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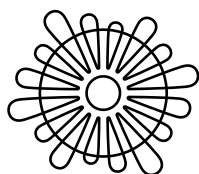
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B. Marijanović

Osamnaesti svezak časopisa *Archaeologia Adriatica* posvećen je profesoru emeritusu Brunislavu Marijanoviću u znak zahvalnosti za sve što je učinio za Odjel za arheologiju, Sveučilište u Zadru i arheologiju općenito.

The eighteenth volume of the journal *Archaeologia Adriatica* is dedicated to professor emeritus Brunislav Marijanović, as an expression of gratitude for everything he has done for the Department of Archaeology, University of Zadar and archaeology in general.

TRAGOVI MASLINARSTVA U PRAPOVIJESTI ISTOČNOG JADRANA

TRACES OF OLIVE CULTIVATION IN THE PREHISTORIC EASTERN ADRIATIC

MATE PARICA

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Korčula, Ričul, Vranjic,
Nadin

U radu se objavljuju primjeri ostataka ploda maslina iz prapovijesnog vremena na istočnoj obali Jadrana, počevši od neolitika pa sve do željeznog doba. Fizički ostatci koštica masline pronađeni su na četirima prapovijesnim lokalitetima, od kojih se tri danas nalaze ispod morske razine. Najranija poznata pojava masline zabilježena je u neolitiku, dok je početak kultivacije masline na našoj obali dokazan u vrijeme oko 1400 godina prije Krista na nalazištu Turanj – Ričul.

KEY WORDS:

olive (*Olea europaea*),
Croatia, Soline –
Korčula, Ričul, Vranjic,
Nadin

The paper presents examples of prehistoric olive fruit remains on the eastern Adriatic coast, from the Neolithic to the Iron Age. Physical remains of olive stones were unearthed at four prehistoric sites, three of which are now below sea level. The earliest known occurrence of olives is recorded in the Neolithic, while the beginning of olive cultivation on our coast has been proved to date to around 1400 BC, at the Turanj – Ričul site.

UVOD

Tradicijski se početak uzgoja masline na istočnom Jadranu povezuje s dolaskom Grka, odnosno s osnivanjem kolonija *Issa* i *Pharos* u 4. stoljeću prije Krista. U stručnoj i znanstvenoj literaturi ova teza provlači se odavno i teško je uopće pronaći izvor informacije koja se poslije uzimala kao sigurna činjenica. U novijim istraživanjima, a najčešće je riječ o podvodnim arheološkim istraživanjima, na više lokaliteta pronađeno je više fizičkih ostataka maslinova ploda koji sežu u dublju prapovijest. Cilj rada je uputiti na znatno ranije korištenje masline na istočnoj obali Jadrana nego što se do sada smatralo.

Poznavanje prapovijesnog korištenja masline na Mediteranu je znatno bolje. Najstariji primjer tragova drveta divlje masline jest pronalazak vatrišta starog 790 000 godina na lokalitetu Gesher Benot Ya'aqov u Izraelu.¹ Na obali Maroka dokazano je korištenje divlje masline prije 100 000 godina, od ranijeg *Homo sapiens*a, i to kao ogrjevnog drva, a moguće i kao hrane.² Ostatci divljih maslina korištenih za prehranu pronađeni su u paleolitičkim slojevima na brojnim nalazištima diljem Mediterana,³ što potvrđuje teze o izvornoj mediteranskoj biljci, ali otvara novu problematiku različitih izvorišta najranijih maslina.⁴ Početak kultivacije masline, kao i većine ostalih kultura, dogodio se u vrijeme neolitika, a posebno su važna potopljena neolitička naselja na Karmelskoj obali,⁵ te u dolini rijeke Jordana u Izraelu.⁶ Val neolitizacije širi se Mediteranom prema sjeveru, a time i nova dostignuća povezana s domestikacijom životinja i biljaka. Iznimno važna znanstvena istraživanja koja pokazuju vrijeme i pravce širenja kultivacije pitome masline obavila je

¹ GOREN-INBAR et al. 2004.

² MARQUER et al. 2022.

³ CARRIÓN, NTINOU, BADAL 2010: 955 gdje je tablično prikazan velik broj lokaliteta s datacijom i literaturom.

⁴ BESNARD, BERVILLÉA 2000.

⁵ GALILI 1997; GALILI et al. 2018.

⁶ LANGGUT, GARFINKEL 2022; LANGGUT 2024.

INTRODUCTION

Traditionally, the beginning of olive cultivation on the eastern Adriatic coast has been associated with the arrival of the Greeks, specifically to the establishment of the colonies *Issa* and *Pharos* in the 4th century BC. This assumption has long been present in professional and scientific literature, to the point where it is difficult to trace the original source of this information, which over time became accepted as a definitive fact. Recent research, often in the context of underwater archaeological investigations, has uncovered physical remains of olive fruits at several sites dating back to deeper prehistory. The aim of this paper is to highlight the significantly earlier use than previously believed of olives on the eastern Adriatic coast.

Our understanding of the prehistoric use of olives in the Mediterranean is considerably more developed. The earliest evidence of wild olive wood use is the discovery of a 790,000-year-old fireplace at the Gesher Benot Ya'aqov site in Israel.¹ On the coast of Morocco, the use of wild olive 100,000 years ago by early *Homo sapiens*, primarily as firewood and possibly as a source of food, has been proved.² Remains of wild olives used for food have been found in Palaeolithic layers at numerous sites across the Mediterranean,³ confirming theories about it being a native Mediterranean plant but also raising new questions about the diverse origins of the earliest olives.⁴ The beginnings of olive cultivation, like most crops, occurred during the Neolithic period. Of particularly importance are, in Israel, the submerged Neolithic settlements on the Carmel coast⁵ and those in the Jordan River Valley.⁶ The wave of Neolithisation spread across the Mediterranean northwards, bringing with it new advances related to the domestication of animals

¹ GOREN-INBAR et al. 2004.

