana in 1895, and the Austrian authorities even constructed a new rail line for the loading and transport of brick for Ljubljana.¹ Clay extraction began to the south of the bend near Vrhnika at which the Ljubljanica River reaches its northernmost point, in the immediate vicinity of the river, and these sites have been actively exploited since the 1960s. After the site was closed the excavated area was flooded by subterranean marsh waters, now fish farm ponds. The embankment between the river and the fish farms is narrow; making the possibility of the penetration of water from the fish farm into the Ljubljanica River great.



1. Lega deblaka in plovila v Ljubljani / Positions of logboat and vessel in Ljubljana (© Google Earth)

The area is about 300 metres to the east of an Early Roman settlement with storage facilities and a port at the bend of the Ljubljanica alongside Dolge Njive, surrounded by a defensive ditch.² Judging by the finds the settlement was abandoned in the first half of the 1st century, with transport activities and habitation moving to Breg on the left bank of the Ljubljanica.

Numerous finds from the riverbed near the fortification, and downstream in its vicinity, confirm the military significance of the area. Notable among these are several gladius with scabbards, a pilum and a bronze helmet from the Augustan period, contemporary bronze ware, buckets and ladles of Italic provenience and ceramic ware.

¹ Jenko 1962. / *Jenko 1962.*

² Concerning the circumstances and finds: Horvat 1990, 2009; Horvat, Kocuvan, Logar 1986; Logar 1984, 1986. / *O okoliščinah in najdbah: Horvat 1990, 2009; Horvat, Kocuvan, Logar 1986; Logar 1984, 1986.*

DOKUMENTIRANJE RIMSKEGA PLOVILA IZ SINJE GORICE

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Tik ob Ljubljani, med Verdom in Sinjo Gorico pri Vrhniki, so sredi 19. stoletja pričeli izkopavati glino za izdelavo opek. Po potresu v Ljubljani leta 1895 so se potrebe po gradbenem materialu tako povečale, da je avstrijska oblast celo zgradila novo železniško progo za tovorjenje opek v Ljubljano.¹ Južno od okljuka, kjer se Ljubljanica v bližini Vrhnike povzpne najbolj severno, so tik ob Ljubljani nastali glinokopi, ki so jih aktivno uporabljali do šestdesetih let 20. stoletja. Po opustitvi je glinokope zalila barjanska podtalnica, danes pa so tam ribniki. Brežina med reko in ribniki je ozka, zato je možnost izlitja vode iz ribnikov v Ljubljanico velika.

Območje leži okoli 300 m vzhodno od zgodnjorimske naselbine s skladišči in pristaniščem v okljuku Ljubljane na Dolgih njivah, obdane z obrambnim jarkom.² Sodeč po najdbah, je bila naselbina opuščena v prvi polovici 1. stoletja, transportne dejavnosti in življenje pa so se preselili na Breg na levi strani Ljubljane.

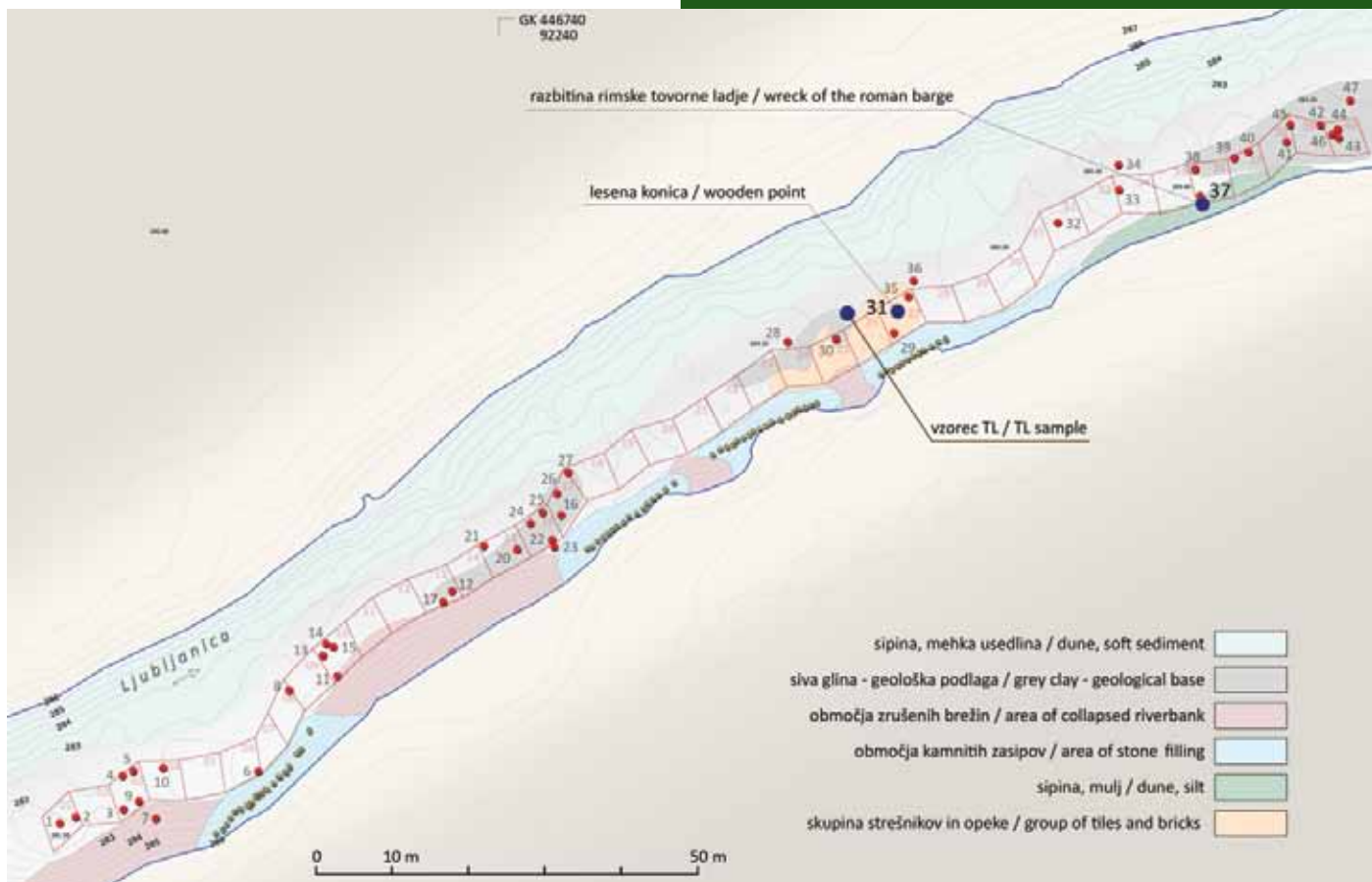
Številne najdbe iz struge ob utrdbi in njeni bližini nizvodno potrjujejo vojaški pomen območja. Med njimi je treba omeniti več gladijev z ostanki nožnic, pilum in bronasto čelado iz avgustejskih časov, sočasne bronaste korce, vedra in zajemalke italške provenience ter keramično namizno posodje.

Tudi na levem bregu Ljubljane ter ob glavni cesti (via publica) med Akvilejo (Aquileia) in Emono so bile dokumentirane sledi rimske arhitekture in aktivnosti uporabnikov, ob reki pa lahko pričakujemo pristaniško infrastrukturo in druge sledi,



2. Terenski pregledi struge Ljubljane leta 2008 / Field survey in Ljubljana at 2008 (photo: M. Musić, DRM)

povezane s transportom in plovbo. Na tem območju so bile odkrite tudi najdbe (koščeni in roženi predmeti, kamnita sekira, keramično posodje), ki pričajo o prazgodovinski naselbini, najverjetneje bakrenodobni. Iz mlajše železne dobe so

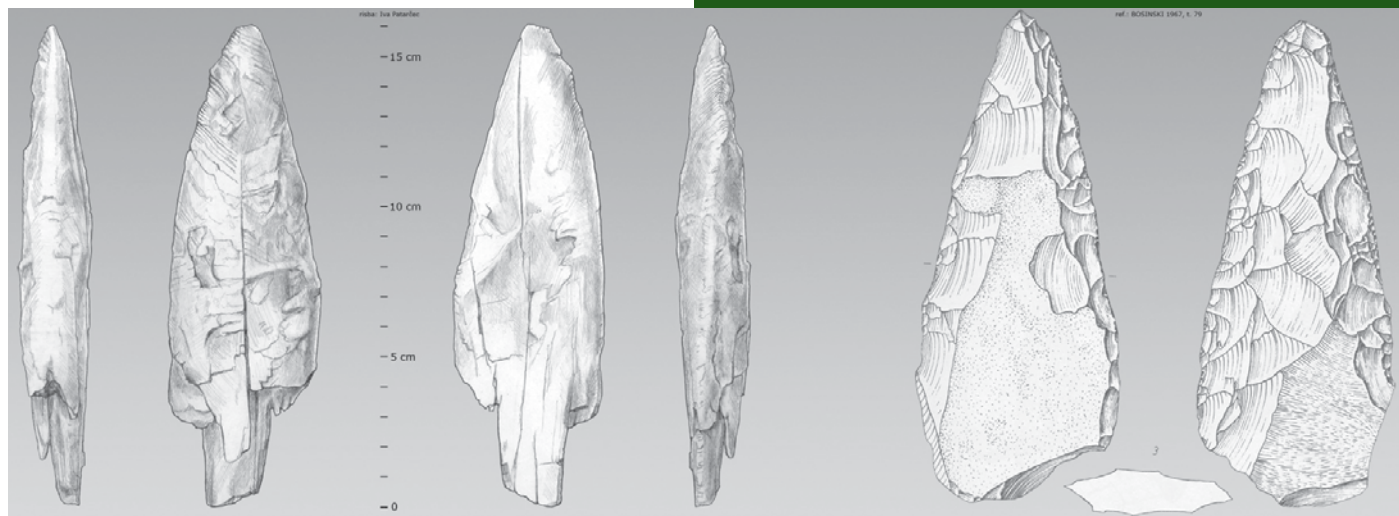


3. Tloris najdb / Map of finds (author: M. Erič)

Also documented on the left bank of the Ljubljanica and along the main road (via publica) between Aquileia and Emona, was evidence of Roman architecture and various activities-along the river we can expect port infrastructure and other evidence related to transport and navigation. Also found in the area were finds (objects of bone and horn, stone axes, ceramic ware) that bear witness to a prehistoric settlement, most likely from the Copper Age. From the early Iron Age there are iron spearheads and a winged bronze belt buckle. The port infrastructure alongside Breg on the left bank of the Ljubljanica was used during the Medieval period and

železne sulične osti in bronasta pasna spona z nakazanimi krilci. Vzdlž Brega na levi brežini Ljubljanice je pristaniška infrastruktura delovala tudi v srednjeveškem in novoveškem obdobju, brežina Ljubljanice pa je bila na tem odseku tlakovana. Več mečev, orodje in keramično posodje so bili prepoznani kot srednjeveški.

V tem delu je Ljubljanica široka okoli 25 m, globina vode pa je od 2,5 do 4 m ob povišanih vodostajih. Struga je vrezana v njene lastne naplavine, pod njimi pa v poznopleistocenske in zgodnjeholocenske jezerske sedimente. Dno je pretežno prekrito z obsežnimi peščenimi in muljastimi sipinami. Brežina med ribniki in Ljubljanico je bila, zato da bi se prepreči-



4. Paleolitska lesena konica / Palaeolithic wooden point (author: I. Patarčec, ARHOS)

the early Post-Medieval. The banks of the Ljubljanica were paved at the time. Several swords, tools and pieces of ceramic ware have been identified as Medieval.

lo njeno rušenje, v 20. stoletju večkrat utrjena z lesenimi piloti in grobim kamnitim zasutjem. Ta zaščita se je v zadnjih desetletjih postopoma rušila.

Skupina za podvodno arheologijo Zavoda za varstvo kulturne dediščine Slovenije (ZVKDS) je v okviru zaščitnega



5. Odkritje fibule Aucisse / Discovery of Aucissa fibulae (photo: M. Gasparič, DRM)

At this point the Ljubljanica is about 25 metres wide, its depth ranges from 2.5 to 4 metres at high water levels. The riverbed is carved into river alluvium, and beneath it into late Pleistocene and early Holocene lake sediment. The bottom is for the most part covered by large sandbanks and silt banks. In the 20th century the embankment between the fish farm and the Ljubljanica was often fortified by wooden piles and backfilled with coarse stone with the purpose of preventing its collapse. This protection has gradually collapsed over the past few decades.

In the frame of rescue operations in 2008 during maintenance work-the consolidation of the right embankment-the Underwater Archaeology Group (SPA) of the Institute for the Protection of Cultural Heritage of Slovenia (ZVKDS) conducted underwater surveys of about 200 metres of the riverbed of the Ljubljanica River alongside the fish farm ponds.³ During the survey about 1,500 objects were discovered in 44 quadrants:



7. Železna pogača (ingot) / Iron bar (ingot) (photo: M. Gasparič, DRM)

for the most part sherds of prehistoric, Roman, Medieval and early Post-Medieval pottery and construction material. A particularly interesting find was an Aucissa fibula, an approximately 10 kg chronologically undetermined iron ingot and

³ Erič, Gaspari 2009. / Erič, Gaspari 2009.

⁴ Gaspari, Erič, Odar 2011, 2012. / Gaspari, Erič, Odar 2011, 2012.

⁵ Documentation report: Erič 2009, Erič, Gaspari 2009; first publication: Gaspari, Erič 2012. / Poročilo o evidentiranju: Erič 2009, Erič, Gaspari 2009; prva objava: Gaspari, Erič 2012.

posega pred vzdrževalnimi deli - utrjevanjem desne brežine - septembra 2008 opravila podvodne terenske preglede okoli 200 m struge Ljubljanice ob ribnikih.³ V 44 kvadrantih je bilo med pregledi odkritih okoli 1500 predmetov, pretežno keramičnih odlomkov prazgodovinskega, rimskega, srednjeveškega in novoveškega posodja in gradbenega materiala. Posebej zanimiva so bila odkritja fibule Aucisse, okoli 10 kg težke, časovno neopredeljene železne pogače (ingot) ter paleolitske lesene konice, dela lovskega orožja človeka, ki je živel pred približno 45.000 leti.⁴

Med zaščitnimi pregledi leta 2008 je skupina na skrajnem vzhodnem delu pregledanega območja ob kvadrantih 35 in 36 na globini 2,5 m (284,11 m nm. v.) odkrila tudi lesene dele plovila z levo in desno bočno čolnico, ravnim dnom, sestavljenim iz petih opaženih talnih platic, in železnimi spojkami.⁵

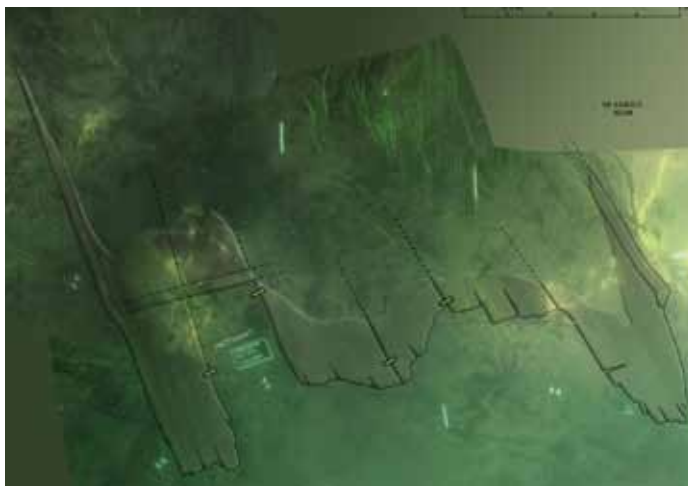


6. Železne spojke in žblji / Iron cramps and nails (photo: M. Gasparič, DRM)

Ostanki plovila so bili prekriti z aktivnim dinamičnim sedimentom dnevne migracije, ležijo pa vodoravno in pod kotom segajo pod desno brežino. V neposredni bližini plovila je bila odkrita tudi večja količina prosto ležečih železnih spojk in kovanih žbljev.

Vzorca lesa talne platice sta bila poslana v analizo z radiometrično metodo AMS ¹⁴C. Prva datacija je bila opravljena v Beta Analytic Inc. v Miamiu, analiza pa je pokazala starost 2040 ± 40 BP (Beta-249390). Druga, ponovljena datacija lesa iz istega vzorca, opravljena v laboratoriju Radiocarbon Accelerator Unit Univerze v Oxfordu, pa je pokazala starost 2143 ± 26 BP (OxA-19598). Na podlagi širine in datacij plovila je bilo mogoče oceniti, da gre za 12 do 15 m dolgo plovilo iz časa zgodnjega principata, najverjetneje iz zadnjih desetletij pred našim štetjem ali prvih desetletij našega štetja.

Maja 2009 je bilo opravljeno prvo evidentiranje. Dokumentirana širina odkritega dela plovila z ravnim dnom in skoraj navpičnima bokoma znaša 2,35 m. Osrednji del dna sestavljajo štiri platice iz lesa, ki domnevno pripada iglavcem. Njihova širina znaša od 20 do 30 cm, debelina pa do 6 cm. Talne platice so prečno spete z železnimi trakastimi spojkami s pravokotno zavrtimi konci, zabiti v robne površine platic. Spojki, ki sta bili dokumentirani na stiku med platicama 1 in 2, ležita okoli 30 cm narazen. Izvedba stikov med platicami v posameznih vzdolžnih pasovih ni bila ugotovljena, prav tako ne način tesnjenja. Prehod v boke tvorita t. i. čolnici, iz enega kosa



8. Fotokica raziskav iz 2009 leta / Photosketch of research in 2009 (photo: R. Kovačič, DRM; photosketch: M. Erič)

Palaeolithic wooden points-part of the hunting gear of a man who lived about 45.000 years ago.⁴

During the rescue survey of 2008 the Group discovered wooden chine-girder sections of a vessel from the left and right side, a flat bottom made of bottom planks and iron cramps at the far eastern section of the surveyed area, along quadrants 35 and 36 at a depth of 2.5 metres (284.11 m.a.s.l.).⁵ The remains of the vessel were covered by active dynamic sedimentation of daily migration and lie horizontally and reach under the right embankment at an angle. A large quantity of free-lying iron cramps and forged iron nails were discovered in the immediate vicinity of the vessel.

Two samples of the bottom planks were sent for analysis using the ¹⁴C AMS radiometric method. The first dating was determined at Beta Analytic Inc. in Miami yielding an age of 2040 ± 40 BP (Beta-249390). A second, repeated dating of the wood



9. Leseni deli plovila / Wooden parts of a vessel (photo: R. Kovačič, DRM)

from the same sample, conducted at the laboratory of the Radiocarbon Accelerator Unit of the University of Oxford, yielded an age of 2143 ± 26 BP (OxA-19598). Given the width of the vessel and the dating it is possible to postulate that this was a 12 to 15 metre long vessel from the period of the early principate, most likely from the last decades before our era and the first decades of our era.

The first documenting was conducted in May of 2009. The documented width of the exposed section of the flat-bottomed

lesa tesana kotna elementa z debelino 6-9 cm. Talni del čolnic meri v širino okoli 20 cm, izmerjena oziroma ohranjena višina pa do 40 cm. Kot med talnim in bočnim delom čolnice znaša vsaj 80°. Dodatne bočne platice niso bile dokumentirane. Ostanke ogrodja so na razmeroma kratkem (< 1 m) razkrite delu plovila dokumentirani le s sledjo nekaj centimetrov širokega prečnega elementa, ki je domnevno segal čez celotno širino dna.

Odkriti ostanke plovila so bili zaradi kasnejših posegov pri urejanju desne brežine močno izpostavljeni, zaradi nepredvidljivega erozijskega delovanja sedimentov, močnega vpliva hidroloških razmer ter delovanja vodnega toka Ljubljanice pa zelo ogroženi. Na pobudo ZVKDS je oktobra 2012 Ministrstvo za izobraževanje, znanost, kulturo in šport RS namenilo interventna sredstva za dokumentiranje plovila in premestitev ostankov v novonastajajoči državni depozitorij za mokri les. Sestavljena je bila mednarodna skupina strokovnjakov, v kateri so poleg domačih specialistov sodelovali tudi podvodni arheologi in konservatorji-restavratorji, specialisti za mokri les iz Mednarodnog centra za podvodnu arheologiju iz Zadra, delujočega v okviru UNESCO-a, ter konservatorji iz Konzervatorskog odjela u Puli za področje Istarske županije Uprave za zaščito kulturne baštine Ministarstva kulture RH. Strokovnjaki Mestnega muzeja Ljubljana, skrbnika in upravitelja depozitorija za mokri les, so poskrbeli za vzpostavitev podvodne infrastrukture v ribnikih, sodelavci Oddelka za računalniški vid Fakultete za računalništvo Univerze v Ljubljani pa za nove metodološke prakse. Dokumentiranje plovila in priprava opekarniških ribnikov za vzpostavitev državnega depozitorija za mokri les RS na Verdu sta potekala v oktobru 2012.

Na podlagi znanih podatkov in pričakovanja, da je ohranjenih delov plovila do 4 m, je bilo načrtovano dvotedensko delo; v tem času bi ostanke dokumentirali, pobrali iz najdišča, vsak del trirazsežno posneli ter les namestili v državni depozitorij za mokri les v bližnjih ribnikih.

V 23 delovnih dnevih je 11 članov skupine opravilo okoli 190 ur potopov za dokumentiranje plovila in pripravo potopljene infrastrukture depozitorija za mokri les. Delo v Ljubljani je bilo zaradi padavin in močno povečanega pretoka⁶ za štiri delovne dni prekinjeno, v tem času pa se je pospešila priprava depozitorija v ribnikih.

Plovilo brez tovora ali predmetov, ki bi jih bilo mogoče prepoznati kot dodatni ladijski inventar, je bila očiščena aktivnega recentnega sedimenta samo v dolžini približno 4,5 m, kar je ob strmo vzpenjajoči se brežini potapljačem še omogočalo varno delo. Ob levem boku plovila je, glede na daljšo stranico kota vstopa v sedimente pod brežino, bilo mogoče čolnici slediti še približno 3 m. Na podlagi novih podatkov in ugotovljene lege plovila v sedimentih desne brežine Ljubljanice sklepamo, da bi lahko bilo ohranjeno še vsaj 10 do 12 m plovila.

Ker je ohranjenega precej več plovila, kot je bilo pričakovano, je prvotni načrt, da se ostanke premestijo v depozitorij za mokri les, spremenjen. Odločeno je bilo, da se odkriti deli dokumentirajo, da pa se plovilo ne bi uničilo, bo zaščiteno in situ.

Odkritje ostalin v Sinji Gorici je širše regionalno pomembno



10. Dokumentiranje plovila oktobra 2012 / Documentation of a vessel in October 2012 (photo: R. Kovačič, DRM)

vessel with almost vertical sides is 2.35 metres. The central section of the bottom consists of four wooden planks, most likely of coniferous wood. Their width ranges from 20 to 30 cm, with a thickness of 6 cm. The bottom planks were fastened to the vertically overlapping ends with iron cramps hammered into the edges of the planks. The iron cramps that were documented at the joints between bottom planks 1 and 2 are set 30 cm apart. The means by which the planks were jointed along individual lengthwise bands was not established, nor the method of caulking. The transitions to the sides are done by chine-girders, corner elements carved from a single piece of wood with a thickness of from 6 to 9 cm. The floor sections of the chine-girders are about 20 cm in width with a measured, i.e. preserved height of up to 40 cm. The angle between the floor and lateral section of the chine-girder is at least 80°. Additional side planks were not documented. The remains of frames were documented on the relatively short (<1 m) exposed section of the vessel only as a trace of a several centimetre wide transverse element that likely stretched across the entire width of the bottom.

The discovered remains of the vessel were, as a result of subsequent interventions during the amelioration of the right bank, very exposed to various effects, and very threatened as a result of the unforeseen erosion of sediment and the strong effects of the hydrological situation and the flow of water in the Ljubljana River. In October of 2012, at the initiative of ZVKDS,

iz več razlogov. Na podlagi konstrukcijskih lastnosti in mer plovila lahko umestimo v skupino rimskih tovornih plovil z ravnim dnom, poševno dvigajočima se premcem in krmo ter navpičnimi ali strmimi boki za plovbo po rekah in jezerih v širšem zaledju severnega Jadrana in osrednje Evrope.⁷ Plovilo je po obliki zelo podobna skoraj sočasni, predvidoma dvakrat večji rimski tovorni ladji iz Lip.⁸ Pomembna razlika med njima je, da je ladja iz Lip zgrajena s tehniko šivanja, plovilo iz Sinje Gorice pa s tehniko spajanja z železnimi spojkami. Spojke so med seboj oddaljene pribl. 30 cm. Dna plovila med dokumentiranjem ni bilo mogoče opazovati, nekateri indici pa vendarle kažejo, da je Plovilo z železnimi spojkami speta tudi na zunanji strani, pri čemer so spojke razporejene križno na tiste v notranjem delu.

Druga pomembna posebnost je tehnika spajanja reber s čolnicami. Na odkriti površini plovila sta bili opaženi samo dve rebri, med seboj oddaljeni okoli 1,7 m. Kljub natančnemu pregledu talnih platic in čolnic ni bilo mogoče opaziti nobenih drugih sledi (lukenj, utorov in drugih sledi obdelave ter sledi žeblice, peres ali moznikov), ki bi dovoljevale sklep, da so bila rebra še v času propadanja ob brežini odstranjena. Rebri (pribl. M: 7 x 7 x 250 cm) spajata čolnici tako, da sta slednji kvadratno izdolbeni, skozi pa segata rebri na zunanjo stran čolnic. Kvadratna oblika izdolbene luknje in rebri, ki legata vanjo, omogočata togo pozicijo in stabilno povezavo. V talne platice (deb. pribl. 6 cm) je prečno v smeri rebra izdolben do 3 cm globok utor, v katerega lega rebro.

⁶ V času raziskav je bil povprečen pretok od 3,5 do 4 m³, po deževju se je pretok povečal na 12 m³, gladina vode se je dvignila za več kot 1,5 m. Podatki <http://www.arso.gov.si/vode/podatki/amp/>. / During the research period the average rate of flow was 3.5 to 4 m³, which increased after the rainfall to 12 m³, with the water level rising by over 1.5 m. Data from <http://www.arso.gov.si/vode/podatki/amp/>.

⁷ Bockius 2000, 2002; Gaspari, Erič 2012. / Bockius 2000, 2002; Gaspari, Erič 2012.

⁸ Müllner 1892; Gaspari 1998, 2009; ladji sta bili v uporabi v 1. stoletju pr. n. š., Plovilo iz Sinje Gorice pa morda še v 1. stoletju n. š. / Müllner 1892; Gaspari 1998, 2009; these vessels were used in the 1st century BC., the vessel at Sinja Gorica perhaps up to the 1st century AD.



11. Del plovila / Part of a vessel (photo: R. Kovačič, DRM)

the Ministry of Education, Science and Sport earmarked intervention funds to document the vessel and to transfer the remains to the nascent national depository of waterlogged wood. An international team of experts was formed in which domestic experts were joined by underwater archaeologists and conservator-restorers-waterlogged wood experts—from the International Centre for Underwater Archaeology in Zadar (operating in the frame of UNESCO), and conservators from the Istria County Conservation Department in Pula of the Croatian Ministry of Culture's Directorate for the Protection of Cultural Heritage. Experts from the Museum of Ljubljana, the administrator and director of the waterlogged wood depository, saw to the establishing of underwater infrastructure at the fish farm ponds, while professionals with the department of computer and information science of the University of Ljubljana's Faculty of Computer and Information Science covered new methodological practice. The documentation of the vessel and preparations at the fish farm to establish the Slovenian national depository for waterlogged wood at Verd took place in October of 2012.

Four work weeks were scheduled based on the available data and the expectation that parts of the vessel were preserved to a height of 4 metres: in this period we would document and collect the remains, create three dimensional documentation for each section and place the wood in the national waterlogged wood depository in the nearby fish farm ponds.

Over a period of twenty-three work days eleven members of the group conducted about 190 hours of diving with the purpose of documenting the vessel and preparing the infrastructure at the waterlogged wood depository. Work in the Ljubljanica River was halted for four days as a result of precipitation and a very elevated flow of water⁶ during which time preparations for the depository in the fish farm ponds was accelerated. The vessel without cargo or objects that could be identified as ship's inventory was cleaned of recent sedimentation only

Tesnjenje med platicami je bilo izvedeno s tesnilom iz rastlinskih vlaken. Tokrat odkriti deli plovila pokažejo, da je ohranjeni bočni del čolnice visok pribl. 40 cm, nanjo pa nalega najmanj 20 cm visoka bočna platica. Na čolnico je pripeša z železnimi spojki in zelo verjetno ojačana s stranskimi tramiči, na katere je bila bočna platica pribita z žebli. Na odkriti dolžini plovila sta bila najdena samo dva tramiča (ohranjena dolžina pribl. 30 cm), med seboj oddaljena največ 15 cm. Njuna funkcija ni povsem jasna, zdi pa se, da sta bila del krmilnega mehanizma. Zaradi zelo občutljivega in krhkega ohranjenega boka (čolnica in bočna platica) sediment iz notranje in zunanje strani ni bil v celoti odstranjen. Tako tudi med tokratnim dokumentiranjem ni bilo mogoče zaznati drugih konstrukcijskih podrobnosti (na primer medsebojnega spajanja platic s peresi in utori ter drugih). Plovilo z zgoraj opisano ali njej podobno tehniko gradnje doslej arheološko še ni bilo raziskano in objavljeno v literaturi.

Pri odstranjevanju peščene sipine in mulja je bilo ugotovljeno, da je bilo plovilo ob ohranjenem boku prekrito s sedimentom z velikim deležem organskih ostalin, pretežno ostankov vejevja, koščkov lesa in črne organske prepereline. Hkrati se je po premisleku o legi plovila ob brežini ponudila razlaga o vzroku za njegovo potopitev. Plovilo je, morda celo desetletja, služilo svojemu namenu za prevoz tovora med Navportom in Emono. Ko je bilo dotrajano in neuporabno, so ga privezali ob brežino v delu struge, kjer ni motilo ostalega tovarnega prometa. Območje, ki leži približno 400 m nizvodno od okljuka Ljubljance z utrjeno naselbino in skladišči na Dolgih njivah, je videti zelo primerno za umik dotrajanih plovil, saj Ljubljana v tem delu naredi najprej rahel ovinek v levo, v nadaljevanju pa močnejšega v desno proti vzhodu, plovba večjih plovil pa se zdi verjetnejša ob levem bregu Ljubljance. Plovilo je po zapustitvi, ko je bilo izpostavljeno neugodnim vremenskim razmeram, postopoma propadalo več let, verjetneje celo več desetletij. Na njem so se nabirale polomljene veje in listje. Zdi se, da jo je že zelo propadlo in poškodovano ob dno Ljubljance pritisnil erozijsko odlomljeni del brežine.

Plovilo je bilo po opravljenih delih zaščiteno s tanko plastjomalja in sipin, prekrita z razgradljivimi protipoplavnimi mrežami iz jute ter obloženo z vrečami s peskom, z upanjem, da jo bo mogoče v bližnji prihodnosti raziskati v celoti.

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to a length of 4.5 metres, the amount the steep river bank allows for safe working conditions for divers. To the left of the vessel it is possible, given the longer length of the angle of entry into the sediment under the slope, to follow the chine-girder to a length of 3 metres. Based on new data and the identified position of the vessel in the sediment of the right bank of the Ljubljanica, we postulated that at least a further 10 to 12 metres of the vessel was preserved.

As more of the vessel than was expected was preserved, the initial plan to transfer the remains to the waterlogged wood depository was altered. It was decided that the exposed section of the vessel be documented and that it would be protected in situ to avoid destroying the vessel.

The discovery of the remains at Sinja Gorica is significant for the broader region for several reasons. Based on the construction characteristics and the dimensions of the vessel we can place it in the group of flat-bottomed Roman barges, with slanted entry prow and stern, and having vertical or steep sides, used for the navigation of rivers and lakes in the broader hinterland of the northern Adriatic and central Europe.⁷ The form of the vessel is similar to the almost contemporary, twice as large Roman barge from Lipe.⁸ The key difference between the two vessels is that the barge from Lipe was constructed using sewing techniques, while the barge from Sinja Gorica is built using fastening techniques with iron cramps. The iron cramps are set at intervals of about 30 cm. The bottom of the vessel could not be observed while under survey, but there are indications that the vessel is also fastened with iron cramps from the outside, and that the cramps are set crosswise to those in the interior of the vessel.

Another key characteristic is the technique of joining the ribs to the chine-girder. On the exposed surface of the vessel only two floor timbers are visible, set about 1.7 metres apart. A detailed inspection of the floor timbers and chine-girder did not reveal any other traces of processing (holes, grooves and other traces of processing and traces of nails, pins or treenails) that would allow for a conclusion that the knees or floor timbers were removed from the bank even during their decay. Two floor timbers (approx. M: 7 x 7 x 250 cm) join the chine-girder, such that the latter is hollowed out square, through which the ribs extend to the outer side of the chine-girder. The square shape of the gouged holes and the floor timbers set into them allow for a firm positioning and stable bond. A groove of up to 3 cm depth is gouged into the bottom planks (about 6 cm thick) transverse to the orientation of the floor timbers into which the timbers are set.

The sealing between the planks was done with caulking of plant fibres. This time the exposed parts of the vessel indicated that the preserved lateral chine-girder has a height of about 40 cm, and that a side plank at least 20 cm high lies on it. It is fastened to the chine-girder with iron cramps and likely reinforced with side timbers to which a side plank was fastened with iron cramps. Only two timbers (with a preserved length of about 30 cm) were found on the exposed length of the vessel, set at most 15 cm apart. Their function is not entirely clear, but it appears that they were part of the steering mechanism. Because of the very sensitive and fragile state of the preserved sides (chine-girder and side plank) the sediment was not entirely removed from the inside and



12. Dokumentiranje plovila oktobra 2012 / Documentation of a vessel in October 2012 (photo: R. Kovačič, DRM)

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Gaspari, A., Erič, M., Odar, B. 2011 - A Palaeolithic wooden

outside. During this year's documenting, therefore, we were unable to discover other construction details (such as the joining of the planks with pins and grooves and other aspects). Vessels built in the above described or a similar technique have not yet been archaeologically researched and published in literature.

During the removal of silt and sandbanks it was established that the vessel was covered on the preserved side with sediment containing a high proportion of organic remains, for the most part the remains of branches, pieces of wood and black decayed organic material. At the same time, upon considering the position of the vessel along the riverbank, a possible explanation of the cause of its sinking emerged. The vessel was likely used to transport cargo between Nauportus and Emona, perhaps for decades. When it became dilapidated and useless, it was tied off at the riverbank at a part of the river channel in which it did not hamper traffic. The area, about 400 metres downstream from the bend of the Ljubljanica where the existence of a settlement and storage facilities at Dolge Njive has been established, appears very suitable for obsolete vessels, as the Ljubljanica River first gently bends to the left and then more abruptly to the right and the navigation of large vessels seems more likely along the left bank. Once abandoned the vessel was subject to unfavourable climatic conditions and gradually decayed over a period of several years, likely even decades, during which time broken branches and leaves accumulated on it. It appears that it was, already quite damaged, pushed to the bottom of the Ljubljanica by a section of the riverbank that collapsed as the result of erosion.

After the work was conducted the vessel was protected with a thin layer of silt and alluvium, covered in degradable jute netting and surrounded with sandbags in the hope that it will be completely investigated in the near future.

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13. Čiščenje aktivnega recentnega sedimenta / Cleaning of recent sediment (photo: R. Kovačič, DRM)





Hercules plovi uz Konavle / Hercules sails along Konavle (photo: L. Bekic)





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