MORSKE ŠKOLJKE RODA *GLYCYMERIS* SPP. IZ KASNOGA GORNJEG PALEOLITIKA ISTOČNOG JADRANA – DOPRINOS ARHEOMALAKOLOŠKIM ISTRAŽIVANJIMA

MARINE SHELLS OF GLYCYMERIS *SPP. FROM THE LATE UPPER PALAEOLITHIC OF THE EASTERN ADRIATIC – A CONTRIBUTION TO ARCHAEOMALACOLOGICAL RESEARCH*

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Malakološki ostaci česti su na arheološkim nalazištima, a uključuju cjelovite ili fragmentirane ljušture puževa, školjkaša i koponožaca. Arheomalakologija, disciplina usmjerena na proučavanje takvih ostataka, omogućuje sagledavanje različitih aspekata prapovijesnog života – od ekonomije i prehrane do društvenih običaja i simbolike. Recentna istraživanja morskih školjki naglašavaju njihovu višestruku ulogu još od donjeg paleolitika, gdje su korištene kao ukrasi, alatke, spremnici i posude. Među vrstama koje se ističu svojom funkcionalnom raznolikošću posebno se izdvajaju školjke roda Glycymeris spp. U dosadašnjim su istraživanjima prapovijesnih nalazišta istočnog Jadrana nalazi školjki roda Glycymeris najčešće interpretirani kao osobni ukrasi, dok njihova moguća utilitarna funkcija nije bila sustavno razmatrana. Ovaj rad donosi pregled nalaza Glycymeris spp. iz kasnog gornjeg paleolitika s područja istočnog Jadrana, sažima dostupne podatke o njihovu kontekstu, očuvanosti i morfološkim karakteristikama. Usporedbom s recentnim istraživanjima o funkciji i ulozi morskih školjki u prapovijesnim kontekstima, ukazuje se na raznolikost interpretacija i potrebu za budućim funkcionalnim analizama koje bi mogle rasvijetliti višestruke uloge školjki roda Glycymeris u zajednicama istočnog Jadrana.

Key words:
Archaeomalacology, Glycymeris *spp., Late Upper Palaeolithic, Eastern Adriatic*

Malacological remains are commonly found at archaeological sites and include both complete and fragmented shells of gastropods, bivalves and scaphopods. Archaeomalacology, the discipline dedicated to studying such remains, offers valuable insights into various aspects of prehistoric life – including economy, subsistence, social practices, and symbolic behaviour. Recent research has highlighted the multifaceted roles of marine shells since the Lower Palaeolithic, when they were used as ornaments, tools, containers and vessels. Among the species that stand out due to their functional diversity, shells of the genus Glycymeris are particularly prominent.

In previous studies of prehistoric sites in the Eastern Adriatic, Glycymeris specimens have most often been interpreted as personal ornaments, while their potential utilitarian functions have remained largely unexplored. This paper presents a systematic review of Glycymeris spp. specimens from the Late Upper Palaeolithic of the Eastern Adriatic, synthesising available data on their archaeological context, state of preservation, and morphological characteristics. By comparing these finds with recent research on the function and role of marine shells in prehistoric contexts, the study emphasises the diversity of possible interpretations and underscores the need for future functional analyses that could shed light on the diverse roles of Glycymeris shells among Late Upper Palaeolithic populations in the Eastern Adriatic.

UVOD – MEKUŠCI U ARHEOLOŠKOM KONTEKSTU

Mekušci su predmet brojnih bioloških, ekoloških, paleontoloških i arheoloških istraživanja.[1] Malakološki nalazi u arheološkim kontekstima obuhvaćaju cjelovite i fragmentirane ljušture različitih vrsta živućih i fosilnih puževa (*Gastropoda*), školjkaša (*Bivalvia*) i koponožaca (*Scaphopoda*), od kojih se najveći dio odnosi na one morske. Istraživanja su pokazala da su mekušci među najranije korištenim resursima, što upućuje na to da odnosi između ljudi i mekušaca sežu do najranijih faza naše evolucije.[2] Razvoj arheomalakologije,[3] discipline usmjerene na proučavanje arheoloških ostataka ljuštura mekušaca, znatno je unaprijedio naše razumijevanje odnosa između ljudi i okoliša i omogućio sveobuhvatniji uvid u kulturnu evoluciju, prehranu i promjene u okolišu kroz prapovijest.[4] Pokazalo se kako ljušture mekušaca nisu samo ostaci drevnih obroka, već i ključni elementi za razumijevanje trgovine, kontakata, društvenih struktura te interakcija između ljudi i okoliša kroz našu evolucijsku povijest.[5] Kao disciplina, arheomalakologija je doprinijela i uspostavi sustavnog prikupljanja podataka o malakofauni s arheoloških lokaliteta, što ranije nije bilo uobičajeno, kao i reviziji postojećih zbirki.

Najranija poznata uporaba morskih mekušaca datira iz donjeg paleolitika, kad su

1 Npr. ERLANDSON 1988; MORTON 1991; BAR-YOSEF 2005; CUENCA-SOLANA, GUTIÉRREZ-ZUGASTI, CLEMENTE-CONTE 2011; BAILEY, HARDY, CAMARA 2013; KLEIN, STEEL 2013; CODDING, WHITAKER, BIRD 2014; THOMAS 2015; PURROY et al. 2016.

2 CODDING, WHITAKER, BIRD 2014; THOMAS 2015.

3 VINARSKI 2014.

4 ERLANDSON 1988; MITCHELL 1996; MANNINO, THOMAS 2002; TRUBITT 2003; d'ERRICO et al. 2005; COLONESE et al. 2011.

5 TABORIN 1993; STINER 1999; ERIKSEN 2002; ÁLVAREZ-FERNANDEZ 2010; COLONESE et al. 2011; STINER, KUHN, GÜLEÇ 2013; KLEIN, STEEL 2013; KANDEL, BRETZKE, CONARD 2018.

INTRODUCTION – MOLLUSCS IN THE ARCHAEOLOGICAL CONTEXT

Molluscs are the subject of numerous biological, ecological, palaeontological, and archaeological studies.[1] In archaeological contexts, malacological remains include both complete and fragmented shells of various species of living and fossilised gastropods (*Gastropoda*), bivalves (*Bivalvia*), and tusk shells (*Scaphopoda*), most of which are marine. Numerous studies show that molluscs were among the earliest resources exploited by hominins, indicating that the relationship between humans and molluscs dates to the earliest stages of our evolution.[2] The development of archaeomalacology,[3] the discipline focused on studying the archaeological remains of mollusc shells, has significantly enhanced our understanding of the relationship between humans and the environment, providing a more comprehensive insight into cultural evolution, subsistence strategies, and environmental changes throughout prehistory.[4] It has been shown that mollusc shells are not only the mere food remains but also key elements for understanding trade, contact, social structures and the interactions between humans and the environment throughout our evolutionary history.[5] As a discipline, archaeomalacology has contributed to the establishment of systematic data collection on malacofauna from archaeological sites (which was not common previously) as well as the revision of existing collections.

The earliest known use of marine molluscs dates back to the Lower Palaeolithic, when ma-

1 E.g. ERLANDSON 1988; MORTON 1991; BAR-YOSEF 2005; CUENCA-SOLANA, GUTIÉRREZ-ZUGASTI, CLEMENTE-CONTE 2011; BAILEY, HARDY, CAMARA 2013; KLEIN, STEEL 2013; CODDING, WHITAKER, BIRD 2014; THOMAS 2015; PURROY et al. 2016.

2 CODDING, WHITAKER, BIRD 2014; THOMAS 2015.

3 VINARSKI 2014.

4 ERLANDSON 1988; MITCHELL 1996; MANNINO, THOMAS 2002; TRUBITT 2003; d'ERRICO et al. 2005; COLONESE et al. 2011.

5 TABORIN 1993; STINER 1999; ERIKSEN 2002; ÁLVAREZ-FERNANDEZ 2010; COLONESE et al. 2011; STINER, KUHN, GÜLEÇ 2013; KLEIN, STEEL 2013; KANDEL, BRETZKE, CONARD 2018.

ljušture morskih školjki služile kao alatke,[6] dok je njihovo meso korišteno u prehrambene svrhe.[7] Među najranijim primjerima ističe se nalaz iz Trinila na Javi, gdje je na morskoj školjki, u kontekstu povezanom s *Homo erectusom*, urezan cik-cak uzorak koji se tumači kao mogući oblik simboličkog izražavanja. Iako kontekst nalaza nije u potpunosti razjašnjen, sugerira da su školjke još u tako ranom razdoblju mogle biti korištene ne samo kao sirovina za alat već i kao podloga za grafičko izražavanje. U srednjem paleolitiku školjke se pojavljuju u jasnom simboličkom kontekstu neandertalaca, primjerice u špiljama Cueva de los Aviones i Cueva Antón, gdje su pronađeni perforirani primjerci s tragovima pigmenta, interpretirani kao osobni ukrasi ili spremnici za boje.[8] U razdoblju gornjeg paleolitika dolazi do sustavne upotrebe određenih vrsta morskih školjki, puževa i koponožaca za izradu neutilitarnih simboličnih predmeta poput osobnih ornamenata.[9] Novija istraživanja ukazuju kako u ovom periodu dolazi i do sustavne utilitarne uporabe određenih vrsta morskih školjki.[10] Prepoznavanje morskih školjki kao alatki omogućili su razvoj i primjena novih metoda, točnije integracija mikroskopskih analiza tragova korištenja, eksperimentalne arheologije i etnografskih podataka.[11] Za razliku od arheoloških, etnografski zapisi bilježe široku upotrebu morskih školjki kao alatki za procesiranje različitih životinjskih, biljnih i mineralnih materijala.[12]

rine shells were employed as tools,[6] and their meat was consumed as food.[7] Among the earliest examples is a find from Trinil, Java, where a zigzag pattern was incised on a marine shell in a context associated with *Homo erectus*, interpreted as a possible form of symbolic expression. Although the context of the find is not fully clarified, it suggests that in such an early period, shells may have been used not only as raw material for tools but also as a medium for graphic expression. In the Middle Palaeolithic, shells appeared in a clear symbolic context among Neanderthals —for example, at the sites of Cueva de los Aviones and Cueva Antón—where perforated specimens bearing traces of pigment have been interpreted as personal ornaments or pigment containers.[8] In the Upper Palaeolithic, the systematic use of selected marine shells, gastropods, and scaphopods for the production of non-utilitarian symbolic objects, such as personal ornaments, is well documented.[9] Recent research also indicates that certain types of marine shells were systematically employed for utilitarian purposes during this period.[10] The identification of marine shells as tools has been facilitated by the development and application of new methodologies – particularly the integration of microscopic use-wear analysis, experimental archaeology, and ethnographic data.[11] In contrast to the archaeological records, ethnographic accounts document the widespread use of marine shells as tools for processing various animal, plant and mineral materials.[12] These ethno-

6 CHOI, DRIWANTORO 2007; JOORDENS et al. 2015.
7 VOIGT 1982; BUCHANAN 1985.
8 ZILHÃO et al. 2010.
9 Npr. KUHN et al. 2001; WEI et al. 2017; BAR-YOSEF MAYER, BOSCH 2019; BORIĆ, CRISTIANI 2019; VANHAEREN et al. 2019.
10 DOUKA 2011; CUENCA-SOLANA et al. 2013; ROMAGNOLI, MARTINI, SARTI 2015; VILLA et al. 2020; LIDOUR, CUENCA-SOLANA 2023.
11 MANCA 2013; 2016; CUENCA-SOLANA et al. 2016; 2021; CUENCA-SOLANA, GUTIÉRREZ-ZUGASTI, GONZÁLEZ-MORALES 2017; MANCA et al. 2018.
12 LEROI-GOURHAN 1945; EMPERAIRE 1958; GUSINDE 1986; VIGIÉ 1987; PROUS 1990; CADE 1998; DUPONT 2003; ALLEN 2009; MANSUR, CLEMENTE CONTE 2009.

6 CHOI, DRIWANTORO 2007; JOORDENS et al. 2015.
7 VOIGT 1982; BUCHANAN 1985.
8 ZILHÃO et al. 2010.
9 E.g. KUHN et al. 2001; WEI et al. 2017; BAR-YOSEF MAYER, BOSCH 2019; BORIĆ, CRISTIANI 2019; VANHAEREN et al. 2019.
10 DOUKA 2011; CUENCA-SOLANA et al. 2013; ROMAGNOLI, MARTINI, SARTI 2015; VILLA et al. 2020; LIDOUR, CUENCA-SOLANA 2023.
11 MANCA 2013; 2016; CUENCA-SOLANA et al. 2016; 2021; CUENCA-SOLANA, GUTIÉRREZ-ZUGASTI, GONZÁLEZ-MORALES 2017; MANCA et al. 2018.
12 LEROI-GOURHAN 1945; EMPERAIRE 1958; GUSINDE 1986; VIGIÉ 1987; PROUS 1990; CADE 1998; DUPONT 2003; ALLEN 2009; MANSUR, CLEMENTE CONTE 2009.

Raznovrsni etnografski primjeri omogućili su stvaranje baze za provođenje eksperimentalnih arheoloških aktivnosti, a integrativne analize otkrivanje novih funkcija morskih školjki u prapovijesti.[13] Među vrstama s istaknutom funkcionalnom raznolikošću posebno se izdvajaju školjke roda *Glycymeris*, koje su u arheološkim kontekstima tradicionalno smatrane simboličkim predmetima,[14] nešto rjeđe prehrambenim izvorom,[15] a postoje i pretpostavke o njihovu korištenju kao sredstvu robne razmjene za hranu,[16] dok su novija istraživanja potvrdila i njihovu utilitarnu funkciju, u kojima su čitavi primjerci, ali i fragmenti interpretirani kao strugala, glačala ili spremnici i posudice[17]. Jedan od razloga zašto se utilitarna funkcija školjki vrste *Glycymeris* spp. nije sustavno prepoznavala jest taj što, zbog svojeg ergonomskog oblika, čvrstoće i često oštrih rubova, nisu zahtijevale dodatne modifikacije za korištenje, što posljedično otežava njihovo razlikovanje od drugih nalaza u arheološkim slojevima koji su mogli biti korišteni za prehranu ili izradu ornamenata. Dok su modificirane ljušture pojedinih vrsta morskih školjki, poput *Callista chione*,[18] lako prepoznatljive kao alatke,[19] nemodificirane primjerke nekih vrsta,[20] tzv. improvizirane alatke,[21] pa tako i one roda *Glycymeris*, nije lako razlikovati od malakoloških ostataka sačuvanih u arheološkim slojevima koji su bili, primjerice, izvor prehrane ili sirovina za izradu ukrasa.

Na arheološkim nalazištima istočnog Jadrana školjke roda *Glycymeris* predstavljaju jednu od najzastupljenijih skupina morskih školjkaša

13 Npr. CUENCA-SOLANA et al. 2011.
14 Npr. ZILHÃO et al. 2010.
15 STINER 1999.
16 BAR-YOSEF 2005.
17 Npr. DOUKA 2011; CUENCA-SOLANA, GUTIÉRREZ-ZUGASTI, CLEMENTE-CONTE 2011; MANCA 2016; SCHÜRCH et al. 2023.
18 CRISTIANI et al. 2005; ROMAGNOLI, MARTINI, SARTI 2015; VILLA et al. 2020.
19 VILLA et al. 2020.
20 Npr. THELLER, HILL 2019.
21 O'DAY, KEEGAN 2001.

graphic examples have provided a foundation for experimental archaeological protocols, while integrative analytical approaches have revealed previously unrecognised functions of marine shells in prehistory.[13] Among the taxa noted for their functional diversity, *Glycymeris* shells are particularly prominent. In archaeological contexts, they have traditionally been considered as symbolic objects,[14] and occasionally as a food source.[15] Hypotheses have also been proposed regarding their role as a medium of commodity exchange for food.[16] However, recent studies have confirmed their utilitarian potential, with both complete specimens and fragments interpreted as scrapers, polishers, containers, or small vessels.[17] One reason the utilitarian function of *Glycymeris* spp. shells has not been systematically recognised is that their ergonomic shape, durability, and often sharp edges allowed for direct use without the need for further modification. As a result, it is not easy to distinguish them from other archaeological artefacts that may have functioned as food-related debris or ornamental objects. While modified shells of particular species, such as *Callista chione*,[18] are easily recognisable as tools,[19] unmodified specimens of some species,[20] known as improvised tools,[21] such as those of the *Glycymeris* genus, are more challenging to identify, as they resemble other malacological remains that may have been discarded after consumption or used in ornament production.

At archaeological sites in the Eastern Adriatic, shells of the *Glycymeris* genus represent one of the most prevalent groups of marine

13 E.g. CUENCA-SOLANA et al. 2011.
14 E.g. ZILHÃO et al. 2010.
15 STINER 1999.
16 BAR-YOSEF 2005.
17 E.g. DOUKA 2011; CUENCA-SOLANA, GUTIÉRREZ-ZUGASTI, CLEMENTE-CONTE 2011; MANCA 2016; SCHÜRCH et al. 2023.
18 CRISTIANI et al. 2005; ROMAGNOLI, MARTINI, SARTI 2015; VILLA et al. 2020.
19 VILLA et al. 2020.
20 E.g. THELLER, HILL 2019.
21 O'DAY, KEEGAN 2001.

tijekom gornjeg paleolitika,[22] dok u mezolitičkim kontekstima gotovo potpuno nestaju.[23] U dosadašnjim su istraživanjima ovoga područja ove školjke uglavnom interpretirane kroz prizmu simboličke funkcije,[24] najčešće kao ukrasi, dok njihova moguća utilitarna uporaba nije bila sustavno istraživana.

Za razliku od istočnog Jadrana, arheomalakološka istraživanja i revalorizacija postojećih nalaza školjkaša znatno su razvijenija u drugim dijelovima Mediterana, poput Španjolske, Francuske i Italije, ali i šire, gdje su školjke roda *Glycymeris* dokumentirane u širokom rasponu funkcionalnih uloga. Ovaj rad donosi pregled dosadašnjih nalaza i interpretacija školjki roda *Glycymeris* s gornjopaleolitičkih nalazišta istočnog Jadrana te ih sagledava u odnosu na postojeća arheomalakološka istraživanja u području Mediterana. Cilj je rada ponuditi sintezu dostupnih podataka, ukazati na različite mogućnosti tumačenja njihove funkcije te naglasiti važnost daljnjih, funkcionalno orijentiranih istraživanja.

ODLIKE MORSKIH ŠKOLJKI IZ RODA *GLYCYMERIS* SPP.

Porodica *Glycymerididae* široko je rasprostranjena i relativno raznolika, a školjkaši iz roda *Glycymeris* broje više od 250 različitih vrsta i jedni su od najvećih školjkaša u Sredozemnom moru.[25] U hrvatskom jeziku nazivaju se čaške. Građene su od debele dvodijelne ljušture s ukršteno-lamelarnom strukturom, koju karakterizira visoka gustoća i relativno dobra otpornost na deformacije.[26] Periostrakum im je prekriven dlačicama karakterističnim

[22] CVITKUŠIĆ 2015; BORIĆ, CRISTIANI 2019.
[23] KOMŠO 2008; CVITKUŠIĆ 2015.
[24] CRISTIANI, FARBSTEIN, MIRACLE 2014; CVITKUŠIĆ 2015; BORIĆ, CRISTIANI 2019; BORIĆ et al. 2023; CVITKUŠIĆ, CRISTIANI, VUJEVIĆ 2024a.
[25] World Register of Marine Species, https://www.marinespecies.org/aphia.php?p=taxdetails&id=138035, pristupljeno 20. 8. 2024.
[26] TAYLOR, LAYMAN 1972.

bivalves during the Upper Palaeolithic.[22] At the same time, in Mesolithic contexts, they are almost absent.[23] In previous research on this area, these shells have mostly been interpreted through the lens of symbolic function,[24] most often as ornaments, while their potential utilitarian use has not been systematically studied.

Unlike in the Eastern Adriatic, archaeomalacological research and the re-evaluation of existing bivalve findings are significantly more developed in other parts of the Mediterranean, such as Spain, France, and Italy, and even further afield, where *Glycymeris* shells have been documented in a wide range of functional roles. This paper presents a systematic review of existing findings and interpretations of *Glycymeris* shells from Upper Palaeolithic sites in the Eastern Adriatic and examines these in the context of current archaeomalacological research across the Mediterranean region. It aims to synthesise the available data, explore diverse functional interpretations, and emphasise the need for continued function-focused research.

CHARACTERISTICS OF MARINE SHELLS OF THE GENUS *GLYCYMERIS*

The *Glycymerididae* family is widely distributed and relatively diverse, with over 250 different species of *Glycymeris*;[25] they are among the largest bivalves in the Mediterranean. In Croatian, they are referred to as *čaške*. They have a thick, bivalve shell with a crossed-lamellar structure, characterised by high density and good resistance to deformation.[26] Their periostracum is covered in characteristic brownish hairs. The generally complex identification of

[22] CVITKUŠIĆ 2015; BORIĆ, CRISTIANI 2019.
[23] KOMŠO 2008; CVITKUŠIĆ 2015.
[24] CRISTIANI, FARBSTEIN, MIRACLE 2014; CVITKUŠIĆ 2015; BORIĆ, CRISTIANI 2019; BORIĆ et al. 2023; CVITKUŠIĆ, CRISTIANI, VUJEVIĆ 2024a.
[25] World Register of Marine Species, https://www.marinespecies.org/aphia.php?p=taxdetails&id=138035 accessed date 20/08/2024.
[26] TAYLOR, LAYMAN 1972.

ne smeđe boje. Općenito složena determinacija školjkaša razlog je različitih podataka o distribuciji vrsta ovog roda.[27] Prema dosadašnjim istraživanjima, potvrđeno je da u Jadranu obitavaju tri vrste čaški: *Glycymeris bimaculata*, *Glycymeris pilosa* i *Glycymeris nummaria*.[28] S obzirom na morfološke karakteristike, pojedine je vrste teže međusobno razlikovati te su znanstvena istraživanja na ovu temu još uvijek aktualna.[29]

G. bimaculata ima karakteristike kojima se najlakše može raspoznati u odnosu na druge dvije vrste: fizički je najveća i može narasti do oko 12 cm, iako su jedinke veće od 9 cm rijetke. Ljušture imaju okrugao oblik i relativno su plosnate. U istočnom Jadranu česta je vrsta u plitkim pjeskovitim priobalnim područjima, gdje se ukopava u tlo na dubinama do 30 metara.[30]

U znanstvenoj i stručnoj literaturi najviše se nedoumica odnosi na vrstu *G. pilosa,* točnije njezino razlikovanje u odnosu na vrstu *Glycymeris glycymeris*. Prema literaturi, *G. glycymeris* obitava u Atlantskom oceanu i Sredozemnom moru, ali nema jasnih dokaza o njezinoj stvarnoj prisutnosti u Jadranu.[31] Iako se u brojnim izvorima spominje prisutnost vrste *G. glycymeris* u Jadranu, nedavna su istraživanja potvrdila da školjkaši istočnog Jadrana pripadaju vrsti *G. pilosa.*[32] Obje su vrste sličnih dimenzija, mogu dosegnuti duljinu do 9 cm, a ljušture su im dublje od vrste *G. bimaculata*.

G. nummaria najmanja je od tri vrste čaški i naraste do 7 cm. Od drugih se vrsta razlikuje po izduženijem, kvadratastom obliku i ljubičastom obojenju ljuštura. Ukopava se u fini, sitni pijesak, koji je relativno rijedak u istočnom dijelu Jadranu i nalazi se samo na određenim lokacijama, poput Ninskog zaljeva

[27] LEGAČ, HRS-BRENKO 1999.
[28] UJEVIĆ PEHARDA, STANIĆ, UGARKOVIĆ 2022: 93.
[29] PURROY et al. 2016; UJEVIĆ PEHARDA, STANIĆ, UGARKOVIĆ 2022.
[30] UJEVIĆ PEHARDA, STANIĆ, UGARKOVIĆ 2022: 93.
[31] PURROY et al. 2016.
[32] UJEVIĆ PEHARDA, STANIĆ, UGARKOVIĆ 2022: 93.

bivalves is the reason for the differing data on the distribution of species from this genus.[27] According to existing research, three species of *Glycymeris* have been confirmed as inhabiting the Adriatic: *Glycymeris bimaculata, Glycymeris pilosa* and *Glycymeris nummaria.*[28] Due to their morphological characteristics, certain species are more difficult to distinguish, and scientific research on this topic is still ongoing.[29]

G. bimaculata has characteristics that make it the easiest to distinguish from the other two species: it is physically the largest and can grow to around 12 cm (although individuals larger than 9 cm are rare). The shells have a round shape and are relatively flat. In the Eastern Adriatic, it is a common species in shallow sandy coastal areas, where it burrows into the seabed at depths of up to 30 metres.[30]

In scientific and professional literature, the most uncertainty revolves around the species *G. pilosa*, specifically its distinction from the species *Glycymeris glycymeris*. According to the literature, *G. glycymeris* inhabits the Atlantic Ocean and the Mediterranean Sea; however, there is no unambiguous evidence of its actual presence in the Adriatic.[31] Although the presence of *G. glycymeris* in the Adriatic is mentioned in numerous sources, recent research has confirmed that the bivalves of the Eastern Adriatic belong to the species *G. pilosa.*[32] Both species are similar in size, reaching up to 9 cm in length, and their shells are deeper than those of *G. bimaculata*.

G. nummaria is the smallest of the three *Glycymeris* species and can grow to 7 cm. It differs from the others by its elongated, square shape and the purple colouration of its shells. It burrows into fine, granular sand, which is relatively rare in the eastern Adriatic, and is found only at specific locations, such as the Bay of

[27] LEGAČ, HRS-BRENKO 1999.
[28] UJEVIĆ PEHARDA, STANIĆ, UGARKOVIĆ 2022: 93.
[29] PURROY et al. 2016; UJEVIĆ PEHARDA, STANIĆ, UGARKOVIĆ 2022.
[30] UJEVIĆ PEHARDA, STANIĆ, UGARKOVIĆ 2022: 93.
[31] PURROY et al. 2016.
[32] UJEVIĆ PEHARDA, STANIĆ, UGARKOVIĆ 2022: 93.

va.[33] Prema istraživanju koje su proveli Colonese i suradnici,[34] vrsta *G. nummaria* smatra se jednom od glavnih vrsta školjkaša korištenih kao hrana na Sredozemlju tijekom paleolitika i mezolitika.

METODOLOŠKI OKVIR I OSNOVA ZA KOMPARACIJU

Ovaj rad temelji se na sintezi dostupnih podataka o školjkama roda *Glycymeris* iz kasnoga gornjeg paleolitika s arheoloških nalazišta istočne jadranske obale, s posebnim naglaskom na njihov kontekst, očuvanost, brojnost i prisutnost perforacija. Cilj je omogućiti komparativnu analizu i otvoriti prostor za buduća istraživanja njihove funkcije. Podaci korišteni u radu temelje se na informacijama iz relevantne literature.

Kao osnovni kriteriji za strukturiranje pregleda korišteni su:

- arheološki kontekst i stratigrafska pripadnost nalaza
- morfološke karakteristike i integritet školjki (cjelovitost, fragmentacija, perforacije)
- podaci o tafonomiji i stanju očuvanosti.

Zbog vrlo malih morfoloških razlika među vrstama unutar roda *Glycymeris*, taksonomska identifikacija arheoloških primjeraka često nije moguća s dovoljnom razinom pouzdanosti. Također, iako su ljušture ovih školjki prirodno čvrste i mehanički otporne, većina paleolitičkih primjeraka pokazuje oštećenja površinskog sloja i/ili gubitak strukturnog integriteta uslijed tafonomskih i/ili antropogenih procesa. Slijedom toga, u ovom su radu svi nalazi grupirani pod oznakom *Glycymeris* spp. Budući da su razlike među vrstama prisutnima u Jadranu minimalne, ovakvo grupiranje ne utječe na komparativnu analizu ni

[33] CRNČEVIĆ 2014.
[34] COLONESE et al. 2011.

Nin.[33] According to the research of Colonese et al.,[34] *G. nummaria* is considered one of the main species of bivalves used as food in the Mediterranean during the Palaeolithic and Mesolithic periods.

METHODOLOGICAL FRAMEWORK AND BASIS FOR COMPARISON

This paper is based on the synthesis of available data on *Glycymeris* shells from the Late Upper Palaeolithic at archaeological sites along the eastern Adriatic coast, with a particular focus on their context, preservation, abundance, and the presence of perforations. The aim is to enable a comparative analysis and establish a foundation for future research on their function. The data used in this paper is drawn from relevant literature.

The structure of the review follows three principal criteria:

- Archaeological context and stratigraphic affiliation of the specimens
- Morphological characteristics and integrity of the specimens (completeness, fragmentation, perforations)
- Taphonomic information and state of preservation

Due to minimal morphological differences between species within the *Glycymeris* genus, taxonomic identification of archaeological specimens is often not possible with a sufficient level of certainty. Also, although the shells of these molluscs are naturally strong and mechanically resistant, most Palaeolithic specimens show surface damage and/or loss of structural integrity due to taphonomic and/or anthropogenic processes. As a result, all specimens in this paper are grouped under the taxon *Glycymeris* spp. Since the differences between species present in the Adriatic are minimal, this grouping does not

[33] CRNČEVIĆ 2014.
[34] COLONESE et al. 2011.

na interpretaciju arheoloških podataka.

U svrhu pregledne i dosljedne kvantifikacije nalaza, primijenjena je osnovna podjela na tri kategorije prema stupnju očuvanosti i prisutnosti perforacije: (1) cjeloviti primjerci s perforacijom, (2) cjeloviti primjerci bez perforacije te (3) fragmentirani i oštećeni primjerci, definirani kao oni kod kojih je očuvanost manja od približno 90 % izvorne strukture, prema kriterijima koje navode Zuschin i suradnici.[35]

Ova kategorizacija ne podrazumijeva funkcionalnu interpretaciju, s obzirom na to da stupanj očuvanosti i prisutnost perforacije sami po sebi ne upućuju nužno na uporabu predmeta. Svrha joj je sustavno praćenje distribucije nalaza školjki roda *Glycymeris* među lokalitetima istočnojadranskog područja. S obzirom na to da se među fragmentiranim primjercima mogu nalaziti i oni s tragovima korištenja, u budućim istraživanjima bit će nužno provesti detaljne tafonomske i eksperimentalne analize kako bi se razjasnili uzroci fragmentacije i potencijalna upotreba oštećenih primjeraka.

Položaj perforacija evidentiran je prema podacima iz dostupne literature (Badanj, Crvena stijena) i izravnim uvidom u materijal (Vlakno, Šandalja II, Pupićina peć), dok u slučajevima bez vizualne dokumentacije (npr. Vela spila) nije bilo moguće provjeriti točnost navoda.

Dodatno, u obzir su uzeta i preliminarna opažanja s izdvojenih primjeraka iz Vlakna i Badnja, uključujući ograničena makroskopska i mikroskopska zapažanja (< 100 x) povezana s perforacijama i tragovima rezidua, koja su ovdje uključena isključivo kao ilustrativna dopuna preglednom prikazu.

Cilj je ovoga pregleda obuhvatiti i interpretativno sagledati dostupne podatke o nalazima školjki roda *Glycymeris*, kako bi se bolje razumjela njihova uloga te uočili potencijalni smjerovi za buduća funkcionalna istraživanja.

[35] ZUSCHIN, STACHOWITSCH, STANTON 2003.

affect the comparative analysis or the interpretation of the archaeological data.

For the purpose of systematic review and consistent quantification of the specimens, a basic division into three categories was applied based on the degree of preservation and the presence of perforation: (1) complete specimens with perforation, (2) complete specimens without perforation, and (3) fragmented and damaged specimens, defined as those with less than approximately 90% of the original structure preserved, according to the criteria of Zuschin et al.[35]

This categorisation does not imply a functional interpretation, as neither the degree of preservation nor the presence of perforation alone necessarily indicates use. Its primary purpose is to systematically document the distribution of *Glycymeris* specimens across sites in the Eastern Adriatic region. Given that some fragmented specimens may exhibit traces of use, future research will need to incorporate detailed taphonomic and experimental analyses to clarify the causes of fragmentation and assess the potential utilisation of fragmented and damaged shells.

The position of perforations was recorded based on data from published sources (Badanj, Crvena Stijena) and through direct examination of material (Vlakno, Šandalja II, Pupićina Peć). In cases where visual documentation was lacking (e.g., Vela Spila), it was not possible to verify the accuracy of the reported information.

Additionally, preliminary observations from selected specimens from Vlakno and Badanj were taken into account, including limited macroscopic and microscopic observations (<100x) related to perforations and residue traces. These are included solely as an illustrative supplement to the interpretative framework.

The aim of this review is to synthesise and interpret the available data on *Glycymeris* specimens in order to better understand their role and to identify potential directions for future functional research.

[35] ZUSCHIN, STACHOWITSCH, STANTON 2003.

PREGLED NALAZA ŠKOLJKI *GLYCYMERIS* SPP. IZ KASNOGA GORNJEG PALEOLITIKA ISTOČNOG JADRANA

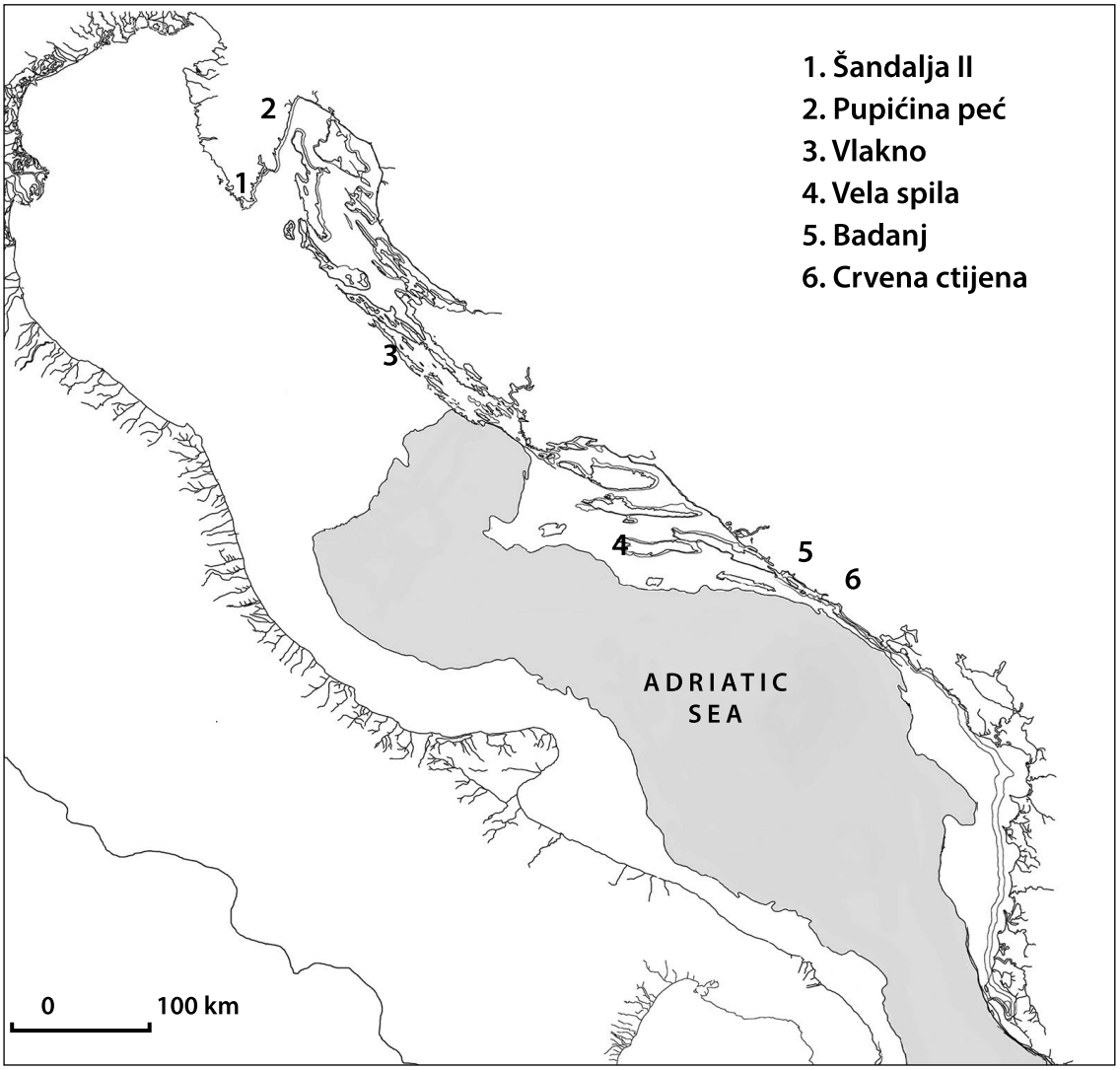
Nalazi školjki roda *Glycymeris* spp. iz kasnoga gornjeg paleolitika dokumentirani su na šest arheoloških lokaliteta duž istočne jadranske obale, a uključuju: Šandalju II, Pupićinu peć, Vlakno, Velu spilu, Badanj i Crvenu stijenu (karta 1). Navedeni lokaliteti, njihova sustavna istraživanja i rezultati raznovrsnih analiza dostupni su u brojnim publikacijama pa se u ovom radu ne donosi njihov detaljan opis.

U nastavku se nalazi sažet pregled arheološkog konteksta za svaki od lokaliteta, u cilju

GLYCYMERIS SPP. SHELL REMAINS FROM THE LATE UPPER PALAEOLITHIC OF THE EASTERN ADRIATIC: A REVIEW

Glycymeris spp. specimens from the Late Upper Palaeolithic have been documented at six archaeological sites along the eastern Adriatic coast: Šandalja II, Pupićina Peć, Vlakno, Vela Spila, Badanj and Crvena Stijena (Map 1). These sites, their systematic research, and the results of various analyses have been published extensively; therefore, a detailed description is not provided in this paper.

Below is a summary of the archaeological context for each site, intended to illustrate



Karta 1. *Gornjopaleolitička nalazišta s Glycymeris spp., istočni Jadran* (izradila: B. Cvitkušić)
Map 1 *Upper Palaeolithic sites with Glycymeris spp., Eastern Adriatic* (created by B. Cvitkušić)

prikaza njihove prostorne distribucije, stratigrafskog položaja te osnovnih karakteristika školjki i njihovih tumačenja u literaturi.

Nalazi *Glycymeris* spp. bit će predstavljeni po lokalitetima geografskim slijedom od sjevera prema jugu istočnojadranskog područja.

Na sjevernom dijelu istočnog Jadrana, na području današnje Istre, morske školjke *Glycymeris* spp. otkrivene su na dva lokaliteta – u Pupićinoj peći i u Šandalji II. Tijekom sustavnih istraživanja **Pupićine peći** prikupljen je bogat repertoar kamenih i koštanih alatki, faune, ljudskih kostiju i osobnih ornamenata.[36] Jedan nalaz morske školjke *Glycymeris* spp. otkriven je u sloju 379.[37] Od ostalih vrsta morskih školjki u kasnogornjopaleolitičkim slojevima Pupićine peći prisutni su malobrojni nalazi dagnji (*Mytilus galloprovincialis*).[38]

Gornjopaleolitički nalazi iz **Šandalje II** tema su raznih interdisciplinarnih istraživanja važnih za rekonstrukciju i bolje razumijevanje prilagodbi i ponašanja prapovijesnih populacija jadranskog prostora. Uz bogate nalaze faune,[39] kamenih[40] i koštanih rukotvorina[41] te osobnih ornamenata,[42] u sloju B/s pronađeni su i kosturni ostaci četiriju osoba.[43] Sedam novih datuma (iz slojeva H, E, C/d i A/d),[44] nešto ranije datacije slojeva F i G[45] te stariji datumi slojeva (E, F, G, C i B),[46] ukazali su na znatne poremećaje u stratigrafiji Šandalje II i miješanje materijala iz različitih slojeva. Od rijetkih nalaza morskih školjki u Šandalji II u sloju B/s otkriven je jedan probušeni primjerak *Glycymeris* spp. i

their spatial distribution, stratigraphic position, and basic characteristics of the shells, as well as their interpretations in the literature.

The *Glycymeris* spp. specimens are presented by site, following a geographical order from north to south of the eastern Adriatic region.

In the northern part of the Eastern Adriatic, in present-day Istria, *Glycymeris* spp. specimens have been recovered at two sites: Pupićina Peć and Šandalja II. During systematic research at Pupićina Peć, an extensive assemblage of stone and bone tools, faunal remains, human bones and personal ornaments was collected.[36] A single specimen of a *Glycymeris* spp. was discovered in layer 379.[37] Other marine bivalve species from the Late Upper Palaeolithic layers at Pupićina Peć include a few specimens of mussels (*Mytilus galloprovincialis*).[38]

Upper Palaeolithic finds from **Šandalja II** have been the subject of various interdisciplinary studies relevant to the reconstruction and deeper understanding of prehistoric adaptations and behaviour in the Adriatic region. Along with extensive faunal remains,[39] stone[40] and bone artefacts,[41] and personal ornaments,[42] the skeletal remains of four individuals[43] were discovered in one layer (B/s). Seven new dates (from layers H, E, C/d and A/d),[44] along with slightly earlier dates for layers F and G[45] and older dates for layers E, F, G, C and B,[46] indicated significant disruptions in the stratigraphy of Šandalja II and mixing of material from different layers. Among the rare marine bivalve species recovered at Šandalja II, a perforated *Glycymeris* spp. specimen and a

36 MIRACLE 1997; 2001; 2005; KOMŠO 2007; 2008; CVITKUŠIĆ, KOMŠO 2015.
37 CVITKUŠIĆ 2015.
38 MIRACLE 2001: 184.
39 MIRACLE 1995; 1996; BRAJKOVIĆ 2000; MIRACLE 2007.
40 MALEZ 1987; KARAVANIĆ 1999; KARAVANIĆ et al. 2013.
41 KARAVANIĆ et al. 2013; ČUJKEVIĆ-PLEČKO, KARAVANIĆ 2018; RUIZ-REDONDO et al. 2020.
42 CVITKUŠIĆ 2015.
43 JANKOVIĆ et al. 2011: 186-188; 2012: 120.
44 RUIZ-REDONDO et al. 2024.
45 RICHARDS et al. 2015.
46 KARAVANIĆ 2009: 172; KARAVANIĆ et al. 2013.

36 MIRACLE 1997; 2001; 2005; KOMŠO 2007; 2008; CVITKUŠIĆ, KOMŠO 2015.
37 CVITKUŠIĆ 2015.
38 MIRACLE 2001: 184.
39 MIRACLE 1995; 1996; BRAJKOVIĆ 2000; MIRACLE 2007.
40 MALEZ 1987; KARAVANIĆ 1999; KARAVANIĆ et al. 2013.
41 KARAVANIĆ et al. 2013; ČUJKEVIĆ-PLEČKO, KARAVANIĆ 2018; RUIZ-REDONDO et al. 2020.
42 CVITKUŠIĆ 2015.
43 JANKOVIĆ et al. 2011: 186-188; 2012: 120.
44 RUIZ-REDONDO et al. 2024.
45 RICHARDS et al. 2015.
46 KARAVANIĆ 2009: 172; KARAVANIĆ et al. 2013.

jedna cjelovita morska školjka *Acanthocardia tuberculata*[47] bez vidljivih tragova modifikacija[48]. *A. tuberculata* otkrivena je i u sloju G kao jedini nalaz morskog porijekla.[49] S obzirom na problematiku stratigrafskog integriteta[50] Šandalje II, ne treba isključiti mogućnost pripadnosti ovih nalaza i kasnijem (holocenu), ali i ranijem razdoblju (orinjasijenu).

Na središnjem dijelu istočnojadranske obale, na području današnje Dalmacije, nalazi morskih školjki *Glycymeris* spp. otkriveni su na dva lokaliteta: u pećini Vlakno na Dugom otoku i Veloj spili na otoku Korčuli. Sustavna istraživanja stratigrafije pećine **Vlakno**,[51] smjestila su ga u krug malobrojnih nalazišta širega jadranskog područja koja omogućavaju praćenje prijelaza kasnog pleistocena na holocen i prilagodbu zajednica na nove ekološke i okolišne uvjete. U gotovo svim slojevima Vlakna zabilježeni su intenzivni antropogeni procesi, a rezultati datacije pleistocenskih slojeva obuhvaćaju kronološki period od oko 14 390 do 19 550 cal BP.[52] Dosad otkriveni stratigrafski slijed obilježen je odlikama epigravetijenske kulture, sa standardnim, ali bogatim repertoarom kamenih i koštanih rukotvorina,[53] faune[54] i osobnih ornamenata,[55] uz pojedine jedinstvene i rijetke nalaze na ovim prostorima, poput gor-

complete, unmodified *Acanthocardia tuberculata*[47] specimen[48] were discovered in layer B/s. A specimen of *Acanthocardia tuberculata* was also found in layer G, representing the only evidence of marine material from this context.[49] Given the issue of stratigraphic integrity[50] at Šandalja II, the possibility that these specimens may belong to a later (Holocene) or earlier (Aurignacian) period cannot be excluded.

Along the central part of the eastern Adriatic coast, in present-day Dalmatia, *Glycymeris* spp. specimens have been discovered at two sites: Vlakno cave on the island of Dugi Otok and Vela Spila on the island of Korčula. Systematic research of the stratigraphy of **Vlakno** cave[51] has placed it among the few sites in the wider Adriatic region that allow the reconstruction of the transition from the Late Pleistocene to the Holocene, as well as the adaptation of hunter-gatherers to new ecological and environmental conditions. Intensive anthropogenic activity has been recorded in almost all layers of the site with radiocarbon dates from Pleistocene strata spanning a period from approximately 14,390 to 19,550 cal BP.[52] The stratigraphic sequence identified thus far is characterised by features of the Epigravettian culture, including a standard but extensive repertoire of stone and bone artefacts,[53] faunal remains[54] and personal ornaments,[55] along with several unique and rare artefacts in this region - such as Upper

47 Morska školjka *Acanthocardia tuberculata* (Linneus 1758) u prijašnjim radovima navođena je kao *Cardium rusticum,* što je prema novoj sistematizaciji (https://www.marinespecies.org/aphia.php?p=taxdetails&id=381058) neprihvaćen naziv.
48 CVITKUŠIĆ 2015.
49 CVITKUŠIĆ 2015.
50 RUIZ-REDONDO et al. 2024.
51 BRUSIĆ 2004; 2007; VUJEVIĆ 2011; 2018; 2021.
52 VUJEVIĆ, BODRUŽIĆ 2014; CVITKUŠIĆ, RADOVIĆ, VUJEVIĆ 2018; VUJEVIĆ et al. 2024; VUJEVIĆ, CVITKUŠIĆ 2024.
53 VUKOSAVLJEVIĆ, PERHOČ, ALTHERR 2014; VUJEVIĆ, BODRUŽIĆ 2021; VITEZOVIĆ, VUJEVIĆ, RADOVIĆ 2024.
54 VITEZOVIĆ, VUJEVIĆ, RADOVIĆ 2024; CVITKUŠIĆ, RADOVIĆ, VUJEVIĆ 2018; RADOVIĆ, SPRYMARQUÉS, VUJEVIĆ 2021.
55 CVITKUŠIĆ, VUJEVIĆ 2021; CVITKUŠIĆ, CRISTIANI, VUJEVIĆ 2024a; CVITKUŠIĆ et al. 2024b.

47 The marine shell *Acanthocardia tuberculata* (Linnaeus 1758) has previously been cited as *Cardium rusticum,* which is an outdated name according to the new classification (https://www.marinespecies.org/aphia.php?p=taxdetails&id=381058).
48 CVITKUŠIĆ 2015.
49 CVITKUŠIĆ 2015.
50 RUIZ-REDONDO et al. 2024.
51 BRUSIĆ 2004; 2007; VUJEVIĆ 2011; 2018; 2021.
52 VUJEVIĆ, BODRUŽIĆ 2014; CVITKUŠIĆ, RADOVIĆ, VUJEVIĆ 2018; VUJEVIĆ et al. 2024; VUJEVIĆ, CVITKUŠIĆ 2024.
53 VUKOSAVLJEVIĆ, PERHOČ, ALTHERR 2014; VUJEVIĆ, BODRUŽIĆ 2021; VITEZOVIĆ, VUJEVIĆ, RADOVIĆ 2024.
54 VITEZOVIĆ, VUJEVIĆ, RADOVIĆ 2024; CVITKUŠIĆ, RADOVIĆ, VUJEVIĆ 2018; RADOVIĆ, SPRYMARQUÉS, VUJEVIĆ 2021.
55 CVITKUŠIĆ, VUJEVIĆ 2021; CVITKUŠIĆ, CRISTIANI, VUJEVIĆ 2024a; CVITKUŠIĆ et al. 2024b.

njopaleolitičkih koštanih harpuna,[56] antropomorfnoga koštanog privjeska i fragmenata rožnjaka ukrašenih apstraktnim geometrijskim linearnim urezima.[57] U holocenskim slojevima pronađeni su i ljudski ostaci, uključujući i potpuno sačuvan ukop, izrazito rijedak nalaz iz ovoga vremena.[58] Većina nalaza morskih školjki otkrivena je u pleistocenskim slojevima, a analizirane su ili u sklopu faune ili osobnih ornamenata.[59] Analize malakoloških nalaza u sklopu faune pokazuju da 99 % nalaza morskih školjkaša čine mediteranska dagnja (*Mytilus* sp.) i kamenica (*Ostrea* sp.), čija je zastupljenost vrlo niska kroz cijelu kasnoglacijalnu i postglacijalnu sekvencu, s većim udjelom u pleistocenu, posebno u stratumu 4, a odlikuje ih velika fragmentiranost.[60] Analize skupa nalaza osobnih ornamenata pokazale su da su morske školjke prisutne samo u pleistocenskim slojevima, a *Glycymeris* spp. najzastupljenija je vrsta morskih školjki s ukupno 74 otkrivena primjerka. Dosad je u literaturi bilo objavljeno 70 nalaza školjki roda *Glycymeris spp.,*[61] no naknadnim je pregledom i uvidom u materijal taj broj povećan na 74 primjerka. Ova razlika rezultat je dopunjavanja postojeće baze podataka tijekom izrade ovog rada i uključuje dodatne evidentirane primjerke iz konteksta osobnih ornamenata. Od ostalih vrsta morskih školjki otkrivena je jedna probušena *Acanthocardia tuberculata* i dvije čitave ljušture školjke *Pecten jacobeus*. U najnižem stratumu 9 otkriven je i fragment morske školjke koja se uvjetno može pripisati vrsti *Pinna nobilis*.[62]

Vela spila pružila je dokaze o vrlo dugom slijedu korištenja, od kasnoga gornjeg paleolitika

Palaeolithic bone harpoons,[56] an anthropomorphic bone pendant, and fragments of decorated chert with abstract geometric linear incisions.[57] Human remains, including a fully preserved burial – a scarce find for this period – were also discovered in the Holocene layers.[58] Most marine shell specimens were recovered from the Pleistocene layers and have been analysed either as part of the faunal assemblage or as personal ornaments.[59] Malacological analyses of the faunal remains show that 99% of the marine bivalve specimens consist of the Mediterranean mussel (*Mytilus* sp.) and oyster (*Ostrea* sp.). Although overall representation is low throughout the Late Glacial and Postglacial sequence, there is a slightly higher concentration in the Pleistocene, particularly in stratum 4, where the assemblage is also characterised by high fragmentation.[60] Analysis of the personal ornaments has shown that marine bivalves are present only in the Pleistocene layers, with *Glycymeris* spp. being the most prevalent taxon, represented by a total of 74 specimens. Until recently, 70 *Glycymeris* spp. specimens had been published in the literature; [61] following further review and examination of the material, this number has increased to 74. This difference reflects additions to the existing database during the preparation of this paper and includes newly recorded specimens associated with personal ornaments. Other identified marine bivalves include one perforated specimen of *Acanthocardia tuberculata* and two complete specimens of *Pecten jacobeus*. In the lowest stratum (9), a fragment of a marine bivalve was also discovered, which can conditionally be attributed to *Pinna nobilis*.[62]

Vela Spila has yielded evidence of a long and continuous sequence of occupation, extending

56 VITEZOVIĆ, VUJEVIĆ, RADOVIĆ 2024.
57 VUJEVIĆ, PARICA 2011.
58 VUJEVIĆ, BODRUŽIĆ 2014; CRISTIANI et al. 2018; BEDIĆ et al. u tisku.
59 BARBIR, VUKOSAVLJEVIĆ, VUJEVIĆ 2020; CVITKUŠIĆ, CRISTIANI, VUJEVIĆ 2024a; CVITKUŠIĆ et al. 2024b; BARBIR 2024.
60 BARBIR 2024.
61 CVITKUŠIĆ, CRISTIANI, VUJEVIĆ 2024a: 93.
62 VUJEVIĆ, CVITKUŠIĆ 2024.

56 VITEZOVIĆ, VUJEVIĆ, RADOVIĆ 2024.
57 VUJEVIĆ, PARICA 2011.
58 VUJEVIĆ, BODRUŽIĆ 2014; CRISTIANI et al. 2018; BEDIĆ et al. (in press).
59 BARBIR, VUKOSAVLJEVIĆ, VUJEVIĆ 2020; CVITKUŠIĆ, CRISTIANI, VUJEVIĆ 2024a; CVITKUŠIĆ et al. 2024b; BARBIR 2024.
60 BARBIR 2024.
61 CVITKUŠIĆ, CRISTIANI, VUJEVIĆ 2024a: 93.
62 VUJEVIĆ, CVITKUŠIĆ 2024.

pa sve do brončanog doba. Slojevi iz kasnoga gornjeg paleolitika bogati su nalazima faune,[63] kamenim rukotvorinama,[64] osobnim ornamentima[65] te rijetkim nalazima keramike[66]. Rezultati radiokarbonskog datiranja slojeva od 20 000 do 14 000 cal BP[67] omogućavaju praćenje dijakronijskih promjena artefakata.[68] U literaturi se navodi kako je u gornjopaleolitičkim naslagama otkriveno ukupno 20 školjki i puževa, a od školjkaša su najčešći nalazi *Chamelea gallina* i *Glycymeris nummaria*.[69] Analiza skupa osobnih ornamenta navodi kako je od morskih školjki u slojevima kasnoga gornjeg paleolitika otkriveno pet primjeraka *Glycymeris* spp.[70]

Na južnom dijelu istočnog Jadrana morske školjke roda *Glycymeris* otkrivene su na dva lokaliteta: u Crvenoj stijeni u Crnoj Gori i u Badnju u Bosni i Hercegovini. Bogata stratigrafija **Crvene stijene**, pripećka smještenog visoko iznad rijeke Trebišnjice u blizini sela Nikšići u Crnoj Gori, omogućila je istraživanja industrija srednjeg i gornjeg paleolitika, mezolitika, ali i materijalnih ostataka kasnijih razdoblja.[71] Analize malakofaune zabilježile su sporadičnu prisutnost dagnji (*Mytilus* sp.), koje su fragmentirane i, prema tumačenju, korištene u prehrambene svrhe.[72] U sloju VIII gornjeg paleolitika (ca 13,7 do 13,4 ky cal BP)[73] otkrivena su tri primjerka *Glycymeris* spp. – jedan čitav primjerak bez perforacije te dva fragmenta, koja se navode u sklopu istraživanja osobnih ornamenata.[74]

Nalazište **Badanj** pripećak je u stijeni kanjo-

63 MAUCH LENARDIĆ, OROS SRŠEN, RADOVIĆ 2018.
64 VUKOSAVLJEVIĆ 2012; VUKOSAVLJEVIĆ, PERHOČ, RADIĆ 2022.
65 CRISTIANI, FARBSTEIN, MIRACLE 2014.
66 FARBSTEIN et al. 2012.
67 DEAN et al. 2020.
68 VUKOSAVLJEVIĆ 2023.
69 RADIĆ, LUGOVIĆ, MARJANAC 2008: 20.
70 CRISTIANI, FARBSTEIN, MIRACLE 2014.
71 BENAC, BRODAR 1958; BASLER 1975; 1979a; 1979b; WHALLON 2017; MIHAILOVIĆ, MIHAILOVIĆ, WHALLON 2017.
72 ČULAFIĆ, 2017.
73 MERCIER et al. 2017.
74 BORIĆ, CRISTIANI 2019; BORIĆ et al. 2023: 53.

from the Late Upper Palaeolithic to the Bronze Age. The Late Upper Palaeolithic layers are rich in faunal remains,[63] stone artefacts,[64] personal ornaments[65] and rare examples of early pottery.[66] Radiocarbon dates range between 20,000 and 14,000 cal BP,[67] enabling the study of diachronic changes in material culture.[68] According to published sources, a total of 20 shells and gastropods were recovered from the Upper Palaeolithic deposits, with *Chamelea gallina* and *Glycymeris nummaria* being the most commonly represented taxa.[69] Analysis of the personal ornament assemblage indicates that five *Glycymeris* spp. specimens were found in the Late Upper Palaeolithic layers.[70]

In the southern part of the Eastern Adriatic, *Glycymeris* specimens have been documented at two sites: Crvena Stijena in Montenegro and Badanj in Bosnia and Herzegovina. The rich stratigraphy of **Crvena Stijena**, a rock shelter located high above the Trebišnjica River near the village of Nikšići in Montenegro, has enabled research on industries spanning the Middle and Upper Palaeolithic, Mesolithic, as well as material remains from later periods.[71] Malacofaunal analyses have recorded the sporadic presence of fragmented mussel specimens (*Mytilus* sp.), interpreted as food remains.[72] In layer VIII, attributed to the Upper Palaeolithic (c. 13,700–13,400 cal BP),[73] three *Glycymeris* spp. specimens were discovered: one complete specimen without perforation, and two fragments, which are included in a study of personal ornaments.[74]

The **Badanj** site is a rock shelter located

63 MAUCH LENARDIĆ, OROS SRŠEN, RADOVIĆ 2018.
64 VUKOSAVLJEVIĆ 2012; VUKOSAVLJEVIĆ, PERHOČ, RADIĆ 2022.
65 CRISTIANI, FARBSTEIN, MIRACLE 2014.
66 FARBSTEIN et al. 2012.
67 DEAN et al. 2020.
68 VUKOSAVLJEVIĆ 2023.
69 RADIĆ, LUGOVIĆ, MARJANAC 2008: 20.
70 CRISTIANI, FARBSTEIN, MIRACLE 2014.
71 BENAC, BRODAR 1958; BASLER 1975; 1979a; 1979b; WHALLON 2017; MIHAILOVIĆ, MIHAILOVIĆ, WHALLON 2017.
72 ČULAFIĆ, 2017.
73 MERCIER et al. 2017.
74 BORIĆ, CRISTIANI 2019; BORIĆ et al. 2023: 53.

na rijeke Bregave u Bosni i Hercegovini udaljen 40-ak kilometara od Jadranske obale. Epigravetijenska stratigrafija ovog lokaliteta pružila je važne podatke o lovačko-sakupljačkim zajednicama i naseljavanju zaleđa istočnojadranske obale. Rezultati datiranih slojeva smještaju gornjopaleolitičku sekvencu u period od prije 16 do 12,7 ky cal BP.[75] Badanj je bogat i nalazima osobnih ornamenata, koštanim artefaktima s dekorativnim urezima te litičkim materijalom, a ovdje je otkrivena i gornjopaleolitička stijenska umjetnost, rijedak nalaz s područja jugoistočne Europe.[76] Analize skupa osobnih ornamenata navode kako je u gornjopaleolitičkim slojevima otkriveno ukupno 53 nalaza morskih školjki vrste *Glycymeris* spp.[77]

SINTEZA I KOMPARATIVNI PREGLED NALAZA

Na temelju dostupnih istraživanja s područja istočnojadranske obale evidentirano je ukupno 137 primjeraka školjki roda *Glycymeris* spp. iz kasnoga gornjeg paleolitika. Raspodjela je po lokalitetima sljedeća: Šandalja II (N = 1), Pupićina peć (N = 1), Vlakno (N = 74), Vela spila (N = 5), Crvena stijena (N = 3) i Badanj (N = 53) (tab. 1). Svi nalazi pripadaju periodu epigravetijenskog tehnokompleksa. Najstariji primjerak školjki roda *Glycymeris* s područja istočnog Jadrana otkriven je u stratumu 9 pećine Vlakno koji je datiran u period od prije 17 026 do 16 678 cal BP (Beta – 677 952).[78] Nalazi školjki roda *Glycymeris* pokazuju znatne razlike među lokalitetima. Na lokalitetima sjevernog Jadrana, u Šandalji II i Pupićinoj peći, otkrivena su dva izolirana primjerka školjki roda *Glycymeris*, dok glavninu uzorka čine nalazi iz Vlakna i Badnja na području središnjeg odnosno južnog Jadrana.

[75] BORIĆ et al. 2023: 8.
[76] BASLER 1976; 1979a: 1979b; 1983; WHALLON 1999; RUIZ-REDONDO et al. 2020; BORIĆ et al. 2023.
[77] BORIĆ, CRISTIANI 2019: 218; BORIĆ et al. 2023: 53.
[78] VITEZOVIĆ, VUJEVIĆ, RADOVIĆ 2024.

in the canyon of the Bregava River in Bosnia and Herzegovina, about 40 kilometres from the Adriatic coast. The Epigravettian stratigraphy of this site has provided important data on hunter-gatherer communities and settlement patterns in the hinterland of the eastern Adriatic coast. The results of the dated layers place the Upper Palaeolithic sequence in the period from 16,000 to 12,700 cal BP.[75] Badanj has yielded a rich assemblage of personal ornaments, bone artefacts with decorative incisions, and lithic material, as well as Upper Palaeolithic rock art - a rare find in the south-eastern European region.[76] Analysis of the personal ornaments indicates that a total of 53 *Glycymeris* spp. specimens were discovered in the Upper Palaeolithic layers.[77]

SYNTHESIS AND COMPARATIVE ANALYSIS OF MATERIAL

Based on the available research from the eastern Adriatic coast, a total of 137 *Glycymeris* spp. specimens from the Late Upper Palaeolithic have been documented. The distribution by site is as follows: Šandalja II (N=1), Pupićina Peć (N=1), Vlakno (N=74), Vela Spila (N=5), Crvena Stijena (N=3), and Badanj (N=53) (Tab. 1). All specimens belong to the Epigravettian techno-complex period. The oldest *Glycymeris* specimen from the Eastern Adriatic was discovered in stratum 9 of Vlakno cave, dated to the period of 17,026–16,678 cal BP (Beta – 677952).[78] The *Glycymeris* assemblage exhibits notable variation across sites. In the northern Adriatic, at Šandalja II and Pupićina Peć, only two isolated specimens were found, while the majority of the material was discovered in Vlakno and Badanj, located

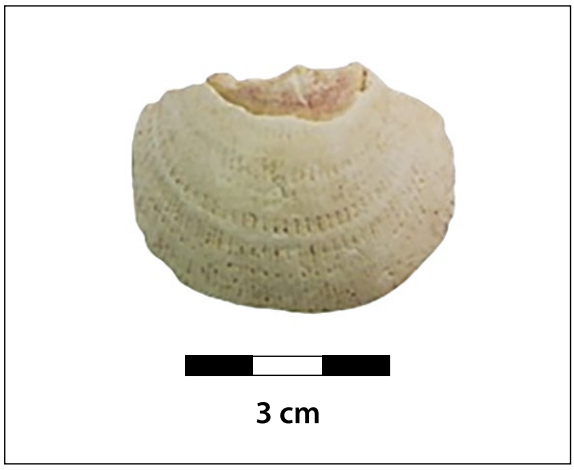
[75] BORIĆ et al. 2023: 8.
[76] BASLER 1976; 1979a: 1979b; 1983; WHALLON 1999; RUIZ-REDONDO et al. 2020; BORIĆ et al. 2023.
[77] BORIĆ, CRISTIANI 2019: 218; BORIĆ et al. 2023: 53.
[78] VITEZOVIĆ, VUJEVIĆ, RADOVIĆ 2024.

TABLICA 1. *Kategorizacija nalaza Glycymeris spp.* (izradila: B. Cvitkušić)
TABLE 1 *Categorisation of Glycymeris spp. specimens* (created by B. Cvitkušić)

Nalazište / *Site*	***Gylcymeris* spp.**		
	Kategorija 1: cjeloviti nalaz s perforacijom / *Category 1: Complete specimens with perforation*	**Kategorija 2: cjeloviti nalaz bez perforacije / *Category 2: Complete specimens without perforation***	**Kategorija 3: fragmenti / oštećeni nalazi / *Category 3: Fragmented and damaged specimens***
Šandalja II			1
Pupićina cave			1
Vlakno	25	4	45
Vela spila	5		
Crvena stijena		1	2
Badanj*	38	5	10
UKUPNO / *TOTAL*	**68**	**10**	**59**

Nalaz iz **Pupićine peći** ima oštećen dio umba i nije moguće odrediti je li bio probušen, a interpretiran je u kontekstu osobnih ukrasa (sl. 1). Primjerak *Glycymeris spp.* iz **Šandalje II** također je interpretiran u kontekstu simboličke funkcije. Nedostaje mu lijevi dio plašta, perforacija se nalazi na području umba, a na vanjskoj strani ljušture vidljivo je zaglađeno područje (sl. 2).

U **Vlaknu** je otkriveno ukupno 74 nalaza školjki roda *Glycymeris*, što je ujedno najveći broj otkrivenih primjeraka na ovome području (sl. 3). Najveći broj nalaza potječe iz stratuma 5 i 6. Prema kategorizaciji, u Vlaknu prevladavaju

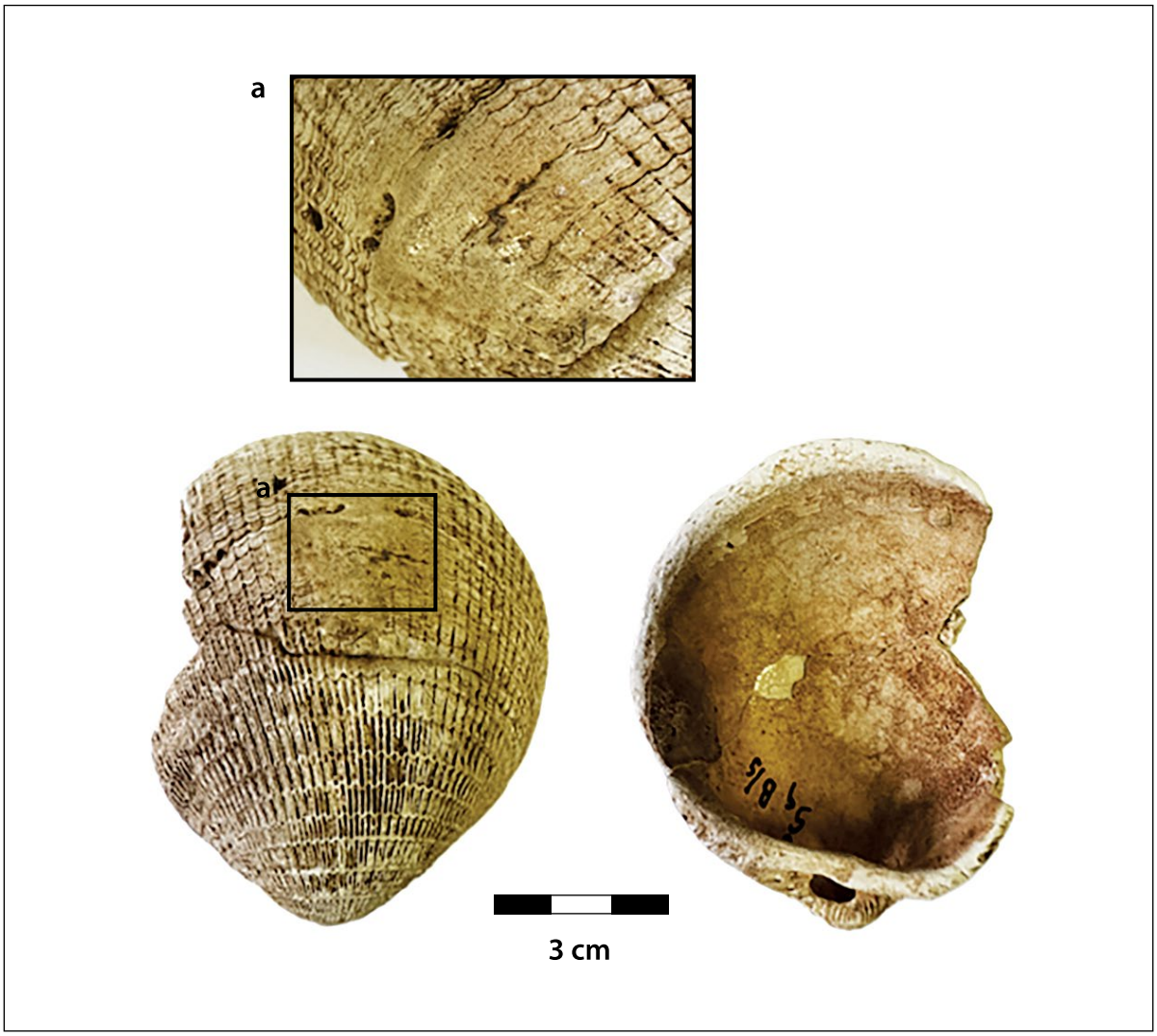


Slika 1. *Nalaz Glycymeris spp. iz Pupićine peći, sloj 379* (snimila: B. Cvitkušić)
Figure 1 *Glycymeris spp. from Pupićina Peć, Layer 379* (photo by B. Cvitkušić)

in the central and southern Adriatic regions, respectively.

The specimen from **Pupićina Peć** has a damaged umbo, making it impossible to determine whether it was originally perforated; nonetheless, it has been interpreted within the context of personal ornamentation (Fig. 1). The *Glycymeris* spp. specimen from **Šandalja II** has likewise been interpreted as having a symbolic function. The left part of its mantle margin is missing, the perforation is located in the umbo area, and a smoothed area is visible on the exterior surface of the valve (Fig. 2).

A total of 74 *Glycymeris* specimens were discovered in **Vlakno**, representing the highest concentration of specimens found in the region (Fig. 3). The majority of the specimens originated from strata 5 and 6. In terms of categorisation, the assemblage is dominated by fragments and damaged specimens (N=45), followed by complete perforated specimens (N=25), while complete, unmodified valves without modifications are the least represented (N=4) (Tab. 2). Perforations are typically located in the umbo area, although in three specimens, the perforation is located in the mantle region above the umbo. Data on the perforation position are based on direct examination of the ma-

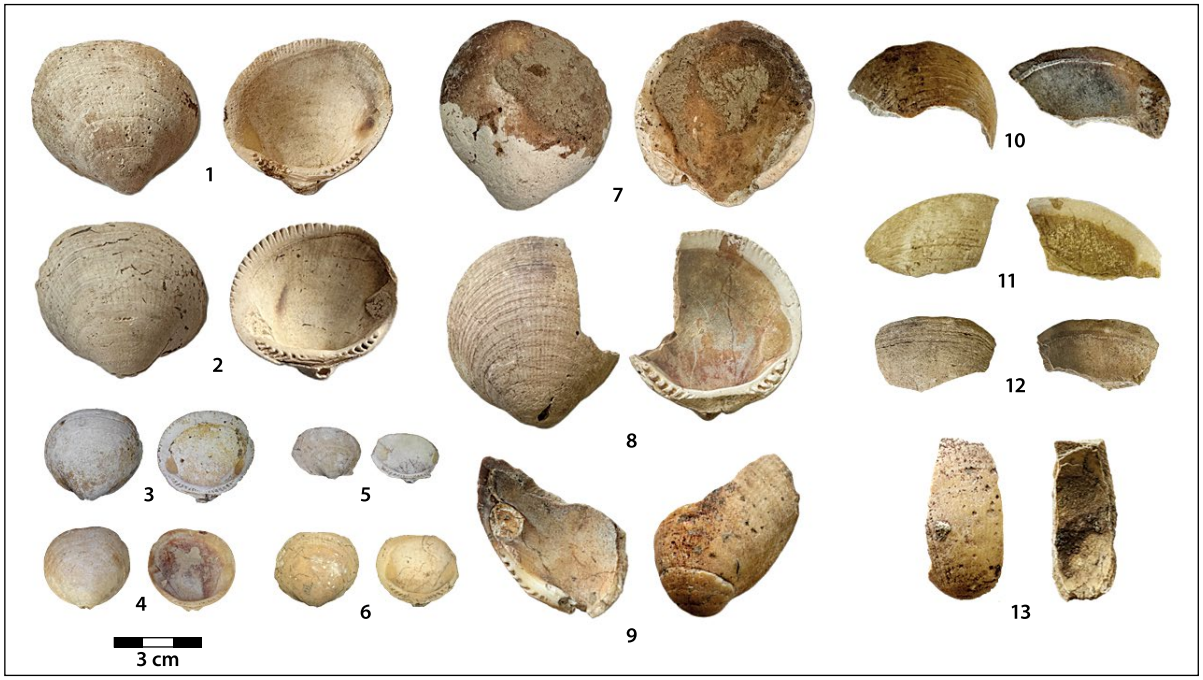


Slika 2. *Nalaz Glycymeris spp. iz Šandalje II, sloj B/s* (snimila: B. Cvitkušić)
Figure 2 *Glycymeris spp. from Šandalja II, Layer B/s* (photo by B. Cvitkušić)

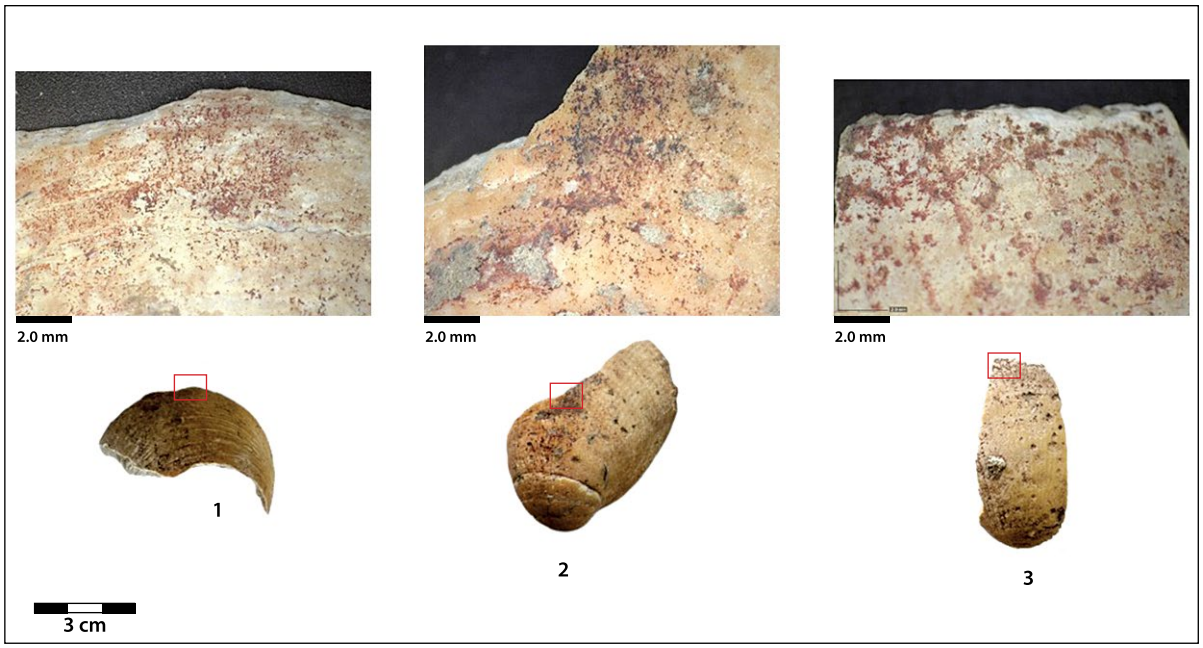
fragmenti i oštećeni primjerci (N = 45), zatim cijeli perforirani primjerci (N = 25), dok je najmanje cjelovitih školjki bez modifikacija (N = 4) (tab. 2). Perforacije su u pravilu smještene na području umba, dok je na tri primjerka zabilježena perforacija na dijelu plašta iznad umba. Podaci o položaju perforacija temelje se na izravnom uvidu u materijal. Pri radu na materijalu opaženo je kako su među perforiranim primjercima školjke velikih i malih dimenzija, dok su fragmenti isključivo dijelovi većih primjeraka. Budući da za ovaj pregledni rad nisu postavljeni standardizirani metrički kriteriji za razvrstavanje prema veličini, ove su razlike promatrane kvalitativno i interpretirane kao preliminarno zapažanje. Također, na nekim primjercima vidljivi su makroskopski

terial. During the analysis, it was observed that perforated specimens include both large and small valves, whereas the fragments are exclusively parts of larger specimens. Since no standardised metric criteria were applied for size categorisation in this review paper, these differences are considered qualitative and are presented as preliminary observations. Additionally, some specimens exhibit macroscopic traces of red pigment (ochre) (Fig. 4).

In **Vela Spila**, five complete *Glycymeris* specimens of larger dimensions were discovered, all featuring perforations at the top of the umbo. The specimens were interpreted as personal ornaments; however, it was noted



Slika 3. *Selekcija nalaza Glycymeris spp. iz Vlakna: 1. VL/O/68.3; 2. VL/O/55.3; VL/O/ 54.2; VL/O/ 68.6; VL/O/ 70.11; VL/O/ 89.2; VL/O/ 3.5; VL/O/ 98.32; VL/O/ 80.6; VL/O/ 87.6; VL/O/ 98.33; VL/O/ 98.46; VL/O/ 76/98.14* (snimila: B. Cvitkušić)
Figure 3 *Selection of Glycymeris spp. from Vlakno: 1. VL/O/68.3; 2. VL/O/55.3; VL/O/54.2; VL/O/68.6; VL/O/70.11; VL/O/89.2; VL/O/3.5; VL/O/98.32; VL/O/80.6; VL/O/87.6; VL/O/98.33; VL/O/98.46; VL/O/76/98.14* (photo by B. Cvitkušić)



Slika 4. *Selekcija nalaza Glycymeris spp. iz Vlakna s makroskopski vidljivim tragovima crvenog pigmenta: 1. VL/O/87.6; 2. VL/O/80.6; 3. VL/O/76/98.14* (snimila: B. Cvitkušić)
Figure 4 *Selection of Glycymeris spp. from Vlakno with macroscopically visible traces of red pigment: 1. VL/O/87.6; 2. VL/O/80.6; 3. VL/O/76/98.14* (photo by B. Cvitkušić)

TABLICA 2. *Distribucija Glycymeris spp. po stratumima u pećini Vlakno* (izradila: B. Cvitkušić)
TABLE 2 *Distribution of Glycymeris spp. by strata in Vlakno Cave* (created by B. Cvitkušić)

Stratum	*Glycymeris* spp.		
	Kategorija 1. Cijeli probušeni primjerci / *Category 1. Complete specimens with perforation*	**Kategorija 2. Cijeli primjerci bez perforacija / *Category 2. Complete specimens without perforation***	**Kategorija 3. Oštećeni primjerci i fragmenti / *Category 3. Fragmented and damaged specimens***
4	2	1	--
5	13	2	14
TEPHRA NYT ~ 14.9±0.4 ka cal BP			
6	9	--	31
7	--	1	--
8	--	--	--
9	1	--	--

tragovi crvenog pigmenta (oker) (sl. 4).

U **Veloj spili** otkriveno je pet cjelovitih primjeraka školjki roda *Glycymeris* većih dimenzija, s perforacijama na vrhu umba. Školjke su interpretirane kao dijelovi osobnih ukrasa, uz napomenu kako zbog prisutnosti tafonomskih promjena nije bila moguća provedba analiza tragova korištenja.[79]

U **Badnju** je dokumentirano 53 nalaza *Glycymeris* spp. (sl. 5) u sklopu analize skupa osobnih ornamenata. Točni podaci o stupnju očuvanosti nisu dostupni u literaturi, a prikazane brojke u kategorizaciji temelje se na podacima E. Cristiani.[80] Većina je cjelovitih nalaza većih dimenzija i na sebi ima perforaciju smještenu na području umba.[81] S obzirom na nedostatak metrijskih podataka, opažanja o dimenzijama temelje se na općem dojmu iz literature i osobnih komunikacija. Uz fragmentirane, u uzorku su prisutni i cjeloviti primjerci bez modifikacija, a neki primjerci pokazuju makroskopske tragove crvenog pigmenta.[82] Mikroskopske analize perforacija pokazale su tragove uporabe, sugerirajući kako su školjke bile obješene.[83]

U **Crvenoj stijeni** otkrivena su ukupno tri primjerka školjki roda *Glycymeris*: jedan cjelo-

[79] CRISTIANI, FARBSTEIN, MIRACLE 2014.
[80] Osobna komunikacija, listopad 2024.
[81] BORIĆ et al. 2023: 53.
[82] BORIĆ et al. 2023: 53.
[83] BORIĆ et al. 2023: 53.

that due to the presence of taphonomic alterations, it was not possible to conduct use-wear analysis.[79]

A total of 53 *Glycymeris* spp. specimens were documented at **Badanj** (Fig. 5) as part of the analysis of personal ornament assemblage. Precise data on their state of preservation are not available in the published literature; the categorisation presented here is based on personal communication with E. Cristiani.[80] Most complete specimens are larger in size and have perforations located in the umbo.[81] Due to the lack of metric data, observations on size are based on general impressions from the literature and personal correspondence. In addition to fragmented specimens, complete unmodified specimens are also present, and some exhibit macroscopic traces of red pigment.[82] Microscopic analyses of the perforations revealed evidence of use-wear, suggesting that the valves had been suspended.[83]

In **Crvena Stijena**, a total of three *Glycymeris* specimens were recovered: one complete unperforated specimen and two fragments (Fig. 5, 1–3). All are comparatively large. The literature mentions them in the context of personal ornamentation.

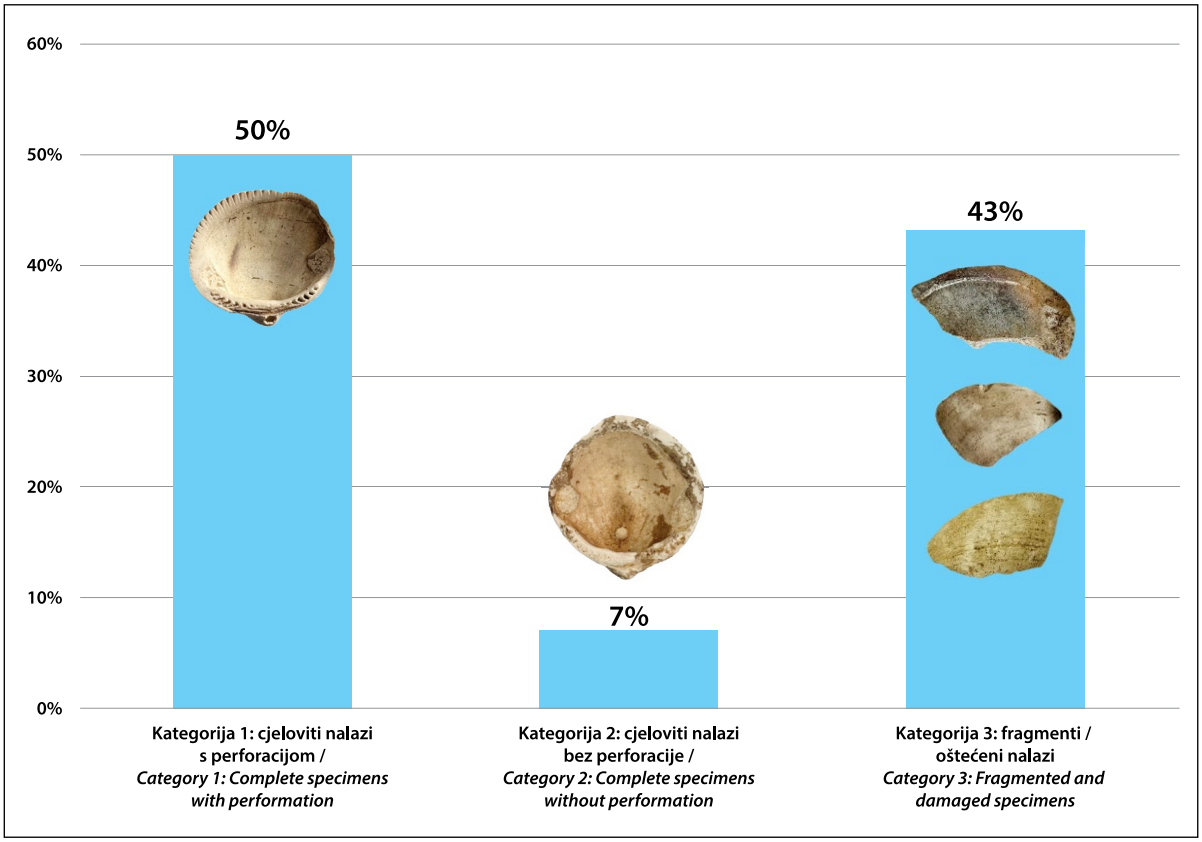
[79] CRISTIANI, FARBSTEIN, MIRACLE 2014.
[80] Personal communication, October 2024.
[81] BORIĆ et al. 2023: 53.
[82] BORIĆ et al. 2023: 53.
[83] BORIĆ et al. 2023: 53.

viti bez perforacije i dva fragmenta (sl. 5, 1-3). Svi su većih dimenzija. Literatura ih navodi u kontekstu osobnih ornamenata.

Prema kategorizaciji uzorka prema stupnju očuvanosti i prisutnosti perforacija, najzastupljenija je kategorija 1 – cjeloviti primjerci s perforacijom (oko 50 %), a slijedi je kategorija 3, koja obuhvaća fragmentirane i oštećene

In terms of sample categorisation by the state of preservation and the presence of perforations, the most common is Category 1 – complete specimens with perforation (about 50%), followed by Category 3, which includes fragmented and damaged specimens (about 43%) (Tab. 1; Graph 1). The least represented are complete unperforated specimens (Cate-

Slika 5. *Nalazi Glycymeris spp. iz Crvene Stijene (1-3), sloj VIII; Selekcija nalaza iz Badnja (4-9): 4. inv. 7463 (sq. XVII/11, 0.8-0.9); 5. inv. 7236/1 (sq. XVII/9, 1.0-1.1); 6. inv. 7705 (sq. XV/5,0.1-0.2); 7. inv. 7709 (sq. XV/5, 0.6-0.7); 8. inv. 7531;9. nv. 7391/2 (sq. XIV/6,0.6-0.7)* (prema: Borić, Cristiani 2019: 290 i Borić et al. 2023: 68; doradila: B. Cvitkušić)
Figure 5 *Glycymeris spp. from Crvena Stijena (1–3), Layer VIII; Selection of specimens from Badanj (4–9): 4. inv. 7463 (sq. XVII/11, 0.8–0.9); 5. inv. 7236/1 (sq. XVII/9, 1.0–1.1); 6. inv. 7705 (sq. XV/5, 0.1–0.2); 7. inv. 7709 (sq. XV/5, 0.6–0.7); 8. inv. 7531; 9. inv. 7391/2 (sq. XIV/6, 0.6–0.7)* (based on Borić, Cristiani 2019: 290 and Borić et al. 2023: 68; revised by: B. Cvitkušić)



Grafikon 1. *Grafički prikaz distribucije nalaza Glycymeris spp. po zadanim kategorijama* (izradila: B. Cvitkušić)
Graph 1 *Graphical representation of the distribution of Glycymeris spp. by categories* (created by B. Cvitkušić)

ne primjerke (oko 43 %) (tab. 1; grafikon 1). Najslabije su zastupljeni cjeloviti primjerci bez perforacije, odnosno kategorija 2, sa 7 %.

Veličina ljuštura također pokazuje određene obrasce. Među primjercima iz Vlakna i Badnja vizualno se uočava da su perforirani primjerci i većih i manjih dimenzija, dok su fragmentirani dijelovi ostaci većih školjki. Budući da nisu primijenjeni standardizirani mjerni kriteriji, ova opažanja imaju preliminarni karakter i ukazuju na potrebu za budućim kvantitativnim analizama veličine.

RASPRAVA

Interpretacija istočnojadranskog uzorka i regionalne usporedbe

Prikazani nalazi školjki roda *Glycymeris* iz kasnoga gornjeg paleolitika istočnog Jadrana otkrivaju složenost i raznolikost njihovih potencijalnih uloga u životu prapovijesnih

gory 2), with 7%.

The size of the specimens also exhibits specific patterns. Among the specimens from Vlakno and Badanj, visual inspection indicates the presence of both large and small perforated specimens, whereas the fragmented pieces appear to derive from larger valves. As no standardised measurement criteria were applied, these observations are preliminary and highlight the need for future quantitative analyses focused on specimen size.

DISCUSSION

Interpretation of the Eastern Adriatic Sample and Regional Comparisons

The presented *Glycymeris* shell specimens from the Late Upper Palaeolithic of the Eastern Adriatic reveal the complexity and diversity of their potential roles in the lives of prehistoric

zajednica. U literaturi su dominantno interpretirani kao simbolički predmeti korišteni kao osobni ornamenti, što i odgovara znatnim udjelom perforiranih primjeraka u uzorku (oko 50 %). Međutim, uočeni obrasci distribucije, morfoloških karakteristika, tragova pigmenta i mogući tragovi korištenja upućuju i na mogućnost višestrukih funkcija.

Izražena geografska varijabilnost u zastupljenosti nalaza može ukazivati na potencijalno različite strategije pristupa morskim resursima ili simboličkim praksama među prapovijesnim zajednicama. Ove razlike ne mogu se jednoznačno tumačiti samo tadašnjom udaljenošću lokaliteta od obale, s obzirom na to da su i južni i sjeverni lokaliteti u to vrijeme bili znatno udaljeni od mora,[84] a sadržavaju različit broj nalaza. Dodatno, nalazi školjki roda *Glycymeris* otkriveni su i u gornjopaleolitičkim slojevima sjevernijih lokaliteta koji su još udaljeniji od tadašnje obale, poput pećine Fumane u Italiji[85] ili Vogelherda i Petersfelsa u Njemačkoj.[86] Ti podaci sugeriraju važnost složenijih čimbenika, poput kulturoloških razlika, obrazaca mobilnosti, pristupa resursima, razmjena i načina prikupljanja.

Kategorizacija prema stupnju očuvanosti i prisutnosti perforacije pokazuje da većina nalaza pripada kategorijama 1 i 3, odnosno probušenim cjelovitim primjercima te fragmentima i oštećenim nalazima. Najmanje su zastupljeni cjeloviti primjerci bez perforacija. Znatna razlika u udjelu cjelovitih primjeraka s perforacijom u odnosu na one bez perforacije, osobito u usporedbi s tanatocenozom, gdje prevladavaju cjeloviti, nemodificirani primjerci[87] (tab. 3), može sugerirati selektivno prikupljanje školjki ovisno o određenoj namjeni. Neki primjerci mogli su biti korišteni kao osobni ukrasi, dok drugi, osobito oni veći i oštećeni, možda svjedoče o drukči-

[84] SURIĆ 2006; SIKORA, MIHANOVIĆ, VILIBIĆ 2014.
[85] PERESANI et al. 2019.
[86] SCHÜRCH et al. 2020; SCHÜRCH et al. 2023.
[87] SIVAN et al. 2006: 142.

hunter-gatherer communities. In the literature, they have been predominantly interpreted as symbolic objects used as personal ornaments, which aligns with the substantial proportion of perforated specimens in the sample (approximately 50%). However, observed patterns in distribution, morphological characteristics, traces of pigment, and possible use-wear suggest the possibility of multiple functions.

The pronounced geographical variability in the frequency of specimens may indicate potentially different strategies for accessing marine resources or symbolic practices among prehistoric communities. These differences cannot be explained solely by the distance of the sites from the coastline at the time, as both southern and northern sites were significantly inland during this period,[84] yet they yielded varying numbers of specimens. Furthermore, *Glycymeris* shells have also been recovered from Upper Palaeolithic layers at more distant inland sites, such as the Fumane Cave in Italy[85] or Vogelherd and Petersfels in Germany.[86] These data suggest the importance of more complex factors, such as cultural differences, mobility patterns, access to resources, exchange networks, and collection strategies.

The categorisation by state of preservation and presence of perforations shows that the majority of the specimens belong to Categories 1 and 3: complete perforated specimens, and fragmented and damaged specimens, respectively. Complete, unperforated specimens are the least represented. The marked difference in the proportion of complete perforated versus unperforated specimens — especially when compared to the thanatocoenosis, in which complete, unmodified specimens prevail[87] (Tab. 3) — may indicate selective collection of shells based on intended use. Some specimens may have been used as personal ornaments, while others, particularly larger and damaged ones, may reflect a

[84] SURIĆ 2006; SIKORA, MIHANOVIĆ, VILIBIĆ 2014.
[85] PERESANI et al. 2019.
[86] SCHÜRCH et al. 2020; SCHÜRCH et al. 2023.
[87] SIVAN et al. 2006: 142.

TABLICA 3. *Usporedba stupnja očuvanosti arheoloških nalaza Glycymeris spp. s istočnog Jadrana i nalaza iz tanatocenoze (prema Sivan et al. 2006)* (izradila: B. Cvitkušić)
TABLE 3 *Comparison of the State of Preservation of Archaeological Glycymeris spp. Specimens from the Eastern Adriatic and Thanatocoenose (based on Sivan et al. 2006)* (created by B. Cvitkušić)

	Čitavi probušeni primjerci / ***Complete specimens with perforation***	**Čitavi primjerci bez perforacije /** ***Complete specimens without perforation***	**Fragmenti i oštećeni primjerci /** ***Fragmented and damaged specimens***
Arheološki nalazi *Glycymeris* spp. s Istočnog Jadrana *Archaeological Glycymeris spp. specimens from eastern Adriatic*	50%	7%	43%
Nalazi u kontekstu tanatocenoze (Sivan et al. 2006.) *Glycymeris spp. specimens from thanatocoenosis (Sivan et al. 2006)*	20%	36%	44%

joj upotrebi – potencijalno utilitarnoj.

Analiza fragmenata školjki roda *Glycymeris*, kao i razlike u očuvanosti primjeraka, pokazali su se kao važan element u recentnim istraživanjima.[88] Relativno visok postotak fragmenata (43 %) u istočnojadranskom uzorku, koji se teško može objasniti isključivo prirodnim procesima, otvara prostor za njihovo razmatranje i uključivanje u detaljnije analize. Iako su fragmentirani primjerci načelno jednako zastupljeni i u kontekstu tanatocenoze, za razliku od arheološkog konteksta, u tanatocenozi je najveći udio fragmenata kojima je sačuvano više od pola ljušture, dok su oni koji se odnose na manje od pola ljušture zastupljeni s tek 4 %.[89] U pećini Vlakno, trenutačno najbogatijem nalazištu školjki roda *Glycymeris* na ovome području, prevladavaju nalazi kategorije 3, a uočeno je i da fragmenti pripadaju većim primjercima, dok su probušeni i veći i manji. Visok stupanj fragmentacije školjki roda *Glycymeris* zabilježen je i u orinjasijenskim slojevima pećine Fumane, gdje su nalazi interpretirani kao osobni ornamenti, dok se za neke primjerke s tragovima pigmenta navodi kako su mogli imati i višestruku funkciju.[90] Sličan obrazac prisutan je i na lokalitetima ranoga gornjeg paleoliti-

[88] CUENCA-SOLANA et al. 2011; CUENCA-SOLANA et al. 2013.
[89] SIVAN et al. 2006: 142.
[90] PERESANI et al. 2019.

different function—possibly utilitarian.

The analysis of *Glycymeris* fragments and differences in specimen preservation has emerged as an important aspect in recent research.[88] A relatively high proportion of fragments (43%) in the eastern Adriatic sample (which can hardly be explained solely by natural processes) opens the possibility for further investigation and inclusion in more detailed functional analyses. Although fragmented specimens are generally equally present in both archaeological assemblages and thanatocoenosis, the latter typically show a higher proportion of fragments in which more than half of the shell is preserved, while fragments with less than half of the shell account for only 4%.[89] At Vlakno cave - the currently richest *Glycymeris* site in the region - Category 3 dominates. It has been noted that the fragments belong to larger specimens, whereas both large and small specimens appear among the perforated examples. A similarly high degree of *Glycymeris* fragmentation has been recorded in the Aurigancian layers of Fumane cave, which were interpreted as personal ornaments. For some specimens bearing pigment traces, it has been suggested that they may have had multiple functions.[90] A comparable pattern is evident at early Upper Pal-

[88] CUENCA-SOLANA et al. 2011; CUENCA-SOLANA et al. 2013.
[89] SIVAN et al. 2006: 142.
[90] PERESANI et al. 2019.

ka u Njemačkoj.[91] Na lokalitetu Vogelherd orinjasijenski nalazi školjki roda *Glycymeris* znatno su većih dimenzija, uključujući primjerke s tragovima okera i modifikacijama koje se tumače kao spremnici za pigment te jedan primjerak s potencijalnom utilitarnom funkcijom alatke za struganje. Nasuprot tome, manji primjerci iz Hohle Felsa, Geißenklösterlea i Petersfelsa, koji pripadaju gravetijenu i magdalenijenu, većinom su bez tragova funkcionalne obrade. Ove razlike u veličini tumače se kroz prizmu kulturoloških preferencija, funkcionalnih namjena ili selektivnog prikupljanja školjki roda *Glycymeris* u različitim razdobljima i društvenim kontekstima.[92] Sličan obrazac distribucije vidljiv je i u uzorku iz Badnja te skromnijem, ali važnom uzorku iz Crvene stijene. Fragment iz Crvene stijene (sl. 5, 2), oblikom sličan pojedinim fragmentima iz Vlakna (sl. 3, 11, 12), nalikuje na fragmente morskih školjki s potvrđenim tragovima korištenja.[93] Na temelju opažanja da neki primjerci iz Badnja nemaju perforacije, autori sugeriraju da možda nisu svi služili kao ornamenti,[94] čime se otvara mogućnost njihove višestruke funkcije.

Nadalje, primjerci s tragovima pigmenta zabilježeni u Badnju i Vlaknu, uključujući i veće cjelovite školjke, mogli bi upućivati na njihovu moguću uporabu kao spremnika ili posuda za pigment – poput onih iz špilje Franchti u Grčkoj[95] ili Vogelherda[96] – što ukazuje na višestruke funkcije ovih školjki u prapovijesnom kontekstu.

Struktura i građa ljuštura školjki roda *Glycymeris* omogućuju prepoznavanje tragova tafonomskih procesa u tanatocenozi poput abrazije od šljunka i pijeska, bušenja predatora te djelovanja morskih organizama poput spužvi, zbog čega se arheološki primjerci školjki

[91] SCHÜRCH et al. 2020; SCHÜRCH et al. 2023.
[92] SCHÜRCH et al. 2023.
[93] CUENCA-SOLANA et al. 2016; MANCA et al. 2018; SCHÜRCH et al. 2023.
[94] BORIĆ et al. 2023: 53.
[95] PERLÈS 2018; 2019: 200.
[96] SCHÜRCH et al. 2023.

aeolithic sites in Germany.[91] At the Vogelherd site, the Aurignacian *Glycymeris* specimens are significantly larger in size and include examples bearing ochre residues and modifications interpreted as pigment containers, as well as one specimen interpreted as a potentially utilitarian scraping tool. In contrast, smaller specimens from Hohle Fels, Geißenklösterle, and Petersfels, from the Gravettian and Magdalenian periods, generally lack visible traces of functional modification. These size differences have been interpreted in light of cultural preferences, functional uses, or selective collection strategies of *Glycymeris* during different periods and within varied social contexts.[92] A similar pattern of distribution is observed in the sample from Badanj, as well as in the smaller yet significant sample from Crvena Stijena. A fragment from Crvena Stijena (Fig. 5, 2), which closely resembles certain fragments from Vlakno (Fig. 3, 11, 12), is morphologically similar to marine shell fragments with confirmed use-wear traces.[93] Based on the observation that some specimens from Badanj lack perforations, the researchers have suggested that not all of them necessarily served as ornaments,[94] thereby opening the possibility of their multiple functions.

Furthermore, specimens with pigment traces recorded at Badanj and Vlakno, including larger complete valves, may indicate their possible use as containers or vessels for pigment, comparable to those from Franchti Cave in Greece[95] or Vogelherd[96] – indicating the multiple functions of *Glycymeris* shells in prehistoric contexts.

The structure and composition of *Glycymeris* shells allow for the recognition of traces of taphonomic processes in a thanatocoenosis, such as abrasion from gravel and sand, predator drilling, and the activity of marine organisms such as sponges. For this reason, archae-

[91] SCHÜRCH et al. 2020; SCHÜRCH et al. 2023.
[92] SCHÜRCH et al. 2023.
[93] CUENCA-SOLANA et al. 2016; MANCA et al. 2018; SCHÜRCH et al. 2023.
[94] BORIĆ et al. 2023: 53.
[95] PERLÈS 2018; PERLÈS 2019: 200.
[96] SCHÜRCH et al. 2023.

roda *Glycymeris* najčešće i tumače kao prazne školjke prikupljene za uporabu kao ukrasi ili spremnici.[97]

POTENCIJAL ZA FUNKCIONALNA ISTRAŽIVANJA

Preliminarno zapažanje mogućih tragova korištenja na primjercima iz Vlakna[98] sugerira da njihova funkcija nije bila isključivo simbolička. Recentna istraživanja, poput istraživanja morskih školjki s lokaliteta Fuente del Salín u Španjolskoj,[99] pokazuju višestruku ulogu morskih školjki u različitim utilitarnim funkcijama, poput struganja biljnih vlakana, drva, životinjskih koža i mineralnih tvari,[100] no takve interpretacije na području istočnog Jadrana za sada ostaju na razini pretpostavke.

Interpretaciju funkcije školjki *Glycymeris* s istočnog Jadrana otežava loša očuvanost materijala i nedostatak sustavnih funkcionalnih analiza. Učestala pojava fragmentacije u prirodnim i arheološkim kontekstima otvara pitanje jesu li arheološki fragmenti posljedica selektivnog prikupljanja iz tanatocenoze, funkcionalne uporabe, namjernog lomljenja ili depozicijskih i postdepozicijskih procesa. Eksperimenti su pokazali da školjke roda *Glycymeris*, zbog izrazito čvrste strukture, ne razvijaju makrotragove na korištenim dijelovima rubova ljušture pri uporabi u funkciji alatke, već isključivo mikroskopske tragove u obliku specifičnog mikroreljefa, zaglađenosti i brazda.[101] Zbog toga su integrativne mikroskopske analize tragova korištenja, eksperimentalne provjere pretpostavljenih funkcija i detaljne tafonomske studije koje se bave karakterizacijom postdepozicijskih

97 STINER 1999: 742.
98 CVITKUŠIĆ, CRISTIANI, VUJEVIĆ 2024.
99 CUENCA-SOLANA et al. 2013.
100 CUENCA-SOLANA et al. 2013; 2016; MANCA et al. 2018; SCHÜRCH et al. 2020; CLEMENTE-CONTE et al. 2024.
101 MANCA 2018.

ological *Glycymeris* specimens are most often interpreted as empty shells collected for use as ornaments or containers.[97]

POTENTIAL FOR FUNCTIONAL RESEARCH

Preliminary observations of possible use-wear traces on specimens from Vlakno[98] suggest that their function was not exclusively symbolic. Recent studies, such as those on marine shells from the Fuente del Salín site in Spain,[99] demonstrate the multifunctional use of marine shells in performing various utilitarian functions, including the scraping of plant fibres, wood, animal hides, and mineral substances.[100] However, such interpretations in the eastern Adriatic context remain, for now, at the level of hypothesis.

The interpretation of the function of *Glycymeris* shells from the eastern Adriatic is challenged by the poor preservation of the material and the lack of systematic functional analyses. The frequent occurrence of fragmentation in both natural and archaeological contexts raises the question of whether the archaeological fragments result from selective collection from thanatocoenosis, functional use, intentional breakage, or depositional and post-depositional processes. Experimental studies have shown that, due to their highly robust structure, *Glycymeris* shells do not develop macroscopic wear traces on the working edges when used as tools, but rather only microscopic traces in the form of distinctive microrelief patterns, smoothing, and striations.[101] Therefore, integrative microscopic use-wear analyses, experimental verification of presumed functions, and detailed taphonomic studies, such as the recent pioneering research

97 STINER 1999: 742.
98 CVITKUŠIĆ, CRISTIANI, VUJEVIĆ 2024.
99 CUENCA-SOLANA et al. 2013.
100 CUENCA-SOLANA et al. 2013; 2016; MANCA et al. 2018; SCHÜRCH et al. 2020; CLEMENTE-CONTE et al. 2024.
101 MANCA 2018.

tragova na morskim školjkama, poput recentne pionirske studije koju su 2023. proveli Cuenca-Solana i suradnici,[102] ključne za razlikovanje prirodnih i antropogenih oštećenja. Nadalje, etnografski podaci također pružaju korisne uvide, osobito za prepoznavanje funkcionalnih aspekata neobrađenih i fragmentiranih školjki, na čemu se temelje brojni eksperimentalni protokoli.[103] Integrativni pristupi omogućuju diferencijaciju između simboličkih i utilitarnih funkcija, što je istaknuto i u recentnim istraživanjima.[104] Ovakva daljnja interdisciplinarna istraživanja mogla bi pridonijeti boljem razumijevanju odnosa dostupnosti, upotrebe i simbolike školjki *Glycymeris* u različitim regionalnim i kulturnim kontekstima.

ZAKLJUČAK

Nalazi školjki roda *Glycymeris* spp. iz kasnoga gornjeg paleolitika istočnog Jadrana predstavljaju vrijedan doprinos razumijevanju raznolikosti upotrebe morskih resursa u prapovijesnim zajednicama. Iako su dosad dominantno interpretirane kao osobni ornamenti, dio primjeraka pokazuje obilježja koja otvaraju prostor za razmatranje njihove potencijalne utilitarne funkcije.

Sinteza dokumentiranih školjki roda *Glycymeris* s gornjopaleolitičkih lokaliteta istočnog Jadrana pokazuje potrebu i potencijal za detaljnim funkcionalnim istraživanjima. Višestruke funkcionalne uloge ovih školjki dodatno potvrđuju nalazi iz gornjopaleolitičkih nalazišta, gdje se pojavljuju u simboličkim i utilitarnim kontekstima. Integrirani analitički pristupi omogućili bi kvantitativnu obradu u širem regionalnom okviru te doprinijeli usporedbi i preciznijem pozicioniranju istočnojadranskih nalaza

[102] CUENCA-SOLANA et al. 2023.
[103] CUENCA-SOLANA et al. 2011; CUENCA-SOLANA et al. 2013; MANCA 2016.
[104] CLEMENTE-CONTE et al. 2024.

conducted by Cuenca-Solana et al. (2023)[102] on post-depositional modifications of marine shells, are essential for distinguishing between natural and anthropogenic alterations. Furthermore, ethnographic data also provide valuable insights, particularly in recognising the functional potential of unmodified and fragmented shells, which form the basis of numerous experimental protocols.[103] Integrative approaches allow for the differentiation between symbolic and utilitarian functions, as highlighted in recent studies.[104] Continued interdisciplinary research of this kind could significantly contribute to a more comprehensive understanding of the relationship between the availability, use and symbolism of *Glycymeris* shells in different regional and cultural contexts.

CONCLUSION

The *Glycymeris* spp. specimens from the Late Upper Palaeolithic of the Eastern Adriatic offer valuable insight into the diverse use of marine resources by prehistoric communities. Although they have predominantly been interpreted as personal ornaments, some specimens exhibit characteristics that raise the possibility of utilitarian function.

The synthesis of documented *Glycymeris* material from Upper Palaeolithic sites in the Eastern Adriatic underscores both the need and the potential for detailed functional research. Evidence from other Upper Palaeolithic contexts suggests that these shells fulfilled multiple roles, appearing in both symbolic and utilitarian settings. The application of integrated analytical approaches would enable more robust quantitative analyses within a broader regional framework and facilitate the comparative interpretation and more precise positioning of the Eastern Adriatic assemblage

[102] CUENCA-SOLANA et al. 2023.
[103] CUENCA-SOLANA et al. 2011; CUENCA-SOLANA et al. 2013; MANCA 2016.
[104] CLEMENTE-CONTE et al. 2024.

unutar mediteranskoga arheološkog konteksta.

Varijabilnost u veličinama, očuvanosti i distribuciji školjki te prisutnost tragova pigmenta i mogućih tragova korištenja ukazuju na potrebu za daljnjim interdisciplinarnim istraživanjima. Sustavne mikroskopske i eksperimentalne analize, u kombinaciji s tafonomskim i kontekstualnim pristupima, mogle bi pružiti precizniji uvid u načine na koje su korišteni ovi morski resursi.

within the wider Mediterranean archaeological record.

Variation in size, state of preservation, and spatial distribution, together with the presence of pigment residues and possible use-wear traces, indicates the necessity for further interdisciplinary research. Systematic microscopic and experimental analyses, combined with taphonomic and contextual studies, may yield a more accurate insight into the utilisation of these marine resources.

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