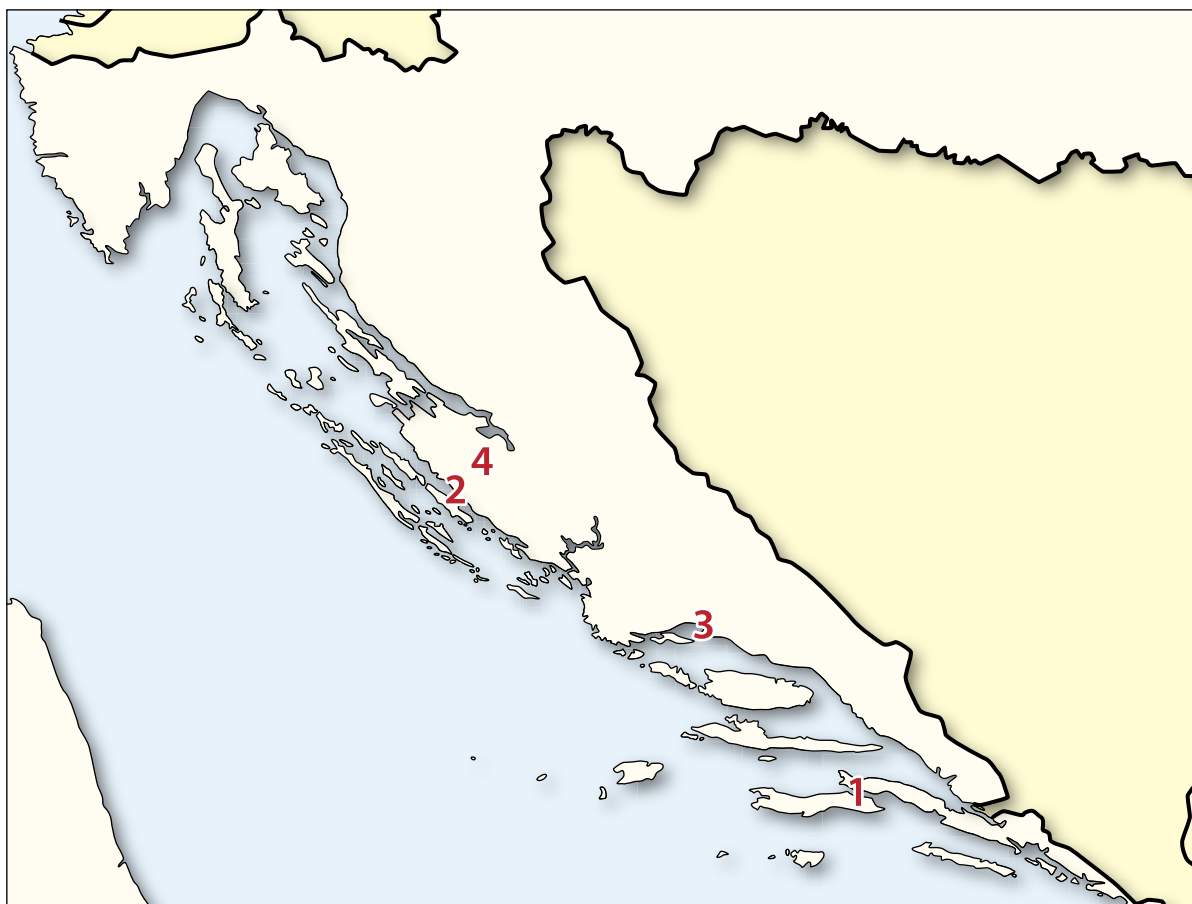
² MARQUER et al. 2022.

³ CARRIÓN, NTINOU, BADAL 2010: 955; a large number of sites, with dates and literature, are shown in the table.

⁴ BESNARD, BERVILLÉA 2000.

⁵ GALILI 1997; GALILI et al. 2018.

⁶ LANGGUT, GARFINKEL 2022; LANGGUT 2024.



KARTA 1. *Smještaj nalazišta na istočnom Jadranu: 1 – Rt Soline – Korčula, 2 – Turanj – Ričul, 3 – Vranjic, 4 – Nadin (izradio: M. Parica; izvor podloge: Reference map Demis Mapper)*

MAP 1 *Location of sites on the eastern Adriatic: 1 – Cape Soline – Korčula, 2 – Turanj – Ričul, 3 – Vranjic, 4 – Nadin (made by M. Parica; source of base map: Reference map Demis Mapper)*

D. Langgut i suradnici.⁷ Geološkim bušenjima u datiranim slojevima najčešće močvarnog okruženja, te analizom peludi, uspjeli su napraviti kartu širenja kultivacije masline.⁸ Navedena rekonstrukcija širenja kultivacije masline važna je za usporedbu s nalazima ostataka maslina na istočnom Jadranu, prije svega u odnosu na brojnost pronađenih maslina tijekom arheoloških istraživanja. U ovom će radu biti spomenuti ostatci masline pronađeni u istraživanjima na istočnoj obali Jadrana koji imaju jasan kronološki kontekst, od kronološki najstarijih prema najmlađim primjercima (Karta 1).

and plants. Extremely important scientific research, demonstrating the period and direction of the spread of olive cultivation, has been conducted by D. Langgut and associates.⁷ Through geological drilling in dated layers (most often in marshy environments) and pollen analysis, they have been able to create a precise map of the spread of olive cultivation.⁸ This reconstruction of the spread of olive cultivation is important for a comparison with eastern Adriatic finds of olive remains, particularly in relation to the abundance of olives recovered in archaeological excavations. This paper mentions olive remains, uncovered in excavations on the eastern Adriatic coast, that have a clear chronological context, from the oldest to the most recent specimens (Map 1).

⁷ LANGGUT et al. 2019; LANGGUT, GARFINKEL 2022.

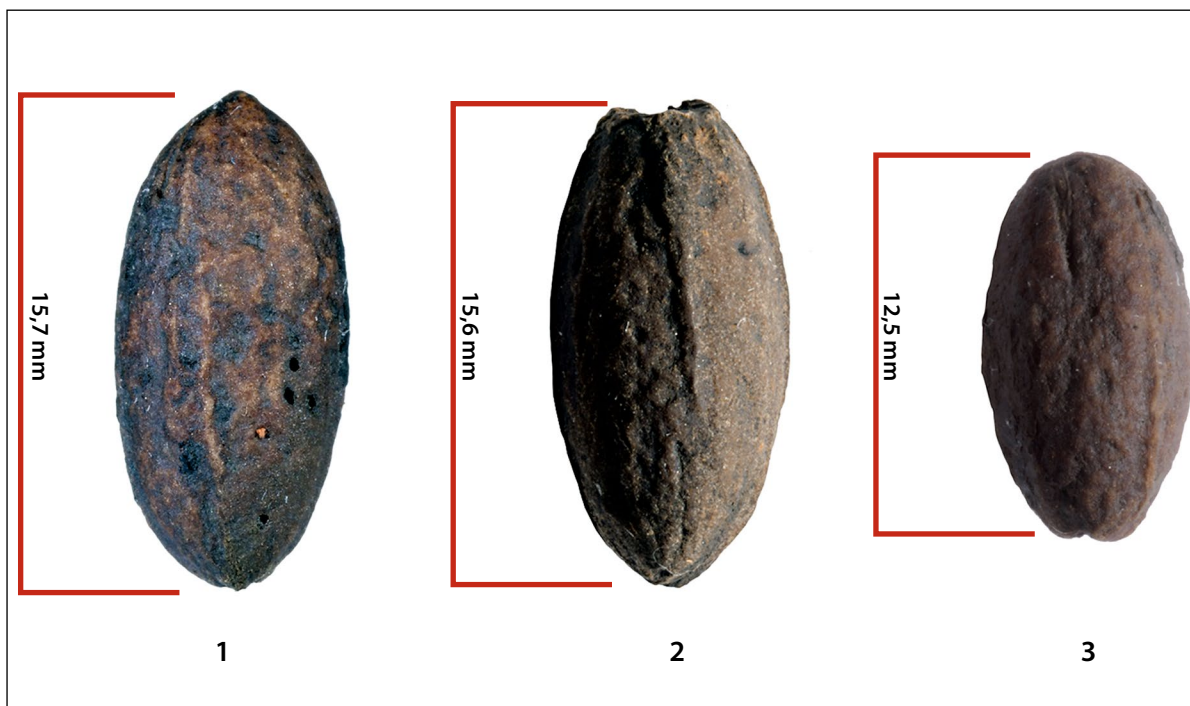
⁸ LANGGUT et al. 2019; LANGGUT, GARFINKEL 2022.

⁷ LANGGUT et al. 2019; LANGGUT, GARFINKEL 2022.

⁸ LANGGUT et al. 2019; LANGGUT, GARFINKEL 2022.



SLIKA 1. Podmorska istraživanja u Solinama na Korčuli (snimio: M. Parica)
FIGURE 1 Underwater investigations in Soline on Korčula (photo by M. Parica)



SLIKA 2. Ostatci maslina iz kasnoneolitičkog lokaliteta Soline (snimio: M. Parica)
FIGURE 2 Olive remains from the Late-Neolithic site of Soline (photo by M. Parica)

Rt Soline – Korčula⁹

Za sada najstariji ostatak masline na istočnom Jadranu (*Olea europaea*) odnosi se na nalaz triju koštica masline iz potopljenoga neolitičkog naselja Solina na otoku Korčuli (sl. 2). Na ovom lokalitetu sistematska istraživanja još traju, riječ je o jednoslojnome kasnoneolitičkom naselju hvarske kulture.¹⁰ Naselje je formirano na umjetno sagrađenoj obali oblika sedmerokuta, te je popločanom cestom spojeno s obalom otoka Korčule. Ostaci naselja nalaze se na od 4 do 5 metara dubine ispod današnje morske razine. Pri istraživanju slojeva unutar naselja (sl. 1), osim uobičajenih kasnoneolitičkih artefakata, preliminarnim pregledom pronađena je i veća količina bioarheološkog materijala. Među svim tim ostacima izdvojene su i tri koštice masline. One su pronađene unutar slojeva nataloženih u jednom segmentu unutar obalnog zida na sjeverozapadnom dijelu naselja. Sloj je bio sastavljen većinom od organskog materijala, međutim, nad slojem su se nalazile kamene ploče, urušene s okolnih neolitičkih suhozidnih konstrukcija. Navedena situacija ide u prilog autentičnosti depozita i nemogućnosti miješanja s nekim recentnijim slojevima. Sloj s čistim organskim materijalom nalazio se dijelom ispod urušenih ploča, a količina iskopanog sedimenta stratigrafske jedinice u kojem su se nalazile koštice maslina iznosi približno 0,8 m³. Jedna koštica (sl. 2/1) poslana je na radiokarbonsku analizu te je dobiven rezultat 90,4 % mogućnosti 4938 – 4778 cal BC.¹¹ Ovaj rezultat odgovara arheološkom materi-

Cape Soline – Korčula⁹

So far, the oldest olive (*Olea europaea*) remains on the eastern Adriatic coast pertain to the find of three olive stones at the submerged Neolithic settlement of Soline on the island of Korčula (Fig. 2). Systematic research is still ongoing at this site, which is a single-layer Late Neolithic settlement of the Hvar culture.¹⁰ The settlement was built on an artificially constructed, heptagonal-shaped shoreline and was connected to the coast of the island of Korčula by a paved road. The settlement remains are located at a depth of 4 to 5 metres below modern-day sea level. During the excavations of the layers within the settlement (Fig. 1), a preliminary survey revealed, in addition to the usual Late Neolithic artefacts, a significant amount of bioarchaeological material. Also identified among all these remains were three olive stones. They were found in layers deposited in one segment within the coastal wall in the northwestern part of the settlement. The layer consisted mostly of organic material; however, it was overlaid by stone slabs that had collapsed from the surrounding Neolithic dry-stone structures. This situation supports the authenticity of the deposits and the impossibility of their having been mixed with any more recent layers. The layer of pure organic material was partly located below the collapsed slabs, and the volume of excavated sediment from the stratigraphic unit containing olive stones was approximately 0.8 m³. One olive stone (Fig. 2/1) was sent for radiocarbon analysis, yielding a result showing a 90.4% probability of 4938–4778 cal BC.¹¹ This result corresponds to the archaeological material, and it matches another radiocarbon date from

⁹ Od prosinca 2023. istraživačke aktivnosti na lokalitetu Soline financirane su iz sredstava projekta: HRZZ IP-2022-10-3893 "Potopljena neolitička nalazišta u podmorju hrvatskog dijela Jadrana / Undersea Neolithic sites in the Croatian Adriatic".

¹⁰ PARICA 2021; PARICA, RADIĆ 2022; PARICA 2022.

¹¹ Beta-661015, Conventional radiocarbon age 5960 ± 30 BP 95,4 % probability 4938 – 4778 cal BC 4755 – 4728 cal BC (6887 – 6727 cal BP) (6704 – 6677 cal BP) 68,2 % probability, 4850 – 4792 cal BC 4897 – 4867 cal BC (6799 – 6741 cal BP) (6846 – 6816 cal BP).

⁹ From December 2023, research activities at the Soline site are financed from the funds of the project: HRZZ IP-2022-10-3893 „Undersea Neolithic site in the Croatian Adriatic“.

¹⁰ PARICA 2021; PARICA, RADIĆ 2022; PARICA 2022.

¹¹ Beta-661015, Conventional radiocarbon age 5960 ± 30 BP 95.4% probability 4938–4778 cal BC 4755–4728 cal BC (6887–6727 cal BP) (6704–6677 cal BP) 68.2% probability, 4850–4792 cal BC 4897–4867 cal BC (6799–6741 cal BP) (6846–6816 cal BP).

jalu i poklapa se s drugim radiokarbonskim datumom s lokaliteta. Iako sediment iz naselja još uvijek nije flotiran, evidentno je da su tri koštice masline iznimno rijetka pojava na lokalitetu, za razliku od brojnih ostataka badema, koje su vjerojatno dokaz kultivacije, te sitnih drvenih grana i iverja. S obzirom na veće količine ukupnoga organskog materijala, u ovom slučaju koštice maslina predstavljaju rijetku pojavu na nalazištu. Je li riječ o importu maslina kao hrane, ili pak o nekom drugom scenariju, za sada je nejasno. Međutim, jasno je da na lokalitetu nema masovnije cirkulacije maslina u vrijeme kasnoneolitičke hvarske kulture.

Turanj – Ričul

Zasad najstariji tragovi masovne pojave koštica maslina nalaze se na potopljenom lokalitetu Turanj – Ričul. Riječ je o poto-

the site. Although the sediment from the settlement has not yet been floated, it is evident that the three olive stones are an exceptionally rare find at the site, in contrast to the numerous remains of almonds (which provide evidence of likely cultivation) as well as small wooden branches and chips. Given the larger quantities of the overall organic material, the olive stones represent an uncommon occurrence at the site. The question remains of whether they were imported as food or were part of another scenario. This remains unclear for now; however, it is evident that there was no significant circulation of olives at the site during the Late Neolithic Hvar culture.

Turanj – Ričul

The oldest known traces to date of a mass occurrence of olive stones have been found at the submerged site of Turanj – Ričul. This is a



SLIKA 3. Lokalitet Ričul iz zraka (snimio: A. Mandić)

FIGURE 3 The Ričul site from the air (photo by A. Mandić)



SLIKA 4. Vidljivi slojevi s maslinama na lokalitetu Ričul (snimio: M. Parica)

FIGURE 4 Visible layers with olives at the Ričul site (photo by M. Parica)

pljenom naselju srednjega brončanog doba, koje je izgrađeno u plitkom moru i nasipavanjem se širila zona naselja (sl. 3). Ovdje se u višegodišnjim podvodnim arheološkim istraživanjima pod vodstvom M. Ilkića pronašlo mnoštvo koštica maslina.¹² Iako su se masline povremeno pronalazile u istraživačkim sondama na prostoru cijelog lokaliteta, iznimno velika koncentracija koštica maslina, trešanja (*Prunus avium*), te drugoga organskog materijala, pronađena je s unutrašnje strane bedema koji je odvajao naselje od kopna. Vidljivo je da je sloj deponiran u plitkom moru između kopna i naselja, te je poslije sačuvan jer se preko depozita širilo naselje i izgrađene su fortifikacije (sl. 4). Stratigrafska jedinica u kojoj je veća koncentracija koštica maslina bila je debljine

now-inundated Middle Bronze Age settlement built in shallow waters, with the settlement area expanding through an embankment (Fig. 3). In the course of several years of underwater archaeological excavations led by M. Ilkić, a large number of olive stones were discovered there.¹² Although olives were occasionally found in exploratory trenches made across the entire site, an exceptionally high concentration of olive and cherry (*Prunus avium*) stones and other organic material was found on the inner side of the rampart that separated the settlement from the mainland. It is evident that the layer was deposited in the shallow waters between the mainland and the settlement and was later preserved as the settlement expanded over the deposit and fortifications were constructed (Fig. 4). The stratigraphic unit with a higher concentration of olive

¹² BRUSIĆ 1977; ČELHAR et al. 2017.

¹² BRUSIĆ 1977; ČELHAR et al. 2017.

oko 20 cm, a sadržavala je još i drvene grane te ostali organski materijal. Nalazila se nad zdravicom koja je u ovom slučaju kompaktni morski šljunak, a u stratigrafskoj jedinici koja je istražena na prostoru 2 m² (okvirno 0,3 m³), pronađeno je oko 300 koštica masline. Sloj je poslije prekriven kamenim urušanjem od arhitekture naselja i fortifikacija. Jedna je radiokarbonska analiza načinjena izravno na koštici masline i dobiveni rezultat obuhvaća vrijeme od 1450. do 1291., 95,4 %, kal. g. pr. Krista,¹³ što odgovara i ostalim radiokarbonskim analizama na nalazištu. Koncentracija koštica masline zajedno s ostalim organskim materijalom sugerira masovniju prisutnost masline na ovom srednjobrončanodobnom lokalitetu.

Vranjic

Godine 2004. započinju građevinski radovi uređenja obalne zone Vranjica koji su rezultirali nizom zaštitnih istraživanja u Vranjicu,¹⁴ a podmorska istraživanja vodila je I. Radić Rossi. Osim pronalazaka antičkih spomenika koji su bili uzidani u kasnije obalne konstrukcije, pronađeni su i bogati prapovijesni slojevi. Na jednom dijelu južne obale dokumentiran je cijeli stratigrafski profil, do 5 metara dubine, a na njemu se mogu vidjeti prapovijesni, antički, te slojevi do srednjeg i novog vijeka.¹⁵ Prapovijesni slojevi sadrže mnoštvo keramičkog i organskog materijala, a serija radiokarbonskih datuma pokazuje kontinuitet od najstarijeg datuma, od 1450.–1310. prije Krista do 575.–485. godine prije Krista, što je najmlađi datum u prapovijesnim slojevima.¹⁶

Iako je riječ o zaštitnim istraživanjima koja

stones was about 20 cm thick and also contained branches and other organic material. It was located above natural substrate, which in this case consisted of compact marine gravel. Approximately 300 olive stones were retrieved from the stratigraphic unit, which was investigated over an area of 2 m² (approximately 0.3 m³). The layer had over time been covered by collapsed stones that were once part of the settlement's structures and fortifications. A radiocarbon analysis was conducted directly on one olive stone, and the obtained result dated it to 1450–1291 cal BC (with a 95.4% probability),¹³ which corresponds with other radiocarbon data from the site. The concentration of olive stones, along with other organic material, suggests a more widespread presence of olives at this Middle Bronze Age site.

Vranjic

In 2004, construction works began on the development of the coastal zone of Vranjic, resulting in a series of protective excavations in the area,¹⁴ with underwater investigations led by I. Radić Rossi. In addition to the discovery of ancient monuments incorporated into later coastal structures, rich prehistoric layers were also uncovered. On one part of the southern coast, the entire stratigraphic profile up to five metres deep was documented, showing layers from prehistoric and ancient times extending to the medieval and modern periods.¹⁵ The prehistoric layers contain a wealth of ceramic and organic material, and a series of radiocarbon dates indicate continuity from the oldest to the most recent date within the prehistoric layers (1450–1310 BC to 575–485 BC).¹⁶

Although these were protective excavations

¹³ Beta-519986, Conventional radiocarbon age 3120 ± 30 BP, 95,4 % probability (95,4 %) 1450 – 1291 cal BC (3399 – 3240 cal BP), 68,2 % probability, (47,5 %) 1432 – 1385 cal BC (3381 – 3334 cal BP), (20,7 %) 1340 – 1316 cal BC (3289 – 3265 cal BP).

¹⁴ RADIĆ ROSSI 2006; 2007; 2008; 2008a; VODIČKA MIHOLJEK 2008; SKELAC, VODIČKA MIHOLJEK 2009.

¹⁵ RADIĆ ROSSI 2011: 302.

¹⁶ RADIĆ ROSSI 2011: 302.

¹³ Beta-519986, Conventional radiocarbon age 3120 ± 30 BP, 95.4% probability (95.4%) 1450–1291 cal BC (3399–3240 cal BP), 68.2% probability, (47.5%) 1432–1385 cal BC (3381–3334 cal BP), (20.7%) 1340–1316 cal BC (3289–3265 cal BP).

¹⁴ RADIĆ ROSSI 2006; 2007; 2008; 2008a; VODIČKA MIHOLJEK 2008; SKELAC, VODIČKA MIHOLJEK 2009.

¹⁵ RADIĆ ROSSI 2011: 302.

¹⁶ RADIĆ ROSSI 2011: 302.



SLIKA 5. Ostatci maslina iz prapovijesnih slojeva Vranjica (snimio: Z. Brusić)

FIGURE 5 Olive remains from the prehistoric layers of Vranjic (photo by Z. Brusić)

su često obavljana istovremeno s građevinskim radovima, na više su mjesta pronađeni očuvani prapovijesni slojevi s grubljom keramikom koja ima dosta široku dataciju, a obuhvaća srednje i kasno brončano doba.¹⁷ U navedenim prapovijesnim slojevima pronalazio se i organski materijal, najčešće koštice. Sudionik zaštitnih istraživanja u Vranjicu tada je bio i Z. Brusić. On je izdvojio ponešto koštica maslina (sl. 5), grožđa (*Vitis vinifera*), trešanja (*Prunus avium*), smokava (*Ficus carica*) i kupina (*Rubus sp.*) iz prapovijesnih slojeva Vranjica, a posebice su vrijedni primjerci koštica maslina koji su izdvojeni iz sloja datiranog radiokarbonskim analizama LTL 1654A, 2909 ± 40 ili 959. godina prije Krista te kraj profila LTL1655A,

often conducted in tandem with construction works, several locations revealed well-preserved prehistoric layers containing coarse ware with a broad dating range encompassing the Middle and Late Bronze Age.¹⁷ Organic material, most commonly fruit stones, was also found in these prehistoric layers. Also participating in the protective excavations in Vranjic at that time was Z. Brusić. He identified several stones of olives (*Olea europaea*) (Fig. 5), grapes (*Vitis vinifera*), cherries (*Prunus avium*), figs (*Ficus carica*), and blackberries (*Rubus sp.*) in the prehistoric layers at Vranjic. Particularly valuable are olive-stone specimens recovered from a layer radiocarbon-dated to LTL 1654A, 2909 ± 40 or 959 BC, and from the end of the profile,

¹⁷ Opširnije o keramici iz Vranjica: ARENA, BARBARIĆ, RADIĆ ROSSI 2019; ARENA et al. 2020.

¹⁷ More extensively on pottery from Vranjic: ARENA, BARBARIĆ, RADIĆ ROSSI 2019; ARENA et al. 2020.

2845 $\pm$ 80 ili 895. god. prije Krista.¹⁸ Iako je datiran sloj sa sigurnim nalazima koštica maslina, masline se pojavljuju i u ostalim slojevima, te je moguće da su neki od njih stariji od navedenog datuma. Zbog zahtjevnih uvjeta u kojima su se ova zaštitna istraživanja odvijala, nije moguće rekonstruirati zapremninu iskopanih stratigrafskih jedinica s bioarheološkim ostatcima, međutim, sudeći prema fotografijama Z. Brusića, riječ je o većoj koncentraciji koštica masline.

Nadin

Nadin je važno naselje s kontinuitetom naseljavanja od prapovijesti do srednjeg i novog vijeka.¹⁹ Od 2015. započinju sustavna istraživanja unutar naselja pod vodstvom M. Čelhar (Sveučilište u Zadru) u suradnji sa Sveučilištem u Maineu, SAD (Gregory Zaro).²⁰ U sklopu arheoloških istraživanja, unutar naseobinskog konteksta datiranog radiokarbonskom metodom u razdoblje starijega željeznog doba, odnosno u vrijeme posljednje četvrtine 9. st. pr. Kr. do sredine 8. st. pr. Krista, pronađena je koštica masline u strukturi veće skladišne posude,²¹ za koju autorice smatraju da je najvjerojatnije lokalne proizvodnje (sl. 6).²² U ovom slučaju valja napomenuti da su uvjeti očuvanja organskog materijala na kopnenim lokalitetima znatno teži, najčešće se sačuvaju karbonizirane sjemenke ili, kao u ovom slučaju, utisnute u svježu glinu.

LTL1655A, 2845 $\pm$ 80 or 895 BC.¹⁸ Although the layer with confirmed finds of olive stones has been dated, olives also appear in other layers, and it is possible that some of these are older than the dates mentioned. Due to the challenging conditions under which these protective excavations were conducted, it has not been possible to reconstruct the volume of the excavated stratigraphic units containing bioarchaeological remains. However, judging by Z. Brusić's photographs, the concentration of olive stones appears to be significant.

Nadin

Nadin was an important ancient town with a continuity of settlement from prehistory to the medieval and modern periods.¹⁹ Since 2015, systematic excavations have been conducted within the settlement under the direction of M. Čelhar (University of Zadar) in collaboration with the University of Maine, USA (Gregory Zaro).²⁰ As part of archaeological excavations within the context of a settlement radiocarbon-dated to the Early Iron Age (specifically to the period from the last quarter of the 9th century BC to the mid-8th century BC), an olive stone was recovered embedded in the structure of a large storage vessel,²¹ which the authors believe was most likely of local production (Fig. 6).²² In this instance, it is important to note that preservation conditions for organic material at terrestrial sites are significantly more challenging. Organic remains are typically preserved as carbonised seeds or, as in this case, imprinted into fresh clay.

¹⁸ BRUSIĆ 2010: 61.

¹⁹ BATOVIĆ, CHAPMAN 1987; BATOVIĆ, BATOVIĆ 2013; KUKOČ, ČELHAR 2019; LOEWEN, NYSTROM, ČELHAR 2021; TOYNE, ČELHAR, NYSTROM 2021; ZARO, GUSAR, ČELHAR 2020; ČELHAR, ZARO 2023; KNEŽIĆ, ŠOŠTARIĆ, ČELHAR, M. 2023.

²⁰ ČELHAR, ZARO 2023.

²¹ KNEŽIĆ, ŠOŠTARIĆ, ČELHAR 2023: 5.

²² KNEŽIĆ, ŠOŠTARIĆ, ČELHAR 2023: 54.

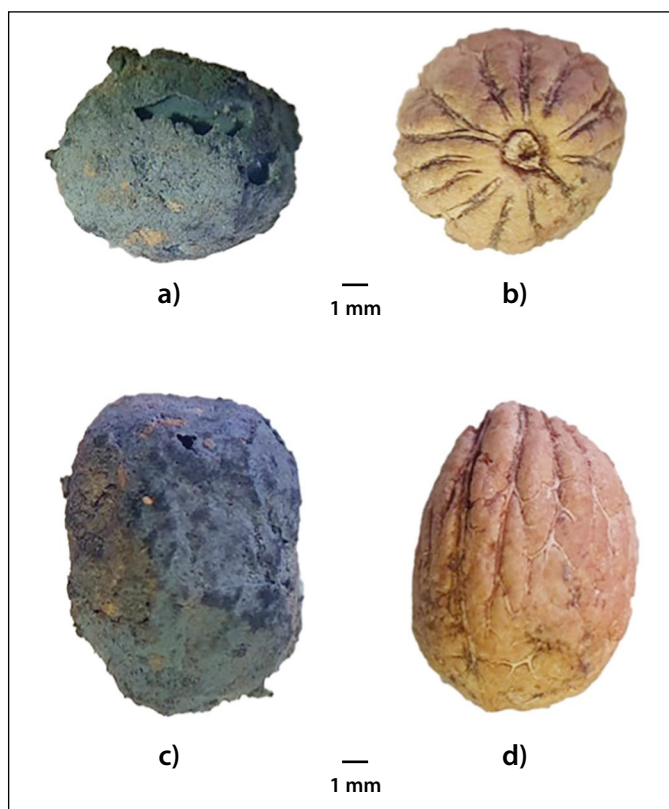
¹⁸ BRUSIĆ 2010, 61.

¹⁹ BATOVIĆ, CHAPMAN 1987; BATOVIĆ, BATOVIĆ 2013; KUKOČ, ČELHAR, 2019; LOEWEN, NYSTROM, ČELHAR, 2021; TOYNE, ČELHAR, NYSTROM, 2021; ZARO, GUSAR, ČELHAR 2020; ČELHAR, ZARO 2023; KNEŽIĆ, ŠOŠTARIĆ, ČELHAR, M. 2023.

²⁰ ČELHAR, ZARO 2023.

²¹ KNEŽIĆ, ŠOŠTARIĆ, ČELHAR 2023: 5.

²² KNEŽIĆ, ŠOŠTARIĆ, ČELHAR 2023: 54.



SLIKA 6. Koštica masline iz stjenke skladišne posude, uzorak 9: a) silikonski odljev otiska gornjeg dijela koštice masline (*Olea europaea*); b) usporedni recentni primjer gornjeg dijela koštice masline; c) silikonski odljev koštice masline s vidljivim zaravnjenim gornjim dijelom i lagano zašiljenim donjim dijelom; d) usporedni primjer recentne koštice masline s blago zašiljenim donjim dijelom (preuzeto iz: Knežić, Šoštarić, Čelhar 2023, snimila: D. Knežić)

FIGURE 6 The olive stone from the wall of the storage vessel, sample 9: a) silicone cast of the upper part of the olive (*Olea europaea*) stone; b) recent specimen of the upper part of an olive stone, for comparison; c) silicone cast of the olive stone showing a flattened upper part and a slightly pointed lower part; d) recent specimen of an olive stone with a slightly pointed lower part, for comparison (taken from Knežić, Šoštarić, Čelhar 2023, photo by D. Knežić)

DIVLJE ILI KULTIVIRANE?

Nameće se pitanje jesu li masline iz prapovijesnih razdoblja na istočnoj obali Jadrana divlje ili kultivirane. U ovom radu nisam ni pokušao odrediti razliku iz više razloga. Prije svega zbog vlastitog neiskustva u obradi bioarheološkog materijala. Zatim, veliki problem predstavlja malobrojnost uzoraka, posebice maslina iz neolitičkog perioda. Sljedeći je problem očuvanost uzoraka, naime, pronađene koštice maslina mogle su proći kroz različite depozicijske procese. Prije ili poslije potapanja kompletnog lokaliteta mogle su imati različite uvjete, ponajprije količinu vlage i različit sastav mulja. Sve navedeno moglo je utjecati na poroznu drvenastu strukturu koštica na način da je moglo doći do promjene u dimenzijama same koštice, prije svega moglo je doći do određenog smanjivanja, što može predstavljati problem kod arheometrijske usporedbe. Osim toga, u znanstvenoj literaturi postoje rasprave o različitim metodama usporedbe koštica divljih i kultiviranih masli-

WILD OR CULTIVATED?

The question arises as to whether the olives from prehistoric periods on the eastern Adriatic coast were wild or cultivated. In this paper I have not attempted to determine this distinction, for several reasons. First and foremost, this is due to my lack of experience in processing bioarchaeological material. Secondly, the small sample size, particularly of olives from the Neolithic, presents a significant challenge. Another issue is the preservation of the specimens. Specifically, the olive stones found may have undergone various depositional processes. Before or after the complete inundation of the sites, the olive stones may have been subjected to varying conditions, primarily different moisture levels and sediment composition. All of these factors could have affected the porous, woody structure of the stones, potentially altering their dimensions. Most notably, they may have undergone some degree of shrinkage, which might pose a challenge for archaeometric comparisons. Moreover, while scientific literature discusses various methods for comparing the stones

na temeljenih na većem uzorku,²³ dok bi za istočnojadranske primjerke koštica genetska analiza bila najpogodnija za razrješavanje ove dvojbe.²⁴

HRANA ILI ULJE?

U radovima koji se odnose na masline u prapovijesti, često se postavlja pitanje jesu li one služile kao hrana praktična za konzervaciju u slanoj vodi, ili je riječ o tragovima proizvodnje maslinova ulja.²⁵ Za prapovijesno vrijeme teško je dati precizan odgovor. Naime, u antici su sustavi za preradu maslina dobro poznati, obvezno uključuju mlinska kamenja koja usitnjuju plod i time melju i košticu masline. Najčešće u antičkim lukama pronalazimo cijele koštice koje su ostatci prehrane mornara na brodovima. Pitanje je može li se maslina preraditi za dobivanje ulja, a da koštice ostanu cijele? Odgovor se krije u svjedočanstvima stanovnika Dugog otoka, koji su za vrijeme Drugoga svjetskog rata bili pod okupacijom talijanskih fašista. Zbog kontrole seoskih uljara i uzimanja znatne količine ulja, ljudi su potajno prerađivali masline u svojim maslinicima. Zrele su se masline stavljale u platnene vreće, te su se nogama gnječile u većim drvenim posudama, uz konstantno dodavanje tople vode. Ulje se izdvajalo na površini i stavljalo u posebne posude gdje se izdvajalo prema vrhu posude, a talog i voda prema dnu. Proces je trajao sve dok se ulje pojavljivalo na površini, a nakon toga se sakrivao sadržaj vreće u kojem su koštice ostajale cijele.²⁶ Ova crtica iz nedavne prošlosti daje nam odgovor kako je mogla izgledati prapovijesna prerada maslina do pojave mlinskog kamena.

Zanimljiv je i nalaz fragmenata velikog

of wild and cultivated olives, these are based on larger sample sizes.²³ It follows that for the eastern Adriatic specimens, genetic analysis would be the most suitable approach to resolve this question.²⁴

FOOD OR OIL?

In studies concerning olives in prehistory, the question often arises as to whether they were used as food (practical for preservation in salted water) or if the remains indicate olive-oil production.²⁵ It is difficult to provide a precise answer regarding prehistoric times. In Classical Antiquity, olive-processing systems are well-documented and necessarily include millstones that crushed the fruit, thereby grinding the olive stones as well. Whole olive stones, typically found in ancient ports, are most often remnants of sailors' food on ships. The question arises: is it possible to process olives for oil extraction while leaving the stones intact? An answer is to be found in the testimonies of residents of Dugi Otok, who were under occupation by Italian fascists during World War II. Due to the invaders' control of village oil mills and requisition of significant quantities of oil, the local population secretly processed olives in their olive groves. Ripe olives were placed in cloth bags and crushed underfoot in larger wooden containers, with warm water constantly added. The oil would separate on the surface and was transferred to special containers, where the oil rose to the top while sediment and water settled at the bottom. The process continued until all the oil had appeared on the surface, after which the contents of the bags, where the stones remained whole, were hidden.²⁶ This anecdote from the recent past provides an insight into how prehistoric olive processing might have looked before the advent of millstones.

²³ HANNACHI et al. 2017; MUREDDU et al. 2022; TERRAL et al. 2021.

²⁴ BESNARD, BERVILLÉA 2000; ELBAUM et al. 2006; JULCA et al. 2020.

²⁵ GALILI et al. 2021; TERRAL et al. 2021.

²⁶ Kazivači su stanovnici Žmana na Dugom otoku, Sabina Parica i Mario Vidulić.

²³ HANNACHI et al. 2017; MUREDDU et al. 2022; TERRAL et al. 2021.

²⁴ BESNARD, BERVILLÉA 2000; ELBAUM et al. 2006; JULCA et al. 2020.

²⁵ GALILI et al. 2021; TERRAL et al. 2021.

²⁶ The informants are residents of Žman on Dugi Otok, Sabina Parica and Mario Vidulić.



SLIKA 7. *Fragmenti četvrtaste skladišne posude na nalazištu* (snimio: M. Parica)

FIGURE 7 *Fragments of a rectangular storage vessel at the site* (photo by M. Parica)

spremnika od zapečene zemlje u podmorju lokaliteta Turanj – Ričul. Riječ je o četvrtastom spremniku s vrlo pravilnim stjenkama i precizno oblikovanim kutom, što sugerira smještaj u kutu prostorije. Spremnik spomenutog oblika i veličine današnjih kupaoških kada mogao je služiti za preradu maslina i dobivanje maslinova ulja na prethodno opisani način.

Dolaskom istočnog Jadrana pod rimsku upravu standardizira se proces prerade ulja koji postaje isti kao i u ostalim dijelovima rimskog svijeta.²⁷

ZAKLJUČAK

U vrijeme neolitika, na istočnom Mediteranu dolazi do kultivacije masline, zatim

An interesting find is fragments of a large container made of fired clay, discovered underwater at the site of Turanj – Ričul. It had been a rectangular container with very regular walls and a precisely shaped corner, suggesting placement in the corner of a room. A container of this shape (in size comparable to a modern bathtub) might have been used for processing olives and extracting olive oil in the previously described manner.

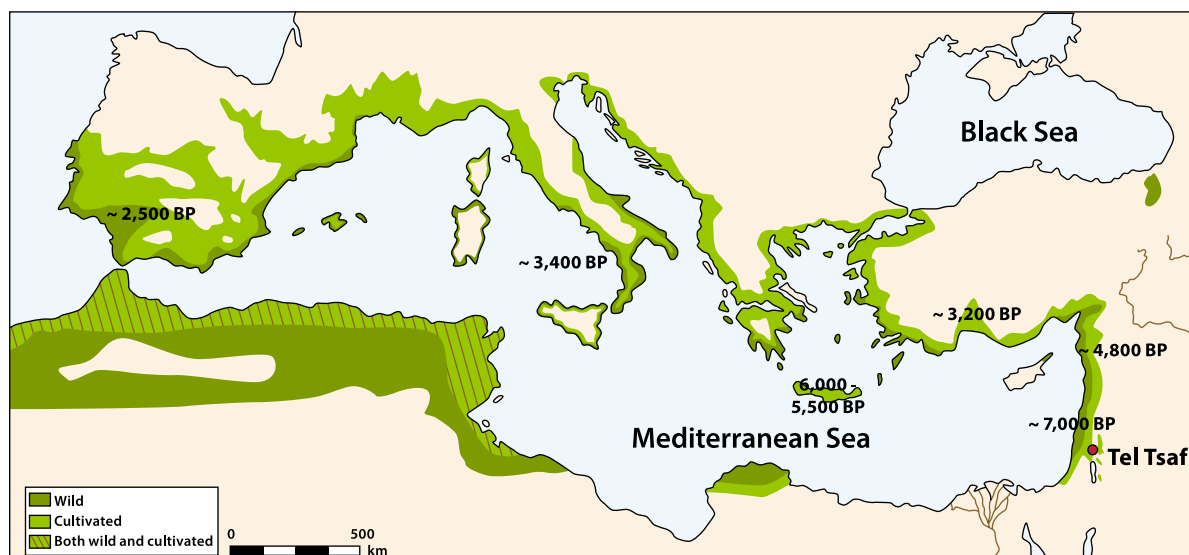
As the eastern Adriatic came under Roman rule, the oil-processing method became standardised, aligning with practices in other parts of the Roman world.²⁷

CONCLUSION

During the Neolithic period, olive cultivation began in the eastern Mediterranean and grad-

²⁷ KOPÁČKOVÁ 2020.

²⁷ KOPÁČKOVÁ 2020.



SLIKA 8. Karta Sredozemlja s vremenom kultivacije masline (izrađeno po: Langgut, Garfinkel 2022.)

FIGURE 8 Map of the Mediterranean with the period of olive cultivation (made by Langgut, Garfinkel 2022.)

se postupno spomenuta kultura širi diljem Sredozemlja. Već u vrijeme neolitika stolna konzervirana maslina za prehranu postaje zanimljiva trgovačka roba, međutim, masline stare gotovo 7000 godina iz potopljenog nalazišta Soline na Korčuli možemo pripisati ili importu s istočnog Mediterana ili pak početku korištenja iz eventualnih lokalnih izvora. Dokazana brojnija pojava maslina na istočnoj obali Jadrana započinje u razdoblju brončanog doba, od 1400. do 1300. prije Krista, na nalazištu Turanj u blizini Biograda, što ide u prilog tezi D. Langgut i suradnika, koji za prostor Jadrana i južne Italije na temelju ostataka peludi u močvarnim nalazištima, određuju početak uzgoja masline okvirno oko 1400. godine prije Krista. Ostaci maslina na lokalitetima Vranjic i Nadin s prijelaza iz brončanog u željezno doba samo potvrđuju kontinuitet prisutnosti masline na istočnom Jadranu. U budućim istraživanjima važno je analizirati sve organske ostatke iz potopljenih nalazišta, odrediti vrste drva, genetsku pripadnost koštica, te analizirati močvarne sedimente, sve u cilju boljeg poznavanja prapovijesne kultivacije masline na istočnom Jadranu.

ually spread throughout the Mediterranean region. Even by the Neolithic, preserved table olives had become an attractive trade commodity. However, the nearly 7,000-year-old olives from the now-inundated site of Soline on Korčula can either be attributed to imports from the eastern Mediterranean or to the initial utilisation of potential local sources. The confirmed greater occurrence of olives on the eastern Adriatic coast dates began in the Bronze Age, between 1400 and 1300 BC, at the site of Turanj near Biograd. This supports the hypothesis of D. Langgut and associates, who estimate the beginning of olive cultivation in the Adriatic and southern Italy, on the basis of pollen remains from marshland sites, to around 1400 BC. The olive remains from the sites of Vranjic and Nadin, dating to the transition from the Bronze to the Iron Age, further confirm the continuity of olive presence in the eastern Adriatic. In future research, it will be important to analyse all organic remains from submerged sites, identify wood species, determine the genetic classification of olive stones and examine marsh sediments, all with the aim of gaining a better understanding of prehistoric olive cultivation on the eastern Adriatic.

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