ARHEOMETRIJA KERAMIKE BRONČANOG DOBA S TROGIRSKOG PODRUČJA

ARCHAEOMETRY OF BRONZE-AGE CERAMICS FROM THE AREA OF TROGIR

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U radu se donose rezultati arheometrijske analize lončarije s nekoliko brončanodobnih nalazišta na području srednje Dalmacije. Provedena je mineraloško-petrografska analiza 38 tankih izbrusaka keramike metodom optičke mikroskopije, dok je na manjem broju uzoraka mineralni sastav određen metodom rendgenske difrakcije na prahu. Analizom rezultata dobivene su informacije o karakteristikama glinovite sirovine, podaci o vrsti i udjelu neplastičnih primjesa, namjerno dodavanih glini, ali i informacije o tehnikama izrade i temperaturama pečenja keramike. Istraživanje je pokazalo da su brončanodobni lončari vjerojatno koristili lokalnu, lako dostupnu glinu i da su joj dodavali neplastične primjese: kalcit, sedimentne stijene i grog. Razmatranjem tehnoloških izbora uočene su promjene u lončarskim praksama između prve i posljednje faze brončanog doba. Također, razvidna je dugotrajna tradicija upotrebe kalcita koji u posljednjoj fazi brončanog doba postaje dominantna primjesa. S druge strane, od ranoga brončanog doba lončari smjesi dodaju i grog, samostalno ili u kombinaciji s kalcitom te rjeđe usitnjenim sedimentnim stijenama, a takva se praksa postupno napušta od kasnoga brončanog doba. Stoga, rezultati ukazuju na vezu između odabira primjesa i kronoloških obrazaca, odnosno takva praksa mogla je biti povezana s periodičnim utjecajima različitih društvenih faktora.

Ključne riječi:
srednja Dalmacija, brončano doba, lončarija, rendgenska difrakcija na prahu, optička mikroskopija, lončarske sirovine, lončarske primjese

The paper presents the results of archaeometric analysis of pottery from several Bronze Age sites in the area of central Dalmatia. A mineralogico-petrographic analysis of 38 thin sections of pottery was carried out using the method of optical microscopy, while the mineral composition of a smaller number of samples was determined using the X-ray powder diffraction method. The research provided data on the characteristics of the clay raw material, the type and proportion of non-plastic tempers intentionally added to the clay, and information on the production techniques and firing temperatures. The research showed that Bronze Age potters very likely used local, easily available clay and non-plastic tempering material: calcite, sedimentary rocks and grog. Through consideration of technological choices, changes in pottery practices between the first and last phases of the Bronze Age were observed. The long-term tradition of using calcite, which becomes a dominant tempering material in the last phase of the Bronze Age, is evident. On the other hand, from the Early Bronze Age, potters used grog, either alone or in combination with calcite and, more rarely, crushed sedimentary rocks, and this practice seems to have been slowly abandoned after the Late Bronze Age. The results therefore indicate a correlation between selection of tempering material and chronological patterns, that is, such a practice could have been related to the periodic influences of various social factors.

Keywords:
Central Dalmatia, Bronze Age, pottery, optical microscopy, X-ray powder diffraction, pottery raw materials, tempering material

Uvod

Lončarstvo brončanog doba na području Dalmacije još je prilično neistraženo. Keramika srednjeg i osobito kasnoga brončanog doba s kontinuitetom u ranu fazu željeznog doba, iako fizički prisutna na velikom broju nalazišta,[1] i dalje predstavlja skup nalaza uglavnom nepotpunog konteksta, s često selektivnim i nesistematiziranim načinom obrade, što je rezultiralo nedostatkom jasnog tipološko-kronološkog okvira za srednjodalmatinski prapovijesni keramički materijal. Pristup obradi lončarije uglavnom se temelji na kulturno-povijesnom pristupu, dok pokušaji kvalitativne analize te razmatranja o interakciji, trgovini i razmjeni, koja uključuju lončariju kao aktivne medijatore kulturnih i društvenih zbivanja na području Jadrana, predstavljaju rijetkost[2]. Iz navedenih razloga, ali i zbog tradicionalnog pristupa obradi keramike, stječe se dojam da u kontekstu istraživanja lončarije brončanog doba na području istočne jadranske obale nema primjetnih pomaka. Primjenom drugačijeg istraživačkoga pristupa, ovom studijom nastoji se utjecati na stanje istraženosti, stavljajući fokus na pitanja vezana uz tehnologiju proizvodnje, upotrebu i distribuciju lončarije.[3] Time se pruža potencijal za nove interpretacije, što u konačnici omogućava i bolje razumijevanje svakodnevnog života zajednica brončanoga doba Dalmacije. Stoga, prva je faza ovih istraživanja usmjerena na lončarske sirovine, odnosno glinoviti materijal i lončarske primjese primjenom interdisciplinarne metodologije. Cilj je proučiti mineraloško-petrografske značajke glinovitog matriksa, mineralnih inkluzija i primjesa, koje je lončar dodavao glini, radi klasifikacije grupa i podgrupa strukture keramike (engl. *fabric groups*). Klasifikacija struktura uzoraka u grupe i podgrupe označava kompozicijske razlike među uzorcima[4] i temelji se na razlikama u vrsti korištenih glina, dok se izdvajanje podgrupa zasniva na dodanoj komponenti, odnosno neplastičnim primjesama. Naime, na sastav lončarske smjese, osim prirodnih čimbenika, utječe i način na koji je lončar pripremio sirovinu te način na koji je posudu gradio i pekao. Stoga, obrasci uočeni u strukturi uzoraka predstavljaju svojevrsni lončarski otisak u materijalu iz kojeg se iščitavaju karakteristični tehnološki izbori. Time se prikupljaju podaci o vrsti sirovinskog materijala korištenog za izradu keramičkih predmeta te podaci o tehnikama izrade posuda i procijenjenoj temperaturi pečenja, a cilj je takve analize rekonstruirati cjelokupni postupak proizvodnje. Cilj je istraživanja i ustanoviti postoje li razlike u lončarskoj praksi kroz relativno dugo razdoblje između ranog i kraja kasnoga brončanog doba na području srednje Dalmacije.

U prvoj fazi istraživanja prikupljeni su uzorci lončarije sa šest poznatih nalazišta na trogirskom području i jedan ulomak s nepoznate lokacije (Sl. 1). Strategija uzorkovanja temelji se na tri osnovna kriterija (Tab. 1), od kojih prvi obuhvaća fizičke karakteristike keramike definirane na temelju tehnoloških parametara koji omogućuju klasifikaciju strukture keramike za svako

Introduction

Bronze Age pottery in Dalmatia is still relatively unexplored. Pottery of the Middle and, especially, Late Bronze Age with continuity into the early phase of the Iron Age, although physically present in many sites,[1] still represents a set of findings with a mostly incomplete context, often with a selective and unsystematized processing method, which has resulted in the lack of a clear typologico-chronological framework for Central Dalmatian prehistoric ceramic material. The processing of the pottery is based mainly on a culturo-historical approach, while attempts at qualitative analysis and consideration of interaction, trade and exchange that include pottery as an active mediator of cultural and social events in the Adriatic region are rare.[2] For the above reasons, but also because of the traditional approach, one gets the impression that there are no noticeable changes in the context of research into Bronze Age pottery on the eastern Adriatic coast. By applying a different research approach, this study tries to influence the state of research by focusing on issues relating to ceramic production, use and distribution.[3] This provides the potential for new interpretations, ultimately enabling a better understanding of the daily life of the Bronze Age communities of Dalmatia. Therefore, the first phase of this research is focused on pottery raw materials, i.e. clay and tempering material, using an interdisciplinary methodology and the archaeometry of ceramics. The goal is to study the mineralogico-petrographic features of the clay matrix, mineral inclusions and tempers that the potter added to the clay, to classify fabric groups and subgroups. The classification of fabric groups and subgroups indicates compositional differences between samples,[4] and it is based on differences in the type of clay used. In contrast, subgroups are separated on the basis of the added tempering material. The composition of the clay paste is influenced not only by natural factors, but also by the way the potter prepared the raw materials, as well as the way the vessel was built and fired. Therefore, the patterns observed in the ceramic fabrics represent a potter's imprint in the material from which characteristic technological choices can be read. This collects data on the type of raw material used for the production of ceramic objects, as well as data on the building techniques and the estimated firing temperature. The goal of such an analysis is to reconstruct the entire production process. The goal of the research is to establish whether there are differences in pottery practice over the relatively long period between the Early Bronze Age and the end of the Late Bronze Age in Central Dalmatia.

In the first stage of this study, pottery samples were collected from six sites in the Trogir area, and one fragment came from an unknown location (Fig. 1). They were chosen on the basis of two basic criteria (Table 1), the first of which includes the physical characteristics of pottery defined on the basis of technological parameters that enable the classification of the fabric for each

1 Barbarić 2011, 281; Paraman, Ugarković, Steskal 2020.
2 Arena 2020; Arena *et al.* 2020.
3 Tite 1999; Sillar, Tite 2000, 6; Albero Santacreu 2014.
4 Quinn 2013.

1 Barbarić 2011, 281; Paraman, Ugarković, Steskal 2020.
2 Arena 2020; Arena *et al.* 2020.
3 Tite 1999; Sillar, Tite 2000, 6; Albero Santacreu 2014.
4 Quinn 2013.

SLIKA 1. Položaj arheoloških nalazišta na trogirskom području (izradila L. Paraman; podloga: Google Maps).

FIGURE 1. Location of archaeological sites in the Trogir area (made by L. Paraman; background: Google Maps).

pojedino nalazište. Postupak klasifikacije proveden je uvidom u svježi lom keramike. Drugi je kriterij usmjeren na morfološke karakteristike, tipične za brončanodobnu i u jednom slučaju željeznodobnu posudu, primjerice oblikovanje ruba oboda te rjeđe djelomično cjelovite posude. Treći je kriterij vremenski kontekst uzoraka, određen na temelju postojećih objava[5] te izvješća[6] o istraživanjima pojedinih nalazišta koja se uglavnom oslanjaju na tradicionalni, tipološko-kronološki pristup te rjeđe radiokarbonsko datiranje nalazišta.

site. The classification procedure was carried out with the naked eye and on a freshly broken ceramic. The second criterion focuses on the morphological characteristics typical of Bronze Age and, in one case, Iron Age vessels: for example, the shaping of the edge of the rim and, more rarely, partially complete vessels. The temporal context of the samples was determined on the basis of previous publications[5] and reports[6] on the excavations of individual sites, in which analyses and dating of pottery are based mainly on the traditional, typologico-chronological approach, and less often on radiocarbon dating of the sites.

5 Babić, Kirigin, Paraman 2020; Paraman, Ugarković, Steskal 2020; Paraman, Ugarković 2021.

6 Madiraca 2012; 2013; Paraman, Šuta 2016; Jerončić 2017a; 2017b.

5 Babić, Kirigin, Paraman 2020; Paraman, Ugarković, Steskal 2020; Paraman, Ugarković 2021.

6 Madiraca 2012; 2013; Paraman, Šuta 2016; Jerončić 2017a; 2017b.

Nalazište / Site	Uzorak / Sample ID	Datacija / Date	Kontekst / Context	Struktura keramike / Ceramic fabric	Oblik posude / Vessel Shape	Debljina stijenke / Wall thickness (cm)	Obrada vanjske površine / Ext Surf Treat	Obrada unutarnje površine / Int Surf Treat	Boja vanjske pov / Ext Surf Colour	Boja unutarnje pov / Int Surf Colour	Boja jezgre / Core Colour
Trogir	57	EIA	priobalno naselje / coastal settlement	fina / fine	lonac / pot	0.6	SM	SM	BR / GR	GR	OR / GR
	58	MBA / LBA	priobalno naselje / coastal settlement	srednje fina / medium	lonac / pot	0.5	SM	SM	OR / GR	OR / GR	DGR
	59	LBA / EIA	priobalno naselje / coastal settlement	srednje fina / medium	lonac / pot	0.9	SM	SM	LGR / B	B	GR
	60	LBA / EIA	priobalno naselje / coastal settlement	srednje fina / medium	lonac / pot	0.7	SM	SM	OR	OR	DGR
	61	LBA	priobalno naselje / coastal settlement	srednje fina / medium	zdjela / bowl	0.6	SM	SM	OR	OR	GR
	62	MBA / LBA	priobalno naselje / coastal settlement	srednje fina / medium	zdjela / bowl	0.6	SM	SM	LBR / GR	LBR / GR	GR
	63	LBA	priobalno naselje / coastal settlement	srednje fina / medium	lonac / pot	0.5	SM	SM	LBR / GR	DGR	DGR
Bristivica-Šupljak	64	EBA	gomila / tumulus	srednje fina / medium	/	0.7	SM	SM	BR / GR	BR / GR	DGR
	65	EBA	gomila / tumulus	gruba / course	/	0.7	UN	UN	BR	OR / BR	DGR
	66	EBA	gomila / tumulus	gruba / course	/	0.5	UN	SM	R / BR	BR	DGR
	67	EBA	gomila / tumulus	gruba / course	/	0.7	UN	SM	OR / BR	BR	DGR
Vinište-Oriovišćak	68	LBA	gradina / hillfort	srednje fina / medium	lonac / pot	0.7	UN	UN	OR / B	OR	OR / GR
	69	LBA	gradina / hillfort	srednje fina / medium	lonac / pot	0.9	SM	SM	LBR	LBR	GR
	70	LBA	gradina / hillfort	srednje fina / medium	lonac / pot	0.6	SM	SM	OR / BR	BR	DGR
	71	MBA / LBA	gradina / hillfort	srednje fina / medium	lonac / pot	0.5	SM	UN	BR / GR	GR	DGR
	72	MBA / LBA	gradina / hillfort	srednje fina / medium	zdjela / bowl	0.7	UN	UN	OR / BR	OR / BR	DGR
	73	MBA / LBA	gradina / hillfort	srednje fina / medium	lonac / pot	0.7	UN	UN	OR / B	OR	OR / GR
Marina-Drid	74	LBA	gradina / hillfort	srednje fina / medium	lonac / pot	0.5	UN	UN	OR	OR	OR
	75	LBA	gradina / hillfort	srednje fina / medium	lonac / pot	0.7	slip	slip	LBR	LBR	DGR
	76	MBA / LBA	gradina / hillfort	srednje fina / medium	zdjela / bowl	0.5	slip	slip	BR / R	GR	LGR
	77	MBA / LBA	gradina / hillfort	srednje fina / medium	zdjela / bowl	0.5	slip	SM	BR	DGR	DGR

Nalazište / Site	Uzorak / Sample ID	Datacija / Date	Kontekst / Context	Struktura keramike / Ceramic fabric	Oblik posude / Vessel Shape	Debljina stijenke / Wall thickness (cm)	Obrada vanjske površine / Ext Surf Treat	Obrada unutarnje površine / Int Surf Treat	Boja vanjske pov / Ext Surf Colour	Boja unutarnje pov / Int Surf Colour	Boja jezgre / Core Colour
Seget Gornji-Sutilla	78	LBA	gradina / hillfort	srednje fina / medium	lonac / pot	0.6	SM	SM	B / BW	B / BW	LGR
	79	LBA	gradina / hillfort	srednje fina / medium	lonac / pot	0.8	SM	SM	B / OR	B / BW	GR
	80	LBA / EIA	gradina / hillfort	srednje fina / medium	lonac / pot	1.1	SM	SM	BR / R	BR / R	DGR
	81	LBA / EIA	gradina / hillfort	srednje fina / medium	lonac / pot	0.9	SM	SM	BR / R	BR / R	DGR
	82	LBA / EIA	gradina / hillfort	srednje fina / medium	lonac / pot	0.6	SM	SM	OR	BR / OR	DGR
	83	LBA / EIA	gradina / hillfort	srednje fina / medium	lonac / pot	0.5	SM	SM	BR / R	BR / R	DGR
	84	MBA / LBA	gradina / hillfort	srednje fina / medium	lonac / pot	0.8	SM	SM	OR / BR	LGR	DGR
	85	LBA	gradina / hillfort	srednje fina / medium	lonac / pot	0.8	SM	SM	BR / R	BR / R	DGR
	86	MBA / LBA	gradina / hillfort	srednje fina / medium	lonac / pot	0.7	SM	SM	BR	LBR	DGR
	87	LBA / EIA	gradina / hillfort	srednje fina / medium	zdjela / bowl	0.5	SM	SM	BR / GR	GR	DGR
	98	LBA / EIA	gradina / hillfort	fina / fine	lonac / pot	0.6	BU	UN	B / BW	B / BW	OR
Plano-Kraljeva ograda	93	MBA	ograđeno naselje / enclosure	srednje fina / medium	/	0.7	slip	slip	LBR	LB / GR	DGR
	94	MBA	ograđeno naselje / enclosure	srednje fina / medium	/	0.6	SM	SM	GR	DGR	DGR
	95	MBA	ograđeno naselje / enclosure	srednje fina / medium	/	0.6	SM	SM	BR	BR	DGR
	96	MBA	ograđeno naselje / enclosure	srednje fina / medium	/	0.5	SM	UN	BR	DGR	DGR
	97	MBA	ograđeno naselje / enclosure	srednje fina / medium	/	0.7	slip	SM	BR	BR	DGR
Okolica Trogira	110	EBA	gomila / tumulus (?)	srednje fina / medium	lonac / pot	0.5	slip	slip	BR	GR	DGR

TABLICA 1. Popis uzoraka lončarije s opisom konteksta pronalaska i osnovnim fizičkim karakteristikama (SM: zaglađena, UN: netretirana, BU: glačana, BR: smeđa, G: siva, DGR: tamnosiva, LGR: svijetlo siva, OR: narančasta; R: crvena, B: bež, W: bjelkasta); EBA: rano brončano doba; MBA: srednje brončano doba; MBA/LBA: ulomci s morfološkim karakteristikama srednjeg i kasnog brončanog doba; LBA: kasno brončano doba; EIA: rano željezno doba; LBA/EIA: ulomci s morfološkim karakteristikama kasnog brončanog i ranog željeznog doba (izradile A. Kudelić i L. Paraman).

TABLE 1. A list of pottery samples with a description of the context and the basic physical characteristics of the ceramics (SM: smoothed, UN: untreated, BU: burnished; BR: brown, G: grey, DGR: dark grey, LGR: light grey, OR: orange; R: red, B: beige, W: white); EBA: Early Bronze Age; MBA: Middle Bronze Age; MBA/LBA fragments with morphological characteristics of the Middle and Late Bronze Age LBA: Late Bronze Age; EIA: Early Iron Age; LBA/EIA: fragments with morphological characteristics of Late Bronze and Early Iron Age (made by A. Kudelić and L. Paraman).

Arheološka nalazišta i uzorci keramike

Trogir

Zaštitnim arheološkim iskopavanjima u povijesnoj jezgri Trogira[7], uz materijalne ostatke iz različitih epoha novije i starije prošlosti, otkriveni su i prapovijesni naseobinski slojevi. Prve analize prapovijesnoga keramičkog materijala ukazale su na povezanost nekih ulomaka s razdobljem eneolitika, dok je većina datirana u rasponu od ranoga brončanog do mlađega željeznog doba.[8] Najveća pak grupa prapovijesne lončarije potječe iz iskopavanja u južnoj, gospodarskoj zgradi palače Garagnin – Fanfogna (današnjem lapidariju Muzeja grada Trogira, dalje u tekstu MGT), čija je preliminarna analiza nedavno objavljena[9]. Sondiranjem kulturnih slojeva na dubini od 1,40 m (razina helenističkoga kulturnog sloja) do 3,94 m prikupljeno je 1800 keramičkih ulomaka, od čega je 215 dijagnostičkih (rubovi, dna, ručke i drške, ukrašeni ulomci). Iako stratigrafski podaci o slojevima i pripadajućim nalazima nisu sačuvani, značajno je da su oni datirani 14C metodom, analizom drvenog ugljena iz dvaju različitih stratuma – prvi je uzorak prikupljen na dubini od 3,10 m (2836 ± 90 godina prije sadašnjosti), a drugi na dubini od 3,70 m (3580 ± 95 godina prije sadašnjosti). U dubljem sloju rezultati ukazuju na početak srednjega brončanog doba, odnosno razdoblje između 17. i kraja 16. stoljeća pr. n. e., dok rezultat analize ugljena iz plićeg sloja pokazuje početak starijega željeznog doba, odnosno razdoblje između sredine 10. i sredine 8. st. pr. n. e.[10] Na žalost, ove datume nije moguće povezati s konkretnim keramičkim nalazima budući da su detaljniji kontekstualni podaci za prikupljene ulomke izgubljeni. Preliminarna je analiza pripisala većinu ulomaka lončariji kasnoga brončanog i željeznog doba, dok je određeni broj ulomaka pripisan lončarskom stilu ranijih faza brončanog doba.[11]

Pregledom dijagnostičkih ulomaka za analize izdvojeno je sedam uzoraka keramike (T. 1) koji predstavljaju karakteristične skupine keramičkih struktura, određene na temelju uvida u svježi lom keramike. Pritom su odabrani i oni ulomci koji pokazuju morfološke karakteristike brončanodobne keramike, a izdvojen je i jedan ulomak željeznodobnog lonca (uzorak 57).

Archaeological sites and pottery samples

Trogir

Preventive archaeological excavations in the historical core of Trogir,[7] in addition to material remains from various eras of the recent and more distant past, have also revealed prehistoric settlement layers. The first analysis of the prehistoric pottery indicated the connection of some sherds with the Copper Age, with most of the sherds dated in the range between the Early Bronze Age and the Late Iron Age.[8] The largest group of prehistoric pottery comes from excavations in the south outbuilding of the Garagnin-Fanfogna Mansion (today's Lapidarium of the Trogir Town Museum, hereinafter TTM) in 1978 and 1980, the preliminary analysis of which was recently published.[9] Through probing of the cultural layers at a depth of 1.40 m (the level of the Hellenistic cultural layer) to 3.94 m, a set of 1,800 ceramic fragments was collected, of which 215 are diagnostic (rim, base, handles, grips and decorated sherds). Although the stratigraphic data on the layers and associated finds have not been preserved, it is significant that charcoal from the features was dated by 14C from two different strata: the first sample was collected at a depth of 3.10 m (2836 ± 90 BP), and the second at a depth of 3.70 m (3580 ± 95 BP). In the deeper layer, the results indicate the beginning of the Middle Bronze Age, i.e. the period between the 17th century BC and the end of the 16th, while the result of carbon dating from the shallower layer shows the beginning of the Early Iron Age, i.e. the period between the middle of the 10th century BC and the middle of the 8th century. [10] Unfortunately, it is not possible to link these dates to concrete ceramic finds, since more-detailed contextual information for the sherds collected has been lost. Preliminary analysis of the pottery attributed most of the sherds to pottery of mostly to the Late Bronze and Iron Ages, while a number of sherds were attributed to the pottery tradition of the earlier phases of the Bronze Age.[11]

Seven ceramic samples (Pl.1) were singled out for analysis by examining the diagnostic sherds, representing characteristic groups of fabrics determined on fresh cross-sections of pottery. At the same time, those fragments that show morphological characteristics typical of Bronze Age pottery were selected, and one fragment of an Iron Age pot (sample 57) was also selected.

7 Pregled istraživanja i osnovna bibliografija kod Babić, Kirigin, Paraman 2020, 31–32.

8 Petrić 1992. Autor donosi analizu nekolicine keramičkih ulomaka koji potječu sa 9 lokacija istraženih pod vodstvom Regionalnog zavoda za zaštitu spomenika kulture u Splitu od 1982. do 1990. godine (Karta 1). Prapovijesne slojeve bilo je moguće izdvojiti samo u jednoj od sjevernih prostorija palače Garagnin – Fanfogna (MGT), gdje su iskopavanja zahvatila veću dubinu kulturnih slojeva, dok su ulomci prikupljeni na ostalim lokacijama ili rezidualnog karaktera ili istovremeni s (pred)helenističkim materijalom. U spomenutoj su prostoriji istraženoj 1989. godine (karta 1: 8), uz slojeve svih faza željeznog doba, istraženi i slojevi kasnoga brončanog doba.

9 Babić, Kirigin, Paraman 2020, 34–40, 68.

10 Babić, Kirigin, Paraman 2020, 12–13, 32.

11 Babić, Kirigin, Paraman 2020, 34–40.

12 Paraman, Ugarković, Steskal 2020, 246, 250–252; Bažoka 2020 sa starijom literaturom.

7 Research review and general bibliography by Babić, Kirigin, Paraman 2020, 31–32.

8 Petrić 1992. The author provides an analysis of several ceramic sherds originating from 9 locations investigated under the leadership of the Regional Institute for the Protection of Cultural Monuments in Split from 1982 to 1990 (Map 1). Prehistoric layers could only be distinguished in one of the northern rooms of the Garagnin-Fanfogna Mansion (TTM), where the excavations covered a greater depth of cultural layers, while the fragments collected at the other locations were either residual or contemporaneous with (pre-)Hellenistic material. In the aforementioned room explored in 1989 (Map 1: 8), in addition to layers of all phases of the Iron Age, layers of the Late Bronze Age were also explored.

9 Babić, Kirigin, Paraman 2020, 34–40, 68.

10 Babić, Kirigin, Paraman 2020, 12–13, 32.

11 Babić, Kirigin, Paraman 2020, 34–40.

12 Paraman, Ugarković, Steskal 2020, 246, 250–252; Bažoka 2020 with bibliography cited therein.

Bristivica – Šupljak, gomila

Prostor današnjeg sela Bristivica (Općina Seget) u trogirskom zaleđu obilježava iznimno sačuvani prapovijesni krajolik, čija su okosnica komunikacijski pravci koji iz trogirskog priobalja vode u unutrašnjost – transverzalni pravac prema Šibeniku te longitudinalni prema uvali Grebaštica. Dosadašnjim je istraživanjem ovoga prostora evidentirano 7 gradinskih utvrđenja i manjih ograda te 44 prapovijesne gomile, čiji su ostaci vidljivi na uzvišenjima i vrhovima brda koja okružuju bristivičko polje.[12] Gomila smještena na brdu Šupljak (503,1 mnv), dominantnoj točki na jugozapadnom rubu bristivičkog područja, istražena je 2012. godine[13] i jedina je istražena prapovijesna gomila trogirskog područja. Svojim položajem i relativno velikim dimenzijama (promjer oko 19 m) pripada skupini pojedinačnih gomila smještenih na istaknutim prostornim dominantama prapovijesnog krajolika.[14] Prapovijesnoj fazi gomile pripadaju ostaci spališta dokumentirani u najnižem sloju u središnjem dijelu gomile te dva ukopa u matičnoj stijeni s većom količinom prapovijesnog materijala, dok su ostali eventualni ostaci po svoj prilici uništeni intenzivnim korištenjem gomile u novijoj povijesti.[15] Ipak, istraživanjem je, uz ostale nalaze, prikupljena znatna količina prapovijesne keramike, ukupno oko 400 ulomaka, od čega najveći dio čine ulomci tijela posuda, za koje je ustanovljeno da velik dio pripada fragmentima istih posuda. Manji broj pripada dijagnostičkim ulomcima (24), među kojima su, osim grube, zastupljeni i ulomci fine keramike, odnosno ulomci posude tip Kotorac, koji pronađeni materijal datiraju u okvir 2. faze cetinske kulture.[16] Budući da je riječ o rijetkom nalazu, ulomci ukrašenih posuda nisu izdvojeni za analize. Stoga, izdvojena su dva tipična ulomka tzv. grube keramike debljih stijenki (0,7 cm), porozne i šupljikave površine, zatim jedan ulomak (uzorak 66), na čijoj su površini i u presjeku vidljiva krupna zrna kalcita, te jedan ulomak srednje fine strukture, bez vidljivih krupnijih primjesa. Boja površine grube keramike je smeđe-crvena, a srednje fine smeđe-siva, dok je boja jezgre svih uzoraka tamnosiva (Sl. 2).

Vinišće – Oriovišćak

Gradinsko utvrđenje Oriovišćak (Oriješćak) kod Vinišća otprije je poznato prapovijesno nalazište,[17] smješteno na istaknutome platou (212 mnv) na antiklinali koja se pruža u smjeru istok – zapad, odvajajući prostor marinske i viniške uvale. Utvrđenje je pravokutnoga oblika, s dobro očuvanim ostacima suhozidnog

Bristivica – Šupljak, tumulus

The area of today's village of Bristivica (municipality of Seget), in the hinterland of Trogir, characterizes an exceptionally-preserved prehistoric landscape, the backbone of which is the communication routes that lead from the Trogir coast inland: the transverse direction to Šibenik and the longitudinal direction to Grebaštica Bay. Research of this area has so far recorded 7 hillforts and enclosures and 44 prehistoric mounds, the remains of which are visible on the high grounds and hilltops on the edges of the Bristivica polje.[12] The tumulus located on the Šupljak hill (503.1 m above sea level), a dominant point on the south-western edge of the Bristivica area, was excavated in 2012,[13] and it is the only prehistoric tumulus excavated in the Trogir area. Due to its position and relatively large dimensions (diameter about 19 m), it belongs to a type of single tumulus located on a prominent elevation of the prehistoric landscape.[14] The remains of the cremation site documented in the lowest layer in the central part of the mound, and two pits in the bedrock with a large amount of prehistoric material, belong to the prehistoric phase of the mound. Other potential remains were most likely destroyed by the intensive use of the mound in more recent history.[15] However, along with other findings, the excavation yielded a considerable amount of prehistoric pottery, a total of about 400 fragments, most of which are fragments of the vessels' bodies, with most of them belonging to the same vessels. There is a smaller number of diagnostic sherds (24), among which there are sherds not only of coarse ceramics, but also of fine: namely, sherds of a Kotorac-type vessel, which dates the material found to the 2nd phase of the Cetina culture.[16] Since it is a rare find, fragments of decorated vessels were not chosen for analysis. Therefore, the following samples were selected: two typical fragments of the so-called coarse fabric with thicker walls (0.7 cm), porous and hollow surfaces; one fragment (sample 66) with coarse calcite visible in the cross-section; and one fragment of a medium-fine fabric without visible coarse temper. The surface colour of the coarse ceramics is brown-red, and of medium-fine brown-grey, while the colour of the core of all samples is dark grey (Fig. 2).

Vinišće – Oriovišćak

The Oriovišćak (Oriješćak) hillfort near Vinišće is a well-known prehistoric site,[17] located on a prominent plateau (212 m above sea level) on an anticline oriented in the east-west direction, separating the area of Marina and Vinišće Bays. The fortification is rectangular in shape, with well-preserved remains of the dry-

13 Madiraca 2012; 2013.

14 Važnost lokacije naglašena je i u novijoj povijesti – istraživanjem je ustanovljeno intenzivno korištenje gomile u kasnom srednjem vijeku, gdje su registrirana naknadna pokapanja u gomilu uz veću količinu pokretnog materijala iz toga razdoblja, kao i ostaci istovremene suhozidne kapelice sagrađene na vrhu gomile – dok je nekoliko godina prije samih istraživanja uz rub gomile sagrađena i nova kapelica (Madiraca 2012, 31–34).

15 Madiraca 2012, 35–36; 2013, 828.

16 Marović, Čović 1983, 199, 212–213.

17 Katić 1994, 6; Burić 2000, 56; 2008, 79–80; Miletić 2006.

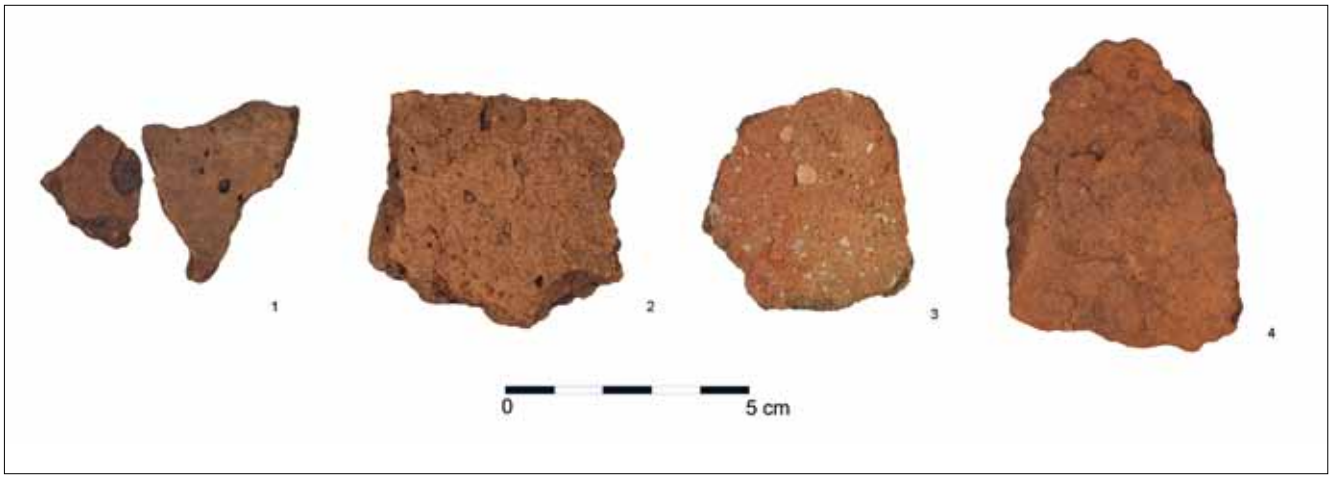
13 Madiraca 2012; 2013.

14 The importance of the location is also emphasized in recent history – the excavation established the intensive use of the mound in the late Middle Ages, where subsequent burials into the mound were registered along with a large amount of movable material from that period, as well as the remains of a contemporary dry-wall chapel built on top of the mound – while, a few years before the excavation, a new chapel was also built on the edge of the mound (Madiraca 2012, 31–34).

15 Madiraca 2012, 35–36; 2013, 828.

16 Marović, Čović 1983, 199, 212–213.

17 Katić 1994, 6; Burić 2000, 56; 2008, 79–80; Miletić 2006.



SLIKA 2. Ulomci keramike s nalazišta Bristivica-Šupljak izdvojeni za analize: brojevi uzoraka od 64 do 67 (s lijeva na desno) (snimila A. Kudelić).

FIGURE 2. Ceramic fragments from the Bristivica-Šupljak site selected for analysis: sample numbers 64 to 67 (from left to right) (photo by A. Kudelić).

bedema sa zapadne, sjeverne i istočne strane, dok je južni rub definiran strmom liticom i nižom terasom s visokim podzidom, čime utvrđena površina iznosi oko 1,64 ha. Terenskim pregledom gradinskog utvrđenja, osim kartiranja, zabilježena je i učestalost te distribucija keramičkih nalaza.[18] Zabilježena je isključivo prapovijesna keramika, sveukupno 659 ulomaka, od čega je prikupljeno njih 178, koji pripadaju dijagnostičkim dijelovima posuda. Preliminarno, korpus prikupljenoga materijala na osnovi morfoloških osobina i usporedbom sa sličnim nalazištima šire regije datira se općenito u brončano doba, s mogućnošću kontinuiteta i u starije željezno doba, budući da je riječ o oblicima koji se pojavljuju kroz širi vremenski period.[19]

Prilikom selekcije keramičkih ulomaka za analize napravljena je klasifikacija prema kriteriju keramičke strukture, što je bilo otežano iz više razloga. Keramika je dosta oštećena, zaobljenih rubova prijeloma, oštećene površine, bež i narančaste boje, vjerojatno kao posljedica postdepozicijskih procesa i činjenice da je riječ uglavnom o površinskom materijalu. Stoga, dio ulomaka presječen je kliještima kako bi se stekao uvid u boju jezgre i strukturu keramike koja obiluje primjesama kalcita. Za analize je izdvojeno šest ulomaka koji nisu izrazitije oštećeni postdepozicijskim procesima, uglavnom fragmenti oboda (T. 2). Za uzorke 71, 72 i 73 na temelju oblikovanja ruba oboda i strukture keramike pretpostavlja se nešto ranija datacija.

Marina – Drid

Utvrda Drid je smještena na istoimenom brdu, istaknutoj dominanti (176 mnv) koja se sa sjeverne strane uzdiže iznad Marinskog zaljeva, omogućujući kontrolu plovidbenih ruta trogirskog akvatorija i kopnenih prometnih pravaca. Uz naglašeni povijesni

wall ramparts on the western, northern and eastern sides, while the southern edge is defined by a steep cliff and a lower terrace with a high wall, which makes the fortified area about 1.64 ha. In addition to mapping, the frequency and distribution of pottery sherds was recorded during the field survey of the hillfort fortifications.[18] Only prehistoric pottery was recorded, a total of 659 fragments, of which 178 were collected, which belong to indicative parts of vessels. Preliminarily, based on morphological features and comparison with similar sites in the region, the corpus of collected material has been dated to the Bronze Age with the possibility of continuity to the Early Iron Age, since it contains forms that appear over a wider period of time.[19]

During the selection of sherds, a classification was made according to the criterion of fabric, which was difficult for several reasons: the pottery is quite damaged, with rounded fracture edges, damaged surface, beige and orange in colour (secondary burning). This is assumed to be due to the influence of post-depositional processes and the fact that these are mostly surface finds. Therefore, some of the sherds were cut with pliers to get an insight into the composition and colour of the calcite-tempered ceramic fabric. Six fragments that were not significantly damaged by post-depositional processes, mainly rim fragments, were selected for analysis (Pl. 2). For samples 71, 72 and 73, a slightly earlier date is assumed, based on the shaping of the rim edge and the ceramic fabric's features.

Marina – Drid

The fortress of Drid is located on the hill of the same name, on an elevated area (176 m above sea level) that rises above the north side of Marina Bay, enabling control of the navigation routes of the Trogir water area and land traffic routes. In addition to the

18 Paraman, Ugarković, Steskal 2020, 252, 254–258.
19 Paraman, Ugarković, Steskal 2020, 258.

18 Paraman, Ugarković, Steskal 2020, 252, 254–258.
19 Paraman, Ugarković, Steskal 2020, 258.

značaj kasnoantičkog/ranobizantskog i ranosrednjovjekovnog kastruma[20], prihvaćeno je i mišljenje da je u razdoblju željeznog doba riječ o gradinskom utvrđenju.[21] Sustavno istraživanje nalazišta u novije vrijeme te iskopavanje vršnog dijela utvrde i sjeveroistočne terase, provedeno u sklopu obnove crkve Gospe od Sniga,[22] rezultiralo je otkrićem starije, prapovijesne faze sjevernog bedema utvrđenja[23] te veće količine prapovijesne lončarije i drugog materijala. Ulomci keramike datirani su u široko vremensko razdoblje, od starije faze brončanog doba do mlađega željeznog doba, te se uklapaju u opću sliku lončarskog stila karakterističnog za nalazišta kaštelansko-trogirskog i marinskog područja.[24]

Za potrebe ove studije, pregledano je 38 dijagnostičkih ulomaka i klasificirani su u dvije grupe. Prvu predstavljaju ulomci većih posuda, debljih stijenki i hrapave površine. Glavnina je sekundarno gorjela pa ima svjetliju oker, žutu i bež boju površine, te sadrži obilnu količinu primjesa kalcita. Iz iste skupine izdvojeni su i ulomci fine keramike, crne boje površine, ali svjetlije sive boje jezgre. Pojedini su ulomci ukrašeni urezivanjem i ubadanjem pa se na osnovu morfologije oblika i tehnika ukrašavanja ova skupina keramičkih ulomaka može datirati u kraj kasnoga brončanog i stariju fazu željeznog doba. Iz ove su skupine za analize izdvojena dva ulomka (T. 2: 7–8). Drugu skupinu čini keramika glatke površine, vjerojatno tretirane glinovitim premazom, tanjih stijenki, bez vidljivih obilnih primjesa koja ima crnu jezgru. Izdvojena dva uzorka pripadaju karakterističnim brončanodobnim posudama s trakastim ručkama (T. 2: 9–10).

Seget Gornji – Sutilija

Gradinsko utvrđenje na brdu Sutilija (305 mnv), koje sa sjeverozapadne strane nadvisuje trogirsko Malo polje, značajno je nalazište za poznavanje prapovijesti i protopovijesti trogirsko-kaštelanskog područja. Karakteriziraju ga masivna osipina bedema, kompleksnost sačuvanih struktura te visoka koncentracija površinskih nalaza.[25] U MGT-u su do sada pohranjena ukupno 952 ulomka keramike iz zaštitnih istraživanja i terenskih pregleda. Od sveukupne keramičke građe (koja uključuje i importiranu keramiku (pred)helenističkog razdoblja), najveći se postotak odnosi na ulomke prapovijesnog posuđa (749 ulomaka), od kojih je, s obzirom na selektivnost prikupljanja površinskog materijala, 48,20% dijagnostičko, a glavina spomenute keramičke građe je nedavno objavljena.[26] Unatoč ograničenjima koja proizlaze iz nedostatka konteksta nalaza, uvid u prapovijesni materijal sa

emphasized historical significance of the Late Antique / Early Byzantine and early-medieval *castrum*,[20] the opinion that it was a hillfort centre of regional importance in the Iron Age period is also accepted.[21] The systematic research of the site in recent times, and the excavation of the upper plateau of the fort and the north-eastern terrace, carried out as part of the restoration of the church of Our Lady of the Snow,[22] resulted in the discovery of an older, prehistoric phase of the northern rampart of the fortification,[23] as well as a large amount of prehistoric pottery and other finds. The pottery spans the period from the earlier phase of the Bronze Age to the later Iron Age and fits into the general picture of the pottery style recorded at the sites of the Kaštela-Trogir and Marina area.[24]

For the purposes of this research, 38 diagnostic fragments were examined, which were classified into two groups of ceramic fabrics. The first is represented by fragments of larger vessels, with thicker walls and a rough surface. Most of them are secondarily burnt and have a lighter ochre, yellow and beige surface colour, and are abundantly tempered with calcite. From the same group, fragments of fine pottery with black surface, but lighter grey at the core, were also recorded. Some sherds are decorated with incising and stabbing; and, on the basis of shape morphology and decoration techniques, this group of pottery can be dated to the end of the Late Bronze Age and the earlier phase of the Iron Age. From this group, two fragments were selected for analysis (Pl. 2: 7–8). The second group is represented by pottery with a smooth surface, probably treated with a clay coating; it has thinner walls, a lesser amount of calcite temper, and a black core. The two samples selected belong to characteristic Bronze Age vessels with handles (Pl. 2: 9–10).

Seget Gornji – Sutilija

The fortress on the Sutilija hill (305 m above sea level), which overlooks Trogir's Malo polje from the northwest, is an important site for learning about the prehistory and protohistory of the Trogir-Kaštela area. It is characterized by the massive rubble of the ramparts, the complexity of the preserved structures and the high concentration of surface finds.[25] So far, a total of 952 ceramic fragments from protective research and field surveys have been stored in the TTM. Of the overall ceramic material (which also includes imported ceramics from the (pre-)Hellenistic period), the largest percentage relates to prehistoric vessels (749 fragments), of which, considering the selectivity of the collection of surface material, 48.20% are diagnostic, and the majority of the ceramics mentioned were recently published.[26] Despite the limitations resulting from the lack of context of the finds, an

20 Katić 1994.

21 Katić 1994, 5.

22 Jerončić 2016; 2017a; 2017b.

23 Jerončić 2017b, 9–12.

24 Čače 2001; Radić Rossi 2011; Arena, Barbarić, Radić Rossi 2020; Paraman, Ugarković, Steskal 2020; Paraman, Ugarković 2021; Šuta 2021.

25 Detaljan pregled istraživanja i dosadašnjih spoznaja o nalazištu s relevantnom bibliografijom kod Paraman, Ugarković 2021.

26 Paraman, Ugarković 2021.

20 Katić 1994.

21 Katić 1994, 5.

22 Jerončić 2016; 2017a; 2017b.

23 Jerončić 2017b, 9–12.

24 Čače 2001; Radić Rossi 2011; Arena, Barbarić, Radić Rossi 2020; Paraman, Ugarković, Steskal 2020; Paraman, Ugarković 2021; Šuta 2021.

25 A detailed overview of the research and current knowledge of the site with relevant bibliography in Paraman, Ugarković 2021.

26 Paraman, Ugarković 2021.

Sutilije sugerira da je određeni dio ulomaka moguće snažnije povezati uz razdoblje brončanog doba.

Na osnovi karakteristika strukture i teksture materijala keramika je klasificirana u tri grupe. Prvu skupinu čine ulomci smeđe-crvene boje površine i tamnosive ili crne jezgre (T. 3: 2–6). Tekstura keramike je porozna s vidljivim primjesama kalcita. Debljina stijenke iznosi između 0,8 i 1,2 cm, dok je površina takvih, vjerojatno posuda većih dimenzija, zaglađena i glačana bez sjaja. Pojedini su ulomci ukrašeni apliciranim trakama ili su sličnom tehnikom izrađene tzv. potkovaste drške. Drugu skupinu čine ulomci na čijoj površini nisu vidljiva gruba zrna kalcita, ali sitnija zrna kalcita vidljiva su u presjeku (T. 3: 8–9). Površina posuda je zaglađena i glačana, ponekad sjajna smeđe-sive, oker-sive ili tamnosive boje sa sivom ili crnom jezgrom, a debljina stijenke iznosi između 0,5 i 0,8 cm te takvi ulomci pripadaju posudama tankih stijenki, zdjelama, šalicama ili loncima. Treću skupinu karakterizira na dodir hrapava površina, bež ili svjetlosmeđe boje površine te svjetlosive ili tamnosive jezgre (T. 3: 1, 7). Primjese kalcita, osim što se osjete na dodir površine, vidljive su golim okom i na svježem lomu ulomka. Debljina stijenke iznosi između 0,8 i 1,2 cm te ulazi u skupinu debelih stijenki lonaca. U odnosu na prikazane tri grupe izdvaja se ulomak trbuha posude s horizontalnom ručkom ovalnog presjeka, ukrašen otiskom namotane niti, bež boje te sjajne uglačane površine (T. 3: 10) datiran u kraj brončanog doba.

Plano – Kraljeva ograda

Udaljeno oko 3,6 km od Trogira, nalazište Kraljeva ograda smješteno je na području trogirskog naselja Plano, na sjeveroistočnoj padini brda Bovan, koje se nalazi na ulazu u Labinsku dragu, jedan od glavnih komunikacijskih pravaca koji povezuje trogirsko-kaštelanski obalni prostor sa zaleđem. Ostaci višedijelnog ograđenoga kompleksa, kojeg karakteriziraju ogradni zidovi, podzidi, terase i gomile, pružaju se u smjeru sjeveroistok – jugozapad na ukupnoj površini od oko 3,4 ha.[27] Preliminarno istraživanje nalazišta[28] je uz dokumentiranje struktura obuhvatilo i manje probno iskopavanje na terasi ograde u vršnom, jugozapadnom dijelu nalazišta (145 mnv, Sonda 2) te na zaravnjenom prostoru uz istočni „ulaz" na sjeveroistočnom ogradnom zidu nižeg, sjeveroistočnog dijela nalazišta (113 mnv, Sonda 1). Velika količina zabilježenih keramičkih nalaza u Sondi 1 (gotovo 90% prikupljenoga keramičkog materijala) u kulturnom sloju debljine 0,30 m, uz nalaze litike i kamenog oruđa, ostatke životinjskih kostiju te kućnog lijepa, ukazuje na najniži, sjeveroistočni dio nalazišta kao jedan od centara aktivnosti na nalazištu. Tehnološke i tipološke karakteristike keramičkih ulomaka pokazuju značajke ranijih faza brončanog doba i odgovaraju lončariji dokumentiranoj

insight into the prehistoric material from Sutilija suggests that some of the pottery sherds can be strongly related to the Bronze Age period.

On the basis of the visible physical characteristics and ceramic fabrics, they can be classified into three groups. The first consists of fragments with a brown-red surface and a dark-grey or black core (Pl. 3: 2–6). The texture of the ceramics is porous, and it is tempered with calcite. The wall thickness is between 0.8 and 1.2 cm, while the surface of such a vessel, probably of larger dimensions, is smoothed and polished without shine. Some fragments are decorated with applied ribbon, or horseshoe handles were made with a similar technique. The second group consists of fragments on the surface of which larger grains of calcite are not visible, but smaller grains of calcite are visible in the cross-section (Pl. 3: 8–9). The surface of the vessels is smoothed and polished, sometimes shiny, brown-grey, ochre-grey or dark grey with a grey or black core; the wall thickness ranges between 0.5 and 0.8 cm, representing thinner walls of bowls, cups and pots. The third group of ceramics is characterized by a surface rough to the touch, a beige or light-brown surface and a light-grey or dark-grey core (Pl. 3: 1, 7). In addition to being felt when the surface is touched, calcite temper is also visible to the naked eye in the cross-section. The wall thickness is between 0.8 and 1.2 cm and belongs to the group of thick-walled pots. Standing out in a separate category is a fragment of a vessel body decorated with imprinted corded thread and with a horizontal handle, beige colour and a shiny, polished surface (Pl. 3: 10), dated to the end of the Bronze Age.

Plano – Kraljeva Ograda

The site of Kraljeva Ograda is located about 3.6 km from Trogir, in the area of the Trogir settlement of Plano, on the north-eastern slope of the Bovan hill, which is located at the entrance to Labinska Draga, one of the main communication routes that connects the Trogir-Kaštela coastal area with the hinterland. The remains of a multi-part enclosure, characterized by enclosure walls, sub-walls, terraces and cairns, extend in a northeast-southwest direction over a total area of about 3.4 ha.[27] In addition to documenting the structures, the preliminary investigation of the site[28] included a smaller test excavation on the terrace of the top enclosure in the south-western part of the site (145 m asl, Probe 2) and on the flattened area next to the eastern 'entrance' on the north-eastern wall of the lower, north-eastern part of the site (113 m asl, Probe 1). The large amount of ceramic finds recorded in Probe 1 (almost 90% of the ceramic material collected) in a cultural layer 0.30 m thick, along with the finds of lithics and stone tools, the remains of animal bones and a domestic vase, points to the lowest, north-eastern part of the site as being one of the centres of activities at the site. The technological and typological characteristics of the ceramic sherds show the features of

27 Nalazište je 2001. godine otkrio fotograf Tonko Bartulović prilikom zračnog snimanja kaštelanskog područja. Neposredno nakon otkrića, prilikom pokušaja pošumljavanja ranije opožarenog područja, nalazište je djelomično oštećeno, dok se daljnja devastacija nalazišta odvila 2017. godine, kada je, u namjeri pripreme terena za kultivaciju, strojevima prekopan dio ograde u vršnom dijelu nalazišta.

28 Paraman, Šuta 2016.

27 The site was discovered in 2001 by photographer Tonko Bartulović during an aerial survey of the Kaštela area. Immediately after the discovery, during an attempt to reforest the previously burnt area, the site was partially damaged, while further devastation of the site took place in 2017 when, with the intention of preparing the terrain for cultivation, a part of the fence in the top part of the site was dug up with machinery.

28 Paraman, Šuta 2016.

na istovremenim nalazištima kaštelansko-trogirskog područja.[29] Starost kulturnih slojeva iz obje sonde određena je metodom 14C na životinjskim kostima – 3316 ± 17 (Sonda 1), odnosno 3287 ± 17 (Sonda 2) prije sadašnjosti – čime je kronološki okvir analizirane lončarije postavljen u srednje brončano doba, odnosno u vrijeme od zadnje trećine 17. do kraja 16. stoljeća pr. n. e.[30]

Istraživanjem je prikupljeno oko 1200 većinom sitnih ulomaka keramike, od čega glavnina pripada tijelima posuda, dok je dijagnostičkih dijelova posuda zabilježeno 216. Definirane su dvije osnovne grupe keramike. Prva je gruba, šupljikave teksture, s primjesama krupnih zrna kalcita, a šupljikava površina vjerojatno je posljedica raspadanja kalcita. Druga grupa keramike je nešto finija, bez krupnih primjesa, zaglađene površine. Boja površine je uglavnom smeđa, a jedan ulomak ističe se svjetlobež bojom površine, dok je jezgra kod svih ulomaka tamnosmeđa i crna. Za izradu mikroskopskih preparata izabrano je pet ulomaka tijela posuda (Sl. 3).

Okolica Trogira – nepoznato nalazište

U čuvaonici MGT nalaze se ulomci keramičke posude koja potječe iz staroga muzejskog fundusa i za koju nije poznato mjesto pronalaska (Sl. 4). Kako se radi o ulomcima izrazito velike, izvorno vjerojatno cjelovito sačuvane posude (lomovi su svježi), pretpostavlja se da je pronađena u gomili iako nije isključena ni mogućnost da je riječ o pećinskom nalazištu.[31] Riječ je o loncu tankih stijenki, zaobljenoga kuglastog tijela i izduženog vrata s trakastom ručkom na prijelazu vrata na trbuh posude. Rub oboda posude je šiljast, ali s unutarnje strane koso zaravnat. Tekstura keramike je porozna, mjestimice šupljikava, površina je mat bez sjaja, a na površini su vidljiva bijela zrna kalcita. Vanjska je površina smeđa te mjestimice siva i narančasta, dok je unutarnja površina smeđe boje, a jezgra je crna. Oblik posude i način oblikovanja ruba oboda pokazuju značajke lončarije ranoga brončanog doba. Ravni, cilindrični vratovi lonaca te koso oblikovani obodi zdjela, šalica, a ponekad i vrčeva, posebno su karakteristični za cetinski lončarski stil.[32] Osim toga, koso oblikovani rubovi karakteristični su i za lončariju ranog i srednjega brončanog doba Istre.[33] No direktna analogija za slično oblikovani obod velike posude nije

the earlier phases of the Bronze Age and correspond to the pottery documented at the contemporary sites in the Kaštela-Trogir area.[29] The age of the cultural layers from both probes was determined by the 14C method on animal bones – 3316 ± 17 (Probe 1) and 3287 ± 17 (Probe 2) BP – which places the chronological framework of the pottery thus analysed in the Middle Bronze Age, i.e. in the time span from the last third of the 17th century BC to the end of the 16th.[30]

About 1,200 fragments of ceramics, mostly small, were collected during the research, most of which belong to vessel bodies, and 216 to diagnostic parts. Two basic groups of ceramics have been defined. The first one has a rough, porous, hollow texture and is calcite-tempered. The pitted surface is probably the result of calcite disintegration. The second group of ceramics is somewhat finer, without coarse mineral grains, with a smooth surface. The colour of the surface is mostly brown, and one fragment stands out with a light beige colour; the core of all fragments is dark brown and black. Five fragments of vessel bodies were selected for thin sections (Fig. 3).

Environs of Trogir – unknown site

In the TTM storage, there are fragments of a ceramic vessel originating from the old museum collection and of which the place of discovery is unknown (Fig. 4). As these are fragments of a larger vessel, originally probably completely preserved (the fractures are fresh), it is assumed that it was found in a tumulus, although the possibility that it was a cave site is not excluded.[31] It is a thin-walled pot with a rounded spherical body and elongated neck with a strip handle at the transition of the neck to the body of the vessel. The edge of the rim is pointed, but on the inside it is set obliquely. The ceramic is porous, hollow in places, the surface is smooth, matte without shine, and white grains of calcite are visible on the surface. The outer surface is brown and, in places, grey and orange, while the inner surface is brown and the core is black. The shape of the bowl and the way the edge of the rim was shaped show characteristics of Early Bronze Age pottery. Flat, cylindrical necks and the obliquely shaped rims of bowls, cups and sometimes jugs are particularly characteristic of the Cetina pottery style.[32] In addition, obliquely shaped rims are also characteristic of the Early and Middle Bronze Age pottery of Istria.[33]

29 Arena et al. 2020; Šuta 2021.

30 Radiokarbonsko datiranje financirano je sredstvima Hrvatske zaklade za znanost, projektom *Tehnološke značajke i kulturne prakse u prapovijesnim lončarskim tradicijama na području Hrvatske* (HRZZ-UIP-2020-02-3637).

31 U Arhivu MGT nalazi se dopis br. 133/80 od 1.7.1980., u kojem se spominju u muzej predani ulomci keramičke „vaze", pronađeni u spilji sjeverno od gradinskog naselja Sv. Nofar na Velom Bijaču (područje Seline/Vlačine), u sjeverozapadnom dijelu Kaštelanskog polja. Prema riječima kolege Ivana Šute iz Muzeja grada Kaštela, spilja je poznata kao prapovijesni lokalitet, ali njezin točan položaj danas nije poznat. Kako se u starom muzejskom fundusu nalazi niz arheoloških nalaza, koji su u muzej pristigli bez popratne dokumentacije, nije moguće sa sigurnošću povezati ulomke posude MGT 2385 s ovim nalazištem. Tijekom druge polovice 20. stoljeća niz je prapovijesnih gomila na trogirskom području uništen prilikom građevinskih i infrastrukturnih radova – na području naselja Plano, trogirskog Čiova i Segeta Gornjeg u bližoj okolici Trogira te na području sela Blizna Donja i Vinovac u marinskom zaleđu.

32 Brojni primjerci kod Marović 1991.

33 Hellmuth Kramberger 2017.

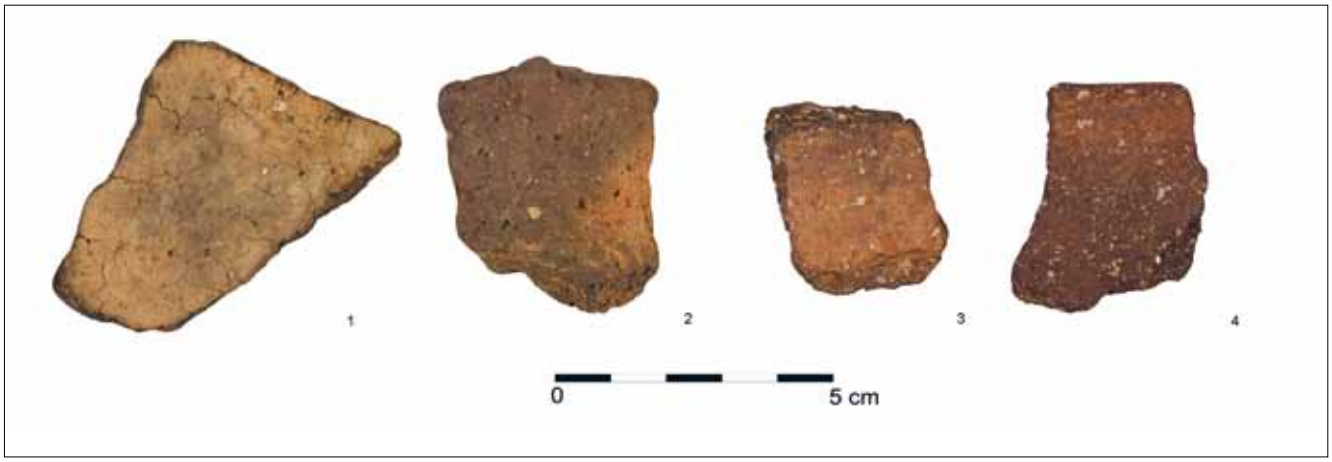
29 Arena *et al*. 2020; Šuta 2021.

30 The radiocarbon dates were funded by the Croatian Science Foundation, the project *TechnologicalFfeatures and Cultural Practices in Prehistoric Pottery Traditions in Croatia* (HRZZ-UIP-2020-02-3637).

31 In the TTM Archive, there is document no. 133/80 of 1 July 1980, which mentions fragments of a ceramic "vase" found in a cave north of the settlement of St Nofar on Veli Bijač (Selina/Vlačina area), in the north-western part of the Kaštela polje. According to Ivan Šuta of the Museum of the City of Kaštela, the cave is known as a prehistoric site, but its exact location is not known today. As the old museum collection contains a number of archaeological finds that arrived at the museum without accompanying documentation, it is not possible to connect the fragments of vessel TTM 2385 with certainty to this site. During the second half of the 20th century, a number of prehistoric mounds in the Trogir area were destroyed during construction and infrastructure works: in the area of Plano, Trogir's Čiovo and Seget Gornji in the immediate vicinity of Trogir, and in the area of the villages of Blizna Donja and Vinovac in the Marina hinterland.

32 Numerous examples in Marović 1991.

33 Hellmuth Kramberger 2017.



SLIKA 3. Ulomci keramike s nalazišta Plano-Kraljeva ograda izdvojeni za analize: brojevi uzoraka 93, 94, 96 i 97 (s lijeva na desno) (snimila A. Kudelić).

FIGURE 3. Ceramic fragments from the Plano-Kraljeva ograda site selected for analysis: sample numbers 93, 94, 96, and 97 (from left to right) (photo by A. Kudelić).

pronađena među lončarijom ranog ili srednjega brončanog doba istočnoga jadranskog područja i zaleđa.

Analitičke metode

Za mineraloško-petrografske analize brončanodobne lončarije s trogirskog područja odabrano je sveukupno 38 uzoraka (Tab. 1). U Laboratoriju za analizu geološkog materijala (LaGEMA) na Rudarsko-geološko-naftnom fakultetu Sveučilišta u Zagrebu napravljeni su tanki izbrusci keramike svih uzoraka. Analiza tankih izbrusaka optičkom je mikroskopijom provedena na Institutu za arheologiju, koristeći polarizacijski mikroskop Zeiss Axiolab 5 u propusnom svjetlu. Analizom je određen mineraloško-petrografski sastav uzorka, boja, mikrotekstura i dvolom matriksa, a određena je i prisutnost litoklasta i keramoklasta te su opisane šupljine i pore. Definiranje dodanih primjesa temelji se na vrsti, veličini, obliku i bimodalnoj raspodjeli zrna u matriksu. Uzorci su potom sortirani u grupe na temelju mineraloško-petrografskih karakteristika matriksa, dok su podgrupe definirane na osnovi vrste dodanih primjesa. Zastupljenost, veličina, razvrstanost i zaobljenost zrna procijenjeni su koristeći upute *Prehistoric Ceramic Research Group*.[34]

Mineralni sastav keramike određen je pomoću rendgenske difrakcije na prahu (XRPD), koristeći Panalytical Empyrean difraktometar s monokromatskim Cu-Kα zračenjem. Postavke mjerenja su 3 – 70 °2θ na rotirajućem postolju, veličina koraka 0,013 °2θ, 80 s po koraku. Mineraloška analiza napravljena prema Moore i Reynolds (1997) te pomoću PANalytical X'Pert HighScore programa, koristeći podatke Međunarodnog centra za difrakcijske podatke (ICDD, *International Centre for Diffraction Data*).

However, a direct analogy for the similarly shaped rim of a larger vessel has not been found in Early or Middle Bronze Age ceramics of the eastern Adriatic area and its hinterland.

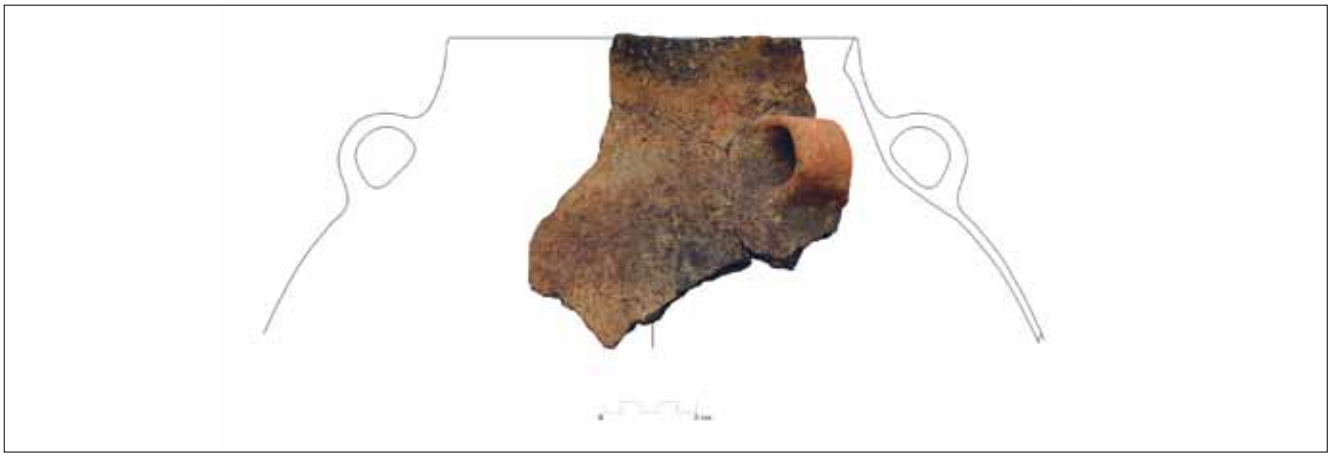
Analytical methods

A total of 38 ceramic sherds were selected for mineralogical and petrographic analysis of the Bronze Age pottery from the Trogir area (Table 1). Thin sections of pottery sherds were prepared at the Laboratory for the Analysis of Geological Materials (LaGEMA) at the Faculty of Mining, Geology and Petroleum Engineering, University of Zagreb. Thin sections were analysed at the Institute of Archaeology under a Zeiss Axiolab 5 polarizing microscope in transmitted light. The petrographic analysis includes the determination of sample colour, matrix microtexture and birefringence, mineral composition, and presence of lithoclasts, ceramoclasts, pores and voids. The definition of tempering material is based on the type, size, shape and bimodal grain size distribution in the matrix. The samples are assigned to groups according to the mineralogical and petrographic characteristic of the matrix, while the subgroups are established according to the type of the tempering material present in the samples. During the petrographic analysis, inclusion density, size, sorting, and roundness were determined according to the instructions of the *Prehistoric Ceramic Research Group*.[34]

Mineralogical composition was obtained using a Panalytical Empyrean diffractometer equipped with Cu-Kα radiation. Scan settings were 3–70° 2θ on the rotating sample stage, 0.013° 2θ step size, 80 s per step. Mineral identification was conducted according to Moore and Reynolds (1997) using PANalytical X'Pert HighScore software with the standardized Powder Diffraction Files of the International Centre for Diffraction Data (ICDD).

34 PCRG 2010.

34 PCRG, 2010.



SLIKA 4. Ulomak keramičkog lonca iz okolice Trogira – nepoznato nalazište, uzorak 110 (izradila A. Kudelić).

FIGURE 4. A fragment of a ceramic pot from surroundings of Trogir – unknown site, sample 110 (made by A. Kudelić).

Rezultati mineraloško-petrografske analize

Rezultati mineraloške analize dobivene rendgenskom difrakcijom na prahu prikazani su u tablici 2. Zajedničko obilježje svih uzoraka je prisutnost kvarca. Kalijski feldspati i plagioklasi prisutni su u većini uzoraka. Tinjčasti materijal, koji odgovara mineralima iz skupine tinjaca, illita te miješanoslojnih minerala illit/smektit, prisutan je u gotovo svim uzorcima. Prisutnost kalcita utvrđena je u svim uzorcima osim u uzorku 64. Vapno i mulit, koji ukazuju na promjene mineralnih faza uslijed pečenja, prisutni su u uzorku 75, odnosno 72.

Mineralni sastav keramičkog matriksa, određen optičkom mikroskopijom, sastoji se od vrlo finih (<0,1 mm) i finih (0,1 – 0,25 mm) kristaloklasta kvarca, feldspata, tinjaca i kalcita (Tab. 3). Kalijski feldspati prisutni su u većini uzoraka, dok su plagioklasi rjeđe zastupljeni. Među tinjcima najčešći je muskovit, a biotit je vrlo rijetko prisutan. Zastupljenost vrlo finih kristaloklasta u rasponu je od 10% do maksimalnih 50% (prosječno 23,4%), a kristaloklasti su vrlo dobro razvrstani u matriksu. Osim vrlo finih, dio uzoraka sadrži i fine, uglavnom djelomično uglate kristaloklaste, zastupljene od 3 do 10%, dobro do vrlo dobro razvrstanih u matriksu.

Boja matriksa je svijetlo do tamnosmeđa, s nekoliko uzoraka narančaste boje. Dvolom matriksa je nizak do visok, ali najčešće umjereno visok.

U većini uzoraka prisutne su zaobljene, najčešće neprozirne željezovite granule. Kod nekoliko uzoraka (62, 63, 69 i 74) prisutne su uglavnom zaobljene, glinovite mase (strukture), sastavljene od vrlo finih mineralnih čestica, bez krupnih primjesa. Takve glinovite strukture zauzimaju oko 15% površine uzorka. Osim toga, rijetko su prisutni (<5 %) fragmenti mikrofosila, odnosno spikule spužvi, foraminifere te fragmenti školjaka s jasno izraženom unutarnjom strukturom.

Results of mineralogical and petrographic analysis

The results of the mineralogical analysis determined by X-ray powder diffraction are presented in Table 2. The common feature of all the samples is the presence of quartz. K-feldspar and plagioclase are present in most samples. Micaceous material, corresponding to mica, illite and mixed-layer illite/smectite, is present in almost all the samples. The presence of calcite was determined in all the samples except sample 64. Lime and mullite, which indicate the mineralogical changes upon firing, are present in samples 75 and 72, respectively.

The mineral composition of the matrix, determined by optical microscopy, consists mainly of very fine (< 0.1 mm) and fine (0.1–0.25 mm) quartz, feldspar, mica and calcite crystalloclast inclusions (Table 3). K-feldspar is identified in most of the samples, while plagioclase is less common. Among the mica minerals, muscovite is the most common, while biotite is very rarely present. The density of very fine crystalloclasts varies from moderate (10%) to abundant (50%, average 23.4%), and these are very well-sorted in the matrix. Besides very fine crystalloclast inclusions, some samples contain fine crystalloclasts present in rare (3%) to moderate (10%) amounts and very well-sorted in the matrix.

The colour of the matrix is light- to dark-brown with several samples of orange colour. The birefringence varies from low to high, but it is mostly medium-high.

Most of the samples contain rounded and opaque structures, iron nodules. Besides, some samples (62, 63, 69 and 74) contain mostly rounded, clayey masses (structures) composed exclusively of very fine mineral grains, without any coarser inclusions. These clayey masses cover up to 15% of the section's area. Fragments of microfossils, sponge spicules, foraminifera and shell fragments with clearly visible inner structure are rarely present (<5%).

Osim kristaloklasta, 33 uzorka (87%) sadrže mineralna zrna kalcita i rjeđe zastupljene litoklaste, uglavnom sastavljene od fragmenata sedimentnih stijena (Sl. 5). Mineralna zrna kalcita su vrlo fina do gruba (<3 mm), uglavnom uglatog do vrlo uglatog oblika te loše do dobro razvrstana u matriksu. Prisutna su u uzorcima do maksimalne zastupljenosti 30%. Zamućenost je prisutna na površini određenih zrna. Fragmenti sedimentnih stijena (litoklasti), uglavnom vapnenca i dolomita, te vrlo rijetko rožnjaka, prisutni su u uzorcima do maksimalne zastupljenosti 15%. Fragmenti metamorfnih stijena, uglavnom kvarcita, rjeđe su zastupljeni. Litoklasti su uglavnom srednje veličine (0,25 – 1 mm), djelomično zaobljeni te loše do dobro, ali najčešće umjereno razvrstani u matriksu. Količina, bimodalna i polimodalna raspodjela zrna i izrazita uglatost ukazuje na to da su litoklasti i mineralna zrna kalcita usitnjavana i dodavana glini tijekom pripreme lončarske smjese.

Grog je prisutan u 17 uzoraka (45%). Zrna groga su smeđe do tamno smeđe boje, uglavnom srednje veličine te djelomično uglata do djelomično zaobljena (Sl. 5). Razvrstanost groga u rasponu je od dobre do loše. Budući da boja groga u pojedinim uzorcima odgovara boji keramičkog matriksa, ona su često teže uočljiva. U uzorcima su prisutna i zaobljena prozirna i neprozirna zrna glinovitih peleta (ARF), što kod pojedinih uzoraka (84, 87, 98) otežava određivanje dodane od prirodno prisutnih inkluzija.

Along with crystalloclasts, 33 samples (87%) contain calcite mineral grains and, less commonly, rock fragments (lithoclasts), generally composed of sedimentary rocks (Fig. 5). Calcite mineral grains are very fine to coarse (< 3 mm) in size, mostly angular to very angular in shape and poorly- to well-sorted. These are present in the samples up to a maximum density of 30%. Some grains are blurred on the surface. Fragments of sedimentary rocks are present up to a moderate amount of 15%. Metamorphic rocks, mostly quartzite, are present in smaller amounts. Lithoclasts are medium in size (0.25–1 mm), sub-rounded and poorly- to well-, but mostly moderately-sorted in the matrix. The amount, bimodal and polymodal grain size, and pronounced angularity distribution indicate that the lithoclasts and calcite grains have been crushed and added to the clay during the paste's preparation.

Moreover, grog (ceramoclasts) and ARF are present in 17 samples (45%). The grog grains are brown to dark brown, medium to coarse in size, and sub-angular to sub-rounded (Fig. 5). The grog is poorly- to well-sorted in the matrix. Since the grog colour corresponds to the matrix colour, the grains are hard to recognize in some of the samples. The samples also contain transparent and opaque clayey pellets (ARF) and therefore, for some samples (84, 87, 98), the differentiation of added inclusions from those naturally present is difficult.

TABLICA 2. Rezultati mineraloške analize keramike s trogirskog područja (Qtz – kvarc; Pl – plagioklasi; Kfs – kalijski feldspati; Mca – tinjci; Cal – kalcit; Dol – dolomit; lime – vapno) (izradila N. Neral).

TABLE 2. Mineral composition of pottery samples from Trogir area determined by X-ray powder diffraction analysis (Qtz – quartz, Pl – plagioclase, Kfs – K-feldspar, Mca – micaceous minerals, Cal – calcite, Dol – dolomite) (made by N. Neral).

Br. uzorka / Sample number	Qtz	Pl	Kfs	Mca	Cal	Dol	Lime	Mulite
58	+	+	/	+	+	/	/	/
59	+	+	/	+	+	/	/	/
64	+	+	+	+	/	/	/	/
65	+	+	+	+	+	+	/	/
68	+	/	+	+	+	/	/	/
69	+	/	+	+	+	/	/	/
71	+	/	+	+	+	/	/	/
72	+	/	+	/	+	/	/	+
74	+	/	+	+	+	/	/	/
75	+	+	/	+	+	/	+	/
84	+	+	/	/	+	/	/	/
85	+	+	+	+	+	/	/	/
86	+	/	+	+	+	/	/	/
93	+	/	+	+	+	/	/	/
96	+	/	+	+	+	/	/	/

Količina pora u uzorcima u rasponu je od 5 do 15% i u prosjeku iznosi 8%. Pore su uglavnom izdužene te djelomično ili paralelno orijentirane, a praznine su prisutne kao nepravilne ili djelomično uglate.

Na temelju zastupljenosti i veličine kristaloklasta u matriksu određene su grupe strukture keramike za svako pojedino nalazište (ukupno 18), dok su na temelju vrste, veličine, oblika i bimodalne raspodjele primjesa u matriksu određene podgrupe struktura keramike također za svako nalazište (Tab. 4).

Karakterizacija lončarskih sirovina i tehnike izrade

Glinovita sirovina

Rezultati su pokazali da je glavnina keramičkih posuda napravljena od glinovitog materijala koji sadrži između 15 i 25% vrlo finih kristaloklasta, vrlo dobro razvrstanih u matriksu, koji čine prirodnu sastavnicu tla. Gline s niskim udjelom mineralnih zrna ili tzv. masne gline korištene su rijetko (uzorak 85), baš kao i vrlo pjeskovite gline (uzorci 69, 86 i 94). Budući da u ovoj fazi istraživanja uzorci tala na području istraživanja nisu prikupljeni podaci o karakteristikama i dostupnosti gline, oslanjaju se na dostupne podatke o geološkoj i pedološkoj građi područja.

Geološkom podlogom srednje Dalmacije dominiraju karbonatne naslage, odnosno vapnenci i dolomiti kredne i paleogenske starosti. Flišne naslage sastavljene od lapora i pješčenjaka rjeđe su zastupljene i uglavnom prisutne uz obalnu liniju područja.[35] U takvom, dominantno krškom okolišu, nastanak i taloženje glinovitih sedimenata vrlo je rijetko. Glinoviti sedimenti na području srednje Dalmacije, iako rijetko zastupljeni, dolaze u asocijaciji s naslagama zemlje crvenice (*terra rossa*) koja je posebice zastupljena u obalnom području od Marine do Trogira.[36] Stoga, pretpostavlja se da su lončari glinu nabavljali u blizini naselja.

Lončarske primjese

Na temelju analize cjelokupnog uzorka doznajemo da su brončanodobni lončari glini dodavali tri osnovne vrste primjesa, usitnjene kalcit stijene i grog, i to prema tri lončarske recepture: kalcit; kalcit, različite vrste stijena i grog; grog (Sl. 6). Takve neplastične primjese pozitivno utječu na mehanička svojstva lončarske smjese; mogu pospješiti viskoznost smjese, čvrstoću i termičku izdržljivost posude, utječu na postupak sušenja, a mogu utjecati i na poroznost.[37] Stoga, odabir primjesa često je povezan i sa znanjima o njihovu utjecaju na finalni proizvod.

The quantities of pores vary from 5% to 15% (average 8%). The pores are mostly elongated and oriented partially or in parallel. The voids are irregular or sub-angular.

Fabric groups have been determined for each archaeological site on the basis of density and size of crystalloclasts in the matrix (18 fabric groups), while the subgroups are determined according to the type, size, shape and bimodal grain size distribution of the tempering material (Table 4).

Characterization of pottery raw materials and production techniques

Clayey raw material

The results showed that most vessels were made of clayey material that naturally contains between 15% and 25% of very fine crystalloclasts, very well-sorted in the matrix. Clays with a low content of mineral grains, or so-called fat clays, were used rarely (sample 85), just like very sandy clays (samples 69, 86 and 94). Since, at this stage of the study, soil samples in the research area had not been collected, data on the characteristics and availability of the clay are based on the data available on the geological and pedological structure of the area.

The geological base of central Dalmatia is dominated by carbonate deposits, namely limestones and dolomites of Cretaceous and Paleogene age. Flysch deposits composed of marl and sandstone are less common and present mostly along the coastal line of the area.[35] In such a predominantly karstic environment, the formation and deposition of clayey sediments are very rare. Clay sediments in the area of central Dalmatia, although rarely present, come in association with deposits of reddish soil (*terra rossa*), mainly distributed in the coastal area from Marina to Trogir.[36] Therefore, it is assumed that the potters procured clay near the settlement.

Tempering material

On the basis of the analysis of the entire sample, we have learned that Bronze Age potters added three basic types of tempering material to the clay – crushed calcite, rocks and grog – according to three pottery recipes: calcite; calcite, different types of rocks and grog; grog (Fig. 6). Such non-plastic inclusions positively affect the mechanical properties of the clay paste; they can improve the viscosity of the paste, and the strength and thermal durability of the vessel; they affect the drying process, and can also affect the porosity.[37] To that extent, the selection of tempering material is often related to knowledge about their impact on the final product.

35 Marinčić, Magaš, Borović 1971; Magaš, Marinčić 1973.

36 Bogunović *et al.* 2000.

37 Rice 1987, 408; Velde, Druc 1999; Roux 2019, 36.

35 Marinčić, Magaš, Borović 1971; Magaš, Marinčić 1973.

36 Bogunović *et al.* 2000.

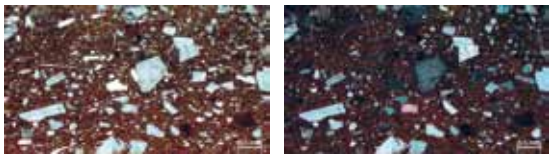
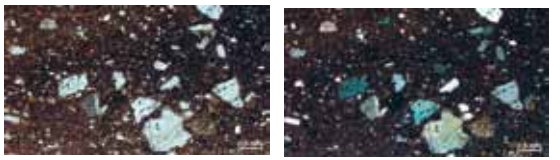
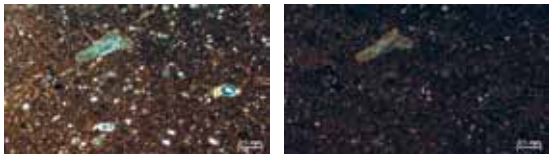
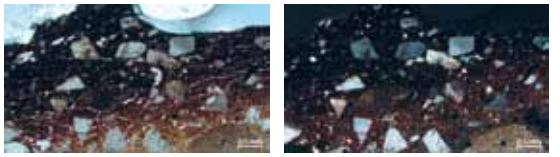
37 Rice 1987, 408; Velde, Druc 1999; Roux 2019, 36.

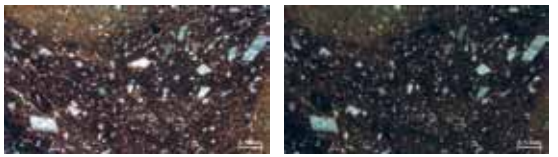
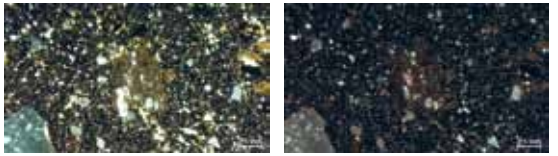
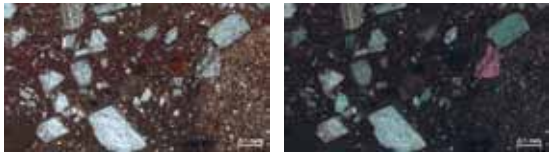
Nalazište / Site	Broj uzorka / Sample ID	Matriks / Matrix								Dodane primjese / Tempering material										Ostale inkluzije / Other inclusions	Pore i praznine / Pores and Voids (%)	FSG
		Dvolom / Birefringence	VFC (%)	FC (%)	Qtz	Fs	Mic	Bt	Cal	Cal. Zastupljenost / density (%)	Cal. Veličina / size	Cal. Razvrstanost / sortation	Cal. oblik / shape	Metamorfno / metamorphic	Sedminetarno / sedimentary (%)	Grog zastupljenost / density (%)	Grog veličina / size	Grog razvrstanost / sortation	Grog oblik / shape			
Trogir	57	MH			+	+	+	/	+	25	F/C	MS	VA	/	+	/	/	/	/	Msh	7	1.1
	58	MH			+	+	+	/	+	30	VF/C	MS	VA	/	/	/	/	/	/	/	7	1.1
	61	MH	15	/	+	+	+	/	+	30	VF/C	MS	VA	/	/	/	/	/	/	/	0	1.1
	62	MH			+	+	+	/	+	25	VF/C	MS	VA	/	+	/	/	/	/	/	0	1.1
	63	MH			+	+	+	/	+	30	VF/C	MS	VA	/	+	/	/	/	/	/	0	1.1
	59	MH	20	5	+	+	+	/	+	25	F/C	MS	VA	/	+	/	/	/	/	/	5	2.1
	60	MH			+	+	+	/	/	20	F/C	MS	SA	/	+	7	M	PS	SR	Msh, VM	7	2.2
Bristivica-Šupljak	64	MH	15	7	+	+	+	/	/	/	/	/	/	/	/	10	M/C	WS	SR	/	15	3.1
	67	MH			+	+	+	/	/	/	/	/	/	/	/	20	M/C	MS	SR	/	0	3.1
	65	MH	25	3	+	+	+	/	/	7	M	WS	A	+	+	10	M/C	WS	SR	/	0	4.1
	66	MH	15	/	+		+	/	+	25	F/C	PS	VA	/	+	/	/	/	/	/	15	5.1
Vinište-Oriovišćak	68	MH	25	3	+	+	+	/	+	20	VF/C	PS	VA	/	+	/	/	/	/	/	10	6.1
	70	MH			+		+	/	+	20	VF/C	PS	A	/	/	/	/	/	/	/	0	6.2
	71	MH			+	+	+	/	+	5	M/C	MS	A	/	10	10	M	PS	SA	/	0	6.2
	73	MH			+		+	/	+	5	F/C	PS	A	/	10	20	M/C	PS	SA	/	10-15	6.2
	69	MH	40	/	+	+	+	/	+	25	VF/C	PS	VA	/	+	/	/	/	/	/	0	7.1
	72	L	15	7	+	+	/	/	/	10	F/C	MS	A	+	10	/	/	/	/	/	0	8.1
Marina-Drid	74	MH	15	/	+		+	/	+	25	VF/C	PS	VA	/	/	/	/	/	/	/	0	9.1
	75	MH	40	3	+	+	+	/	+	20	VF/C	PS	A	/	+	7	M	PS	SR	/	0	10.1
	77	MH			+	+	+	/	+	15	F/M	MS	VA	/	/	7	M	PS	SA	/	0	10.1
	76	MH	15	10	+		+	/	/	10	M	WS	A	/	/	5	M	PS	SA	/	0	11.1

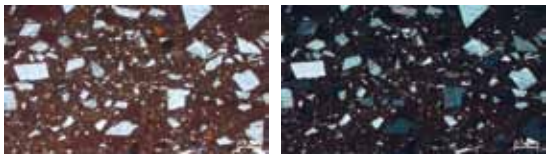
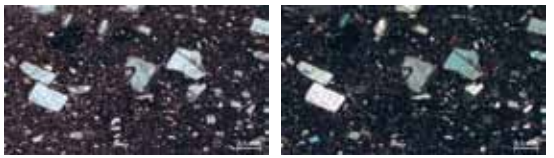
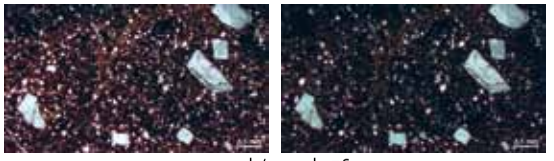
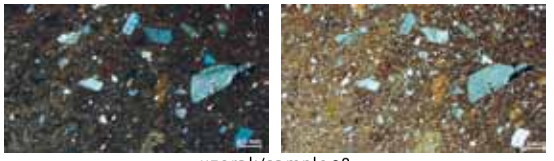
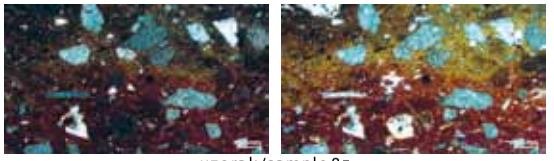
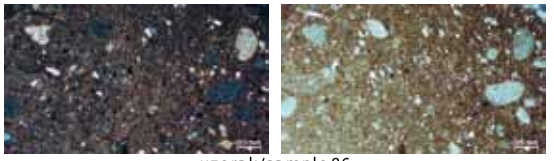
Nalazište / Site	Broj uzorka / Sample ID	Matriks / Matrix										Dodane primjese / Tempering material										Ostale inkluzije / Other inclusions	Pore i praznine / Pores and Voids (%)	FSG
		Dvolom / Birefringence	VFC (%)	FC (%)	Qtz	Fs	Mic	Bt	Cal	Cal. Zastupljenost / density (%)	Cal. Veličina / size	Cal. Razvrstanost / sortation	Cal. oblik / shape	Metamorfno / metamorphic	Sedimentarno / sedimentary (%)	Grog zastupljenost / density (%)	Grog veličina / size	Grog razvrstanost / sortation	Grog oblik / shape			
Trogir area	110	MH	15	/	+	+	+	/	+	20	F/M	MS	SA	/	7	20	M/C	WS	SA		/	0	18
Plano-Kraljeva Ograda	96	L	25	/	+	+	+	/	+	30	F/C	PS	A	/	+	10	M	PS	SA		/	15	17.1
	97	MH		/	+	+	+	/	+	25	VF/C	PS	A	/	+							16	17.2
	94	MH	50	7	+		+	/	/	/	/	/	/	/	/	7	M	PS	SA		/	0	16.1
	93	MH	25	/	+	+	+	/	/	/	/	/	/	/	/	7	M	PS	SA		/	0	15.1
	95	L		7	+	+	+	/	/	/	/	/	/	/	/	7	M	PS	SR		/	0	15.1
Seget Gornji-Sutilla	78	MH	25	/	+	+	+	+	+	20	VF/C	PS	A	/	10	/	/	/	/		/	0	12.1
	79	L			+	+	+	/	+	25	VF/C	MS	VA	/	+	/	/	/	/		spikle spicules	2	12.1
	80	H			+	+	+	/	+	15	F/C	PS	A	/	7	/	/	/	/		/	0	12.1
	81	MH			+	+	+	+	+	20	F/C	PS	VA	/	+	/	/	/	/		/	5	12.1
	82	MH		/	+	+	+	/	+	20	F/C	PS	A	/	/	/	/	/	/		/	0	12.1
	83	L			+		+	/	+	20	VF/C	PS	VA	/	/	/	/	/	/		/	7	12.1
	84	L			+	+	+	/	+	20	VF/C	PS	A	/	10	57	M	PS	SA		Msh	15	12.1
	87	MH			+	/	+	/	+	5	M	WS	A	/	/	5	M	PS	SA		ARF, Msh,	0	12.2
	98	MH			+	+	+	/	+	15	VF/C	PS	VA	/	+	5	M	PS	SR		ARF	0	12.2
	85	H	10	/	+	+	+	/	/	15	VF/M	PS	SA	/	7	/	/	/	/		/	0	13.1
	86	H	40	/	+		+	+	+	+	VF/C	PS	SR	+	15	/	/	/	/		/	0	14.1

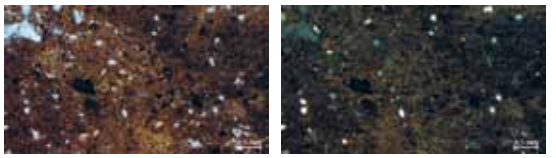
TABLICA 3. Rezultati petrografije keramike s trogirskog područja (VFC – vrlo fini kristaloklasti; FC – fini kristaloklasti; Qtz – kvarc; Fs – feldspat; Mic – tinjci; Bt – biotit; Cal – kalcit; L – nizak; MH – umjereno visok; H – visok; VF – vrlo fini; F – fini; M – srednji; C – grubi; PS – loše razvrstano; MS – umjereno razvrstano; WS – dobro razvrstano; SA – djelomično uglato; SR – djelomično zaobljeno; A – uglato; VA – vrlo uglato; VM – biljni material; ARF – glinoviti peleti; Msh – ljuske mekušaca; FSG – podgrupe strukture keramike) (izradile N. Neral i A. Kudelić).

TABLE 3. Ceramic petrography analysis of pottery from Trogir area (VFC – very fine crystalloclasts; FC – fine crystalloclasts; Qtz – Quartz; Fs – Feldspat; Mic – Mica; Bt – Biotite; Cal – Calcite; L – low; MH – medium high; H – high; VF – very fine; F – fine; M – medium; C – coarse; PS – poorly sorted; MS – medium sorted; WS – well sorted; SA – subangular; SR – sub-rounded; A – angular; VA – very angular; VM – vegetal material; ARF – Argilaceous rock fragments; Msh – Mollusc shell; FSG – Fabric subgroups) (made by N. Neral and A. Kudelić).

Nalazište / Site	Grupe / Groups	Podgrupe / Subgroups	Mikrofotografija / Photomicrograph (desno / right XPL image)
Trogir	1. Vrlo fini kristaloklasti kvarca, feldspata, tinjaca i kalcita zastupljeni oko 15 %. / Very fine crystalloclasts (15 %) of quartz, feldspar, mica, and calcite.	1.1. Prisutne su primjese uglatih zrna **kalcit**a, veličine između 0,25 i 3 mm, zastupljeni 25 – 30 %, a prisutna su (<5 %) i djelomično zaobljena zrna sedimentnih stijena (vapnenca), veličine od 0,25 do 1 mm. / The samples contain very angular **calcite**, 0.25 to 3 mm in size present in common to very common amounts (25 – 30 %). Sub-rounded sedimentary rocks (limestone), 0.25 to 1 mm in size, are sparsely present (< 5 %).	 uzorak/sample 57
	2. Vrlo fini (15 %) i fini (5 %) kristaloklasti kvarca, feldspata, tinjaca i kalcita. / Very fine (15 %) and fine (5 %) crystalloclasts of quartz, feldspar, mica, and calcite.	2.1. Prisutne su primjese vrlo uglatih zrna **kalcit**a, veličine između 0,1 i 3 mm, zastupljeni oko 20 %, a mjestimično su prisutna i djelomično zaobljena zrna sedimentnih stijena (<5 %, vapnenac i rjeđe rožnjak). / The samples contain very angular **calcite**, 0.1 to 3 mm in size present in common amounts (20 %). Sub-rounded sedimentary rocks (limestone and less common chert) are sparsely present (< 5 %).	 uzorak/sample 59
		2.2. Prisutne su primjese djelomično uglatih zrna **kalcit**a, veličine 0,25 do 3 mm, zastupljeni oko 20 %. Mjestimično su prisutne (<5 %) i djelomično zaobljene sedimentne stijene (vapnenac i rjeđe rožnjak). U uzorku se nalazi djelomično zaobljeni **grog**, veličine od 0,25 – 1 mm, zastupljenosti oko 7 %. / The samples contain sub-angular **calcite**, 0.25 to 3 mm in size present in common amounts (20 %). Sedimentary rocks (limestone and less common chert) are sparsely present (< 5 %). The samples also contain sub-rounded **grog** grains, 0.25 to 1 mm in size and present in sparse amounts (7 %).	 uzorak/sample 60
Bristivica-Šupljak	3. Vrlo fini (15 %) i fini (7 %) kristaloklasti kvarca, feldspata i tinjaca. / Very fine (15 %) and fine (7 %) crystalloclasts of quartz, feldspar, and mica.	3.1. Prisutne su primjese djelomično zaobljenog i djelomično uglatog **grog**a, veličine između 0,25 i 2 mm, zastupljeni 10 – 20 %. / The samples contain sub-rounded to sub-angular **grog**, 0.25 to 2 mm in size and present in moderate to common amounts (10 – 20 %).	 uzorak/sample 64
	4. Vrlo fini (25 %) i fini (3 %) kristaloklasti kvarca, feldspata i tinjaca. / Very fine (25 %) and fine (3 %) crystalloclasts of quartz, feldspar, and mica.	4.1. Prisutne su primjese uglatih zrna **kalcit**a, veličine 0,25 do 3 mm, zastupljene oko 7 %. Mjestimično su prisutne (<5 %) i sedimentne (vapnenac) i metamorfne (kvarcit) stijene. U uzorku se nalazi i djelomično zaobljeni **grog** veličine 0,1 do 2 mm, zastupljen oko 10 %. / The samples contain angular **calcite**, 0.25 to 3 mm in size present in sparse amounts (7 %). Sedimentary (limestone, dolomite, chert) and metamorphic (quartzite) rocks are sparsely present (< 5 %). The samples also contain sub-rounded **grog**, 0.1 to 2 mm in size and present in moderate amounts (10 %).	 uzorak/sample 65
	5. Vrlo fini kristaloklasti kvarca, tinjaca i kalcita zastupljeni oko 15 %. / Very fine crystalloclasts (15 %) of quartz, mica, and calcite.	5.1. Prisutne su primjese vrlo uglatih zrna **kalcit**a, veličine između 0,1 i 3 m, zastupljeni oko 25 %, a rijetko su prisutna (<5 %) i djelomično uglata zrna sedimentnih stijena, najviše vapnenca. / The samples contain very angular **calcite**, 0.1 to 3 mm in size present in common amounts (25 %). Sedimentary rocks (mostly limestone) are sparsely present (< 5 %).	 uzorak/sample 66

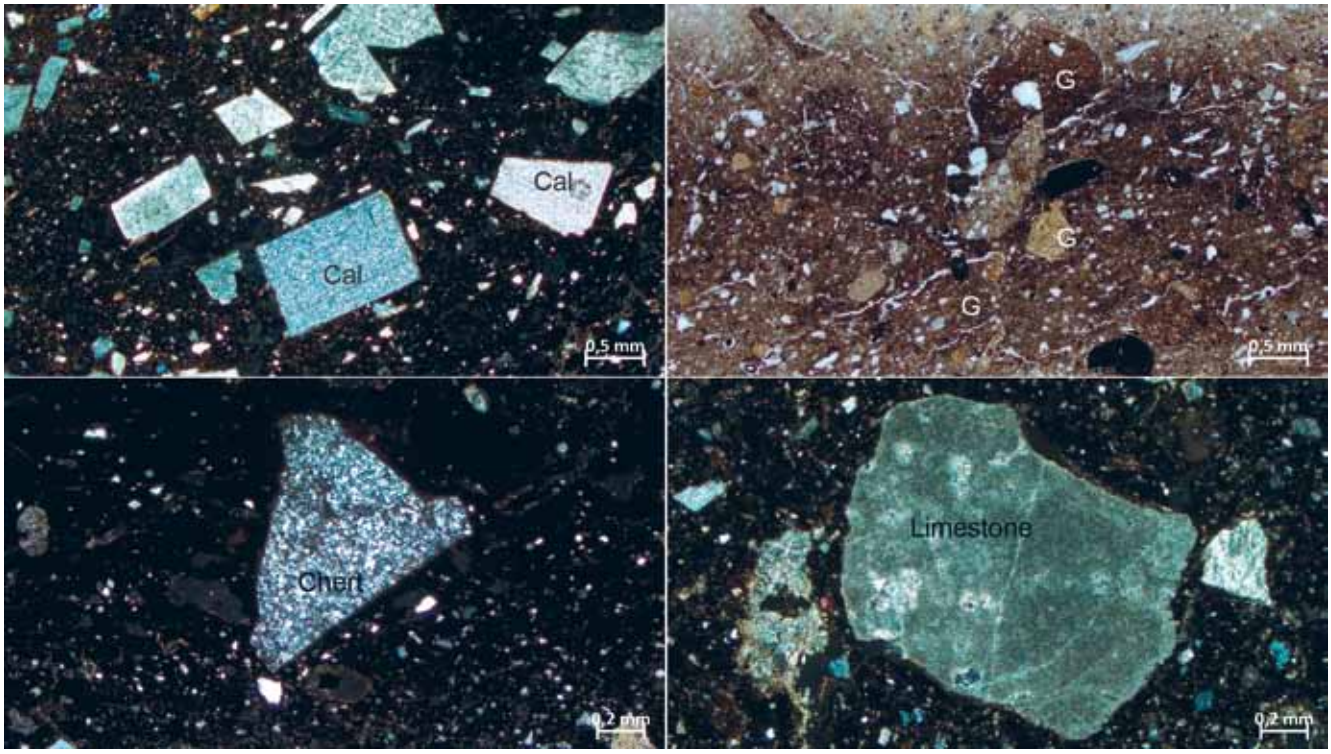
Nalazište / Site	Grupe / Groups	Podgrupe / Subgroups	Mikrofotografija / Photomicrograph (desno / right XPL image)
Vinišće-Oriovišćak	6. Vrlo fini (25 %) i fini (3 %) kristaloklasti kvarca, feldspata, tinjaca i kalcita. / Very fine (25 %) and fine (3 %) crystalloclasts of quartz, feldspar, mica, and calcite.	6.1. Prisutne su primjese vrlo uglatih zrna **kalcit**a, veličine između 0,1 i 3 mm, zastupljeni oko 20 %, a rijetko su prisutne (<5 %) i sedimentne stijene, vapnenci i dolomiti. / The samples contain very angular **calcite**, 0.1 to 3 mm in size and present in moderate amounts (20 %). Sedimentary rocks (limestone and dolomite) are sparsely present (< 5 %).	 uzorak/sample 68
		6.2. Prisutne su primjese vrlo uglatih zrna **kalcit**a, veličine između 0,1 i 3 mm, zastupljeni 5 – 20 %, a prisutne su (<10 %) i djelomično zaobljene **sedimentne stijene** (vapnenci, dolomit i rožnjak) veličine između 0,1 i 3 mm. U uzorku se nalazi djelomično zaobljeni **grog** veličine 0,25 do 1 mm, zastupljen 10 – 20 %. / The samples contain very angular **calcite**, 0.1 to 3 mm in size in sparse to common amounts (5 – 20 %). Sub-rounded sedimentary rocks (limestone, dolomite, chert), 0.1 to 3 mm in size, are sparsely present (< 10 %). The samples also contain rounded **grog**, 0.25 to 1 mm in size, present in moderate to common amounts (10 – 20 %).	 uzorak/sample 73
	7. Vrlo fini kristaloklasti kvarca, tinjaca i kalcita zastupljeni oko 40 %. / Very fine crystalloclasts (40 %) of quartz, mica, and calcite.	7.1. Prisutne su primjese vrlo uglatih zrna **kalcit**a, veličine između 0,1 i 3 mm, zastupljeni oko 25 %, a rijetko su prisutne (<5 %) i sedimentne stijene, vapnenci. 7 The samples contain very angular **calcite**, 0.1 to 3 mm in size and present in common amounts (25 %). Sedimentary rocks (limestone) are sparsely present (< 5 %).	 uzorak/sample 69
	8. Vrlo fini (15 %) i fini (7 %) kristaloklasti kvarca, feldspata i kalcita. / Very fine (15 %) and fine (7 %) crystalloclasts of quartz, feldspar, and calcite.	8.1. Prisutne su primjese uglatih zrna **kalcit**a, veličine između 0,1 i 3 mm, zastupljeni oko 10 %, a jednako su prisutne i djelomično zaobljen fragmenti **sedimentnih stijena**, vapnenca često zamućenih po površini. / The samples contain angular **calcite**, 0.1 to 3 mm in size and present in moderate amounts (10 %). Sub-rounded sedimentary rocks (limestone) are also present in moderate amounts (10 %). The grains are blurred on surface.	 uzorak/sample 72

Nalazište / Site	Grupe / Groups	Podgrupe / Subgroups	Mikrofotografija / Photomicrograph (desno / right XPL image)
Marina-Drid	9. Vrlo fini kristaloklasti kvarca, tinjaca i kalcita zastupljeni 15 %. / Very fine crystalloclasts (15 %) of quartz, mica, and calcite.	9.1. Prisutne su primjese vrlo uglatih zrna **kalcit**a, veličine između 0,1 i 3 mm, zastupljeni oko 25 %. / The samples contain very angular **calcite**, 0.1 to 3 mm in size and commonly present (25 %).	 uzorak/sample 74
	10. Vrlo fini (40 %) i fini (3 %) kristaloklasti kvarca, feldspata, tinjaca i kalcita. / Very fine (40 %) and fine (3 %) crystalloclasts of quartz, feldspar, mica, and calcite.	10.1. Prisutne su primjese vrlo uglatih zrna **kalcit**a, veličine između 0,1 i 3 m, zastupljeni 15 – 20 %, a pojedina zrna su djelomično zamućena po površini. U uzorku se nalazi i djelomično zaobljeni **grog** veličine 0,25 do 1 mm, zastupljen između 7 i 10 %. / The samples contain very angular **calcite**, 0.1 to 3 mm in size and present in moderate to common amounts (15 – 20 %). The grains are blurred on surface. The samples also contain sparse to moderate amounts (7 – 10 %) of sub-rounded **grog**, 0.25 to 1 mm in size.	 uzorak/sample 75
	11. Vrlo fini (15 %) i fini (10 %) kristaloklasti kvarca, feldspata i tinjaca. / Very fine (15 %) and fine (10 %) crystalloclasts of quartz, feldspar, and mica.	11.1. Prisutne su primjese uglatih zrna **kalcit**a, veličine između 0,25 i 3 mm, zastupljeni oko 10 %. U uzorku se nalazi sporadično (<7 %) djelomično zaobljeni **grog** veličine 0,25 do 1 mm. / The samples contain angular **calcite**, 0.25 to 3 mm in size and present in moderate amounts (10 %). The samples also contain sparse amounts (< 7 %) of sub-rounded **grog**, 0.25 to 1 mm in size.	 uzorak/sample 76
Seget Gornji-Sutilija	12. Vrlo fini kristaloklasti kvarca, feldspata, tinjaca i kalcita zastupljeni oko 25 %. / Very fine crystalloclasts (25 %) of quartz, feldspar, mica, and calcite.	12.1. Prisutne su primjese uglatih zrna **kalcit**a, veličine između 0,1 i 3 mm, zastupljeni između 20 i 30 %. U uzorku se nalaze i djelomično zaobljena zrna **sedimentnih stijena,** vapnenca i dolomita maksimalne zastupljenosti 10 % i veličine od 0,1 do 2 mm. / The samples contain angular **calcite**, 0.1 to 3 mm in size and present in common to very common amounts (20 – 30 %). Sub-rounded **sedimentary rocks** (limestone and dolomite), 0.1 to 2 mm in size, are present in moderate amounts (< 10 %)	 uzorak/sample 78
		12.2. Prisutne su primjese djelomično uglatih zrna **kalcit**a, veličine između 0,1 i 3 mm, zastupljeni 5 – 15 %, a rijetko su zastupljena (<5 %) djelomično zaobljena zrna sedimentnih stijena (vapnenca). U uzorku se nalazi vrlo mala količina djelomično zaobljenog **grog**a (<7 %) veličine 0,25 do 1 mm. / The samples contain sub-angular **calcite**, 0.1 to 3 mm in size present in sparse to moderate amounts (5 – 15 %). Sub-rounded sedimentary rocks (limestone) are sparsely present (< 5 %). The samples also contain sparse amounts (7%) of sub-rounded **grog**, 0.25 to 1 mm in size.	 uzorak/sample 98
	13. Vrlo fini kristaloklasti kvarca, feldspata i tinjaca zastupljeni oko 10 %. / Very fine crystalloclasts (10 %) of quartz, feldspar, and mica.	13.1. Prisutne su primjese djelomično uglatih zrna **kalcita i sedimentnih stijena**, veličine između 0,1 i 3 mm, zastupljeni približno 22 %. / The samples contain sub-angular **calcite** and sedimentary rocks present in common amounts (22 %). The size of calcite and **sedimentary fragments** is between 0.1 to 3 mm.	 uzorak/sample 85
	14. Vrlo fini kristaloklasti kvarca, feldspata, tinjaca i kalcita zastupljeni oko 40 %. / Very fine crystalloclasts (40 %) of quartz, feldspar, mica, and calcite.	14.1. Prisutne su primjese djelomično uglatih i zaobljenih zrna sedimentnih (vapnenci) i metamorfnih (kvarcit) **stijena** veličine između 0,1 i 1 mm, zastupljeni između 15 i 20 %. / The samples contain sub-angular to rounded sedimentary (limestone) and metamorphic (quartzite) **rocks** present in moderate to common amounts (15 – 20 %). The size of fragments varies between 0.1 to 1 mm.	 uzorak/sample 86

Nalazište / Site	Grupe / Groups	Podgrupe / Subgroups	Mikrofotografija / Photomicrograph (desno / right XPL image)
Plano-Kraljeva ograda	15. Vrlo fini (15 %) i fini (7 %) kristaloklasti kvarca, feldspata i tinjaca. / Very fine (15 %) and fine (7 %) crystalloclasts of quartz, feldspar, and mica.	15.1. U uzorku se nalazi djelomično zaobljeni i djelomično uglati **grog** veličine 0,25 do 1 mm, relativno male zastupljenosti od približno 7 %. / The sample contain sub-rounded to sub-angular **grog** present in sparse amounts (7 %). The size of grog is between 0.25 to 1 mm.	 uzorak/sample 93
	16. Vrlo fini (50 %) i fini (7 %) kristaloklasti kvarca, feldspata i tinjaca. / Very fine (50 %) and fine (7 %) crystalloclasts of quartz, feldspar, and mica.	16.1. U uzorku se nalazi djelomično zaobljeni i djelomično uglati **grog** veličine 0,25 do 1 mm, relativno male zastupljenosti od približno 7 %. / The sample contain sub-rounded to sub-angular **grog** present in sparse amounts (7 %). The size of grog is between 0.25 to 1 mm.	 uzorak/sample 94
	17. Vrlo fini kristaloklasti kvarca, feldspata, tinjaca i kalcita zastupljeni oko 25 %. / Very fine crystalloclasts (25 %) of quartz, feldspar, mica, and calcite.	17.1. Prisutne su primjese uglatih zrna **kalcit**a, veličine između 0,1 i 3 mm, zastupljeni oko 30 %. U uzorku se u malom omjeru (<5 %) nalaze i djelomično uglate sedimentne stijene, vapnenac i dolomit. / The samples contain angular **calcite**, 0.1 to 3 mm in size, present in very common amounts (30 %). Sedimentary rocks are sparsely present (< 5 %).	 uzorak/sample 96
		17.2. U uzorku se nalazi djelomično zaobljeni i djelomično uglati **grog** veličine 0,25 do 1 mm, zastupljen oko 10 %. / The sample contains sub-rounded to sub-angular **grog** present in moderate amounts (10 %). The grains are 0.25 to 1 mm in size.	 uzorak/sample 97
Okolica Trogira	18. Vrlo fini kristaloklasti kvarca, tinjaca i kalcita zastupljenosti oko 15 %. / Very fine crystalloclasts (15 %) of quartz, mica, and calcite.	18.1. U uzorku se nalazi djelomično zaobljeni i djelomično uglati **grog** veličine 0,25 do 2 mm, zastupljen oko 20 %. Prisutna su i djelomično zaobljena zrna kalcita i vapnenca veličine između 0,25 i 1 mm, zastupljeni oko 10 %, no nije jasno je li riječ o dodanoj primjesi. / The sample contain sub-rounded to sub-angular **grog** present in moderate amounts (20 %). The size of grog varies between 0.25 to 2 mm. Sub-rounded **calcite** and limestone are also determined. These are 0.25 to 1 mm in size and present in moderate amounts (15 %). The origin of calcite and limestone in the sample (naturally present or intentionally added) remain unclear.	 uzorak/sample 110

TABLICA 4. Opis grupa i podgrupa strukture keramike s nalazišta na području Trogira (izradile: A. Kudelić i N. Neral).

TABLE 4. Description of fabric groups and subgroups of pottery from the Trogir area (made by A. Kudelić and N. Neral)



SLIKA 5. Mikrofotografije primjesa: kalcit (a), grog (b), fragmenti stijena (c, d) (snimila N. Neral).

FIGURE 5. Photomicrographs of tempering material: a) calcite (a), grog (b), rock fragments (c, d) (photo by N. Neral).

Usitnjeni kalcit zabilježen je u keramici sa svih analiziranih nalazišta i predstavlja najzastupljeniju vrstu lončarske primjese (Sl. 7). Riječ je o vrlo raširenom mineralu koji nastaje u poroznim karbonatnim naslagama uslijed precipitacije iz vode bogate kalcijem. U tim uvjetima dolazi do nastanka kristala kalcita koji postupno ispunjavaju šupljine unutar karbonatnih naslaga. Pronalazi se u žilama vapnenačkih stijena pa upotreba kalcita kao primjese ukazuje na korištenje lako dostupnih resursa iz okoliša. Osim toga, lako se usitnjava zbog odlične kalavosti i relativno niske tvrdoće (3 po Mohsovoj ljestvici).

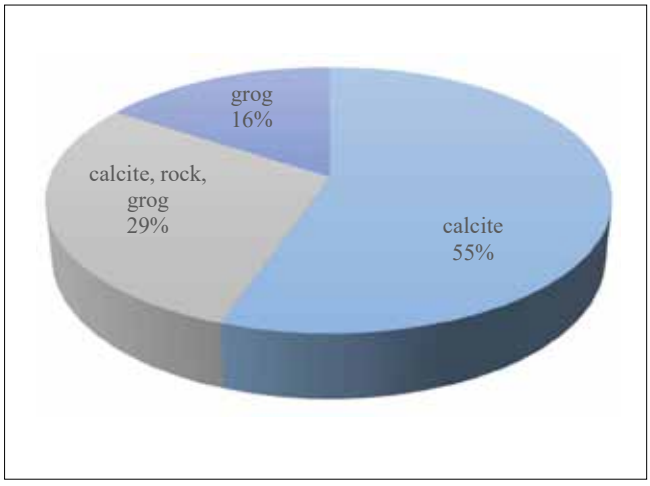
Upotreba kalcita, kao lončarske primjese, na istočnoj obali Jadrana zabilježena je još od neolitika, dok kod istovremenih zajednica na zapadnoj obali Jadrana takva praksa nije zabilježena.[38] Kasnije, tijekom brončanog doba, usitnjeni kalcit i različite stijene koriste se kao lončarska primjesa i na području zapadne obale Jadrana sa zaleđem,[39] a ovim istraživanjem slično je zabilježeno i za dio područja istočnojadranske obale. Štoviše, na području srednjeg Balkana upotreba usitnjenog kalcita zadržala se do danas, i to u kontekstu tradicijskog lončarstva,[40] osobito istočne obale Jadrana sa zaleđem. Stoga, može se zaključiti da je praksa upotrebe kalcita na području Dalmacije vrlo karakteristična i predstavlja izrazito dugovječnu tradiciju.

Crushed calcite was recorded in ceramics from all the sites analysed and represented the most common type of temper (Fig. 7). It is a prevalent mineral in porous carbonate deposits due to precipitation from calcium-rich water. Under these conditions, calcite crystals are formed, gradually filling the carbonate deposits' voids. It is found in the veins of limestone rocks, and therefore the use of calcite as a temper indicates the use of an easily available resource from the local landscape. In addition, it is easily crushed, due to its excellent ductility and relatively low hardness (3 on the Mohs scale).

The use of calcite has been recorded on the eastern coast of the Adriatic since the Neolithic. In contrast, such a practice has not been recorded in contemporary communities on the western coast of the Adriatic.[38] Later, during the Bronze Age, crushed calcite and various rocks were used in the central and southern Adriatic with its hinterland,[39] and this research has also recorded a similar pattern for part of the eastern Adriatic coast. Moreover, in the area of the Central Balkans, and especially on the eastern coast of the Adriatic, the use of crushed calcite has continued to this day in the context of traditional pottery.[40] To that extent, using calcite in Dalmatia is very characteristic and represents a long tradition.

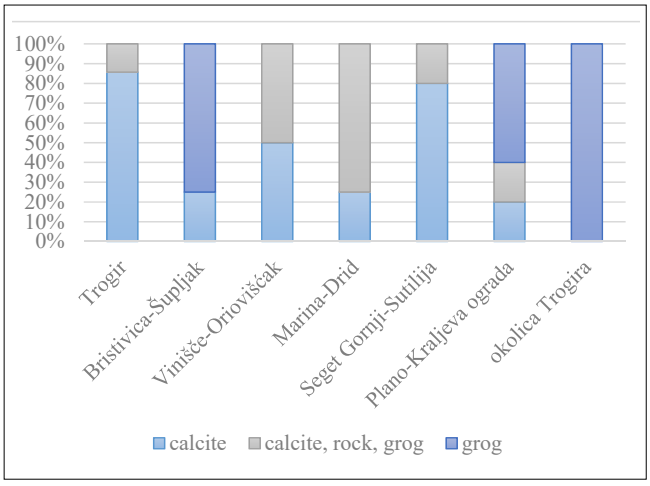
38 Spataro 2002, 193–197.
39 Cannavó, Levi 2018, 54–57.
40 Carlton 2002; 2014; 2019; Đorđević 2011.

38 Spataro 2002, 193–197.
39 Cannavó, Levi 2018, 54–57.
40 Carlton 2002; 2014; 2019; Đorđević 2011.



SLIKA 6. Udio pojedine lončarske recepture odnosno vrsta neplastičnih primjesa u svim analiziranim uzorcima (izradila A. Kudelić).

FIGURE 6. The proportion of individual pottery recipes or types of non-plastic temper material in all analysed samples (made by A. Kudelić).



SLIKA 7. Zastupljenost pojedine lončarske recepture u odnosu na nalazište (izradila A. Kudelić).

FIGURE 7. Representation of individual pottery recipes in relation to the site (made by A. Kudelić).

Mnogo manji broj analiziranih uzoraka sadrži grog kao jedinu vrstu primjese (16%), a najčešće je korišten zajedno s usitnjenim, pretežno sedimentnim stijenama i kalcitom (29%). Grog je u uzorcima uglavnom slabo zastupljen (u prosjeku 9,6%), izuzev uzoraka 67, 73 i 110, kod kojih je grog jedina vrsta primjese, zastupljenosti 20%. Dimenzije groga su relativno male od 0,2 mm do 1 mm, zrna su djelomično zaobljena i rijetko su uglata, uglavnom su providna, smeđe boje i sastava sličnog sastavu matriksa pa se pretpostavlja da je grog izrađen od ulomaka sličnih keramičkih posuda. Stoga, grog se može okarakterizirati kao lako dostupna, antropogena sirovina koja se nalazi unutar svakog naselja, a u funkcionalnom smislu ima sličan utjecaj na mehanička svojstva posude kao i ostale neplastične primjese.[41] Grog se koristio od neolitika, posebice na području Panonske nizine, gdje je to dominantna lončarska primjesa, osobito tijekom brončanog doba.[42] Na području zapadne obale Jadrana tradicija upotrebe groga karakteristična je isključivo za brončanodobnu Terramare kulturu na području sjeverne Italije,[43] dok je na području središnjeg i južnog dijela zapadne obale Jadrana sa zaleđem mnogo učestalija upotreba obiju sirovina, fragmenata stijena i kalcita zajedno s grogom.[44] Stoga, izbor groga ne smatra se uobičajenom i stalnom lončarskom praksom na području zapadne, osobito istočne obale Jadrana. Razloge neki istraživači nalaze u dostupnosti sirovine i geološkim značajkama područja, gdje se odvijala proizvodnja. Primjerice, prema rezultatima opsežnih istraživanja brončano-

A much smaller number of analysed samples contain grog as the only type of temper (16%). Much more often, grog was used together with crushed rocks, predominantly sedimentary, and calcite (29%). Grog is poorly represented in the samples (an average of 9.6%), except samples 67, 73 and 110, where grog is the only type of temper, with a density of 20%. The grains are relatively small in dimension, at 0.2–1 mm, and are partially rounded, rarely angular; they are mostly transparent, brown in colour, and their composition is similar to the composition of the matrix. Therefore, it is assumed that the grog is made from fragments of ceramic vessels made from similar raw material. To that extent, grog can be characterized as an easily accessible, anthropogenic raw material found within every settlement; and, in a functional sense, it is similar to other non-plastic inclusions in its effect on the mechanical properties of the vessel.[41] Grog has therefore been used since the Neolithic, especially in the area of the Pannonian Plain, where it was a dominant tempering material mainly during the Bronze Age.[42] On the western Adriatic coast, the tradition of using grog in northern Italy is characteristic exclusively of the Terramare culture.[43] In contrast, in the central and southern part of the western Adriatic coast with its hinterland, the use of both raw materials, rock and calcite, together with grog, is much more frequent.[44] To that extent, the choice of grog is not considered a common tempering practice in the western and especially the eastern Adriatic area. Some researchers find the reasons in

41 Rice 1987, 408; Velde, Druc 1999.

42 Kreiter 2007; Kudelić 2018; Karavanić, Kudelić 2019, 82–84; Kudelić, Sirovica 2022, 140–141.

43 Cannavó *et al.* 2017; Cannavó, Levi 2018, 44.

44 Cannavó, Levi 2018, 54–57.

41 Rice 1987, 408; Velde, Druc 1999.

42 Kreiter 2007; Kudelić 2018; Karavanić, Kudelić 2019, 82–84; Kudelić, Sirovica 2022, 140–141.

43 Cannavó *et al.* 2017; Cannavó, Levi 2018, 44.

44 Cannavó, Levi 2018, 54–57.

dobnih lončarskih receptura u Italiji, usitnjene stijene i minerali dominiraju na mnogo širem području, dok grog dominira isključivo na područjima koja su bogata sedimentima.[45]

Međutim, razlog za izbor groga na području s dugovječnom tradicijom upotrebe kalcita, kao što je to područje Dalmacije, nije izgledno tražiti isključivo u geološkim značajkama područja. Naime, takva predindustrijska društva imaju jasno definirane stilske i tehnološke okvire naslijeđene od svojih predaka i razvijene unutar svoje zajednice, a korištenje tradicionalnih materijala te primjena naučenih i provjerenih tehnika izrade temeljna su načela lončarske prakse.[46] Tako naučena i naslijeđena praksa prenosi se generacijama, stvarajući tradiciju i gradeći identitet.

U kontekstu ovog istraživanja, praksa dodavanja groga može se smatrati stranim elementom ugrađenim u postojeću i dobro definiranu lončarsku praksu, dok se prisutnost groga može tumačiti iz tehno-funkcionalne ili simboličke perspektive. Stoga, valja razmotriti i činjenicu da je grog termički mnogo stabilniji materijal u odnosu na kalcit, koji se raspada na temperaturama iznad 750 °C, ali i da vrlo mala količina groga, koji se nalazi u smjesi s dominantno prisutnim kalcitom, nema utjecaj na mehanička ili neka druga svojstva. Samim time može se pretpostaviti da grog nije korišten iz tehno-funkcionalnih razloga. S druge strane, ako je grog izrađivan od starije, razbijene posude, postupak ugrađivanja takvog materijala u novi predmet simbolizira održavanje kontinuiteta i identiteta kao dijela individualne i društvene prakse. Takva je praksa zabilježena u lončarskim tradicijama etnoloških i arheoloških zajednica kao sastavni dio njihove kulture.[47] Upotreba groga u lončarstvu na području Trogira, odnosno srednje Dalmacije tijekom brončanog doba, može se stoga tumačiti kao tehnološki izbor nastao pod utjecajem složenih društveno-kulturnih čimbenika. Naime, grog kao dominantna primjesa nalazi se isključivo kod analiziranih uzoraka (Sl. 8) sa stilskim značajkama cetinske keramike datirane u rano brončano doba (nalazište Bristivica – Šupljak) i na ulomku ranobrončanodobnog lonca iz okolice Trogira (uzorak 110). Slično je zabilježeno preliminarnim rezultatima petrografije keramike cetinske kulture, također s područja srednje Dalmacije (gomile s nalazišta Brnjice, Poljakuša i Vučevica), gdje se grog navodi kao jedina lončarska primjesa.[48] Osim kod ranobrončanodobne lončarije, grog je korišten i za izradu lončarije s nalazišta Plano – Kraljeva ograda datiranog radiokarbonskom metodom u kraj 17. i 16. st. pr. n. e., odnosno u srednje brončano doba. Lončarija datirana u kasno brončano doba s morfološkim karakteristikama starije, srednjobrončanodobne keramike[49] i dalje se izrađivala koristeći mali udio groga zajedno

the availability of raw materials and the geological features of the area where the production occurred. For example, according to the results of extensive research into Bronze Age pottery recipes in Italy, crushed rocks and minerals dominate in a much wider area. In contrast, grog dominates exclusively in sedimentary areas.[45]

However, the reason for choosing grog in an area with a long-standing tradition of using calcite, such as Dalmatia, is unlikely to be found exclusively in the geological features of the area. Such pre-industrial societies have clearly-defined stylistic and technological frameworks inherited from their ancestors and developed within their community. The use of traditional materials and the use of learned and proven manufacturing techniques are the basic principles of pottery practice.[46] Therefore, learned and inherited practice is passed down through the generations, creating a tradition and building an identity.

In the context of this study, the practice of adding grog can be considered as a foreign element incorporated into the existing and well-defined pottery practice, while its presence can be interpreted from a techno-functional or symbolic perspective. To that extent, it is necessary to consider the fact that grog is a thermally much more stable material than calcite, which decomposes at temperatures above 750 °C, but also that a very small amount of grog, present within the dominantly calcite-tempered fabric, does not affect the mechanical or other properties of the vessels. By that alone, it can be assumed that grog was not used for techno-functional reasons. On the other hand, for example, if grog is made from fragments of older, broken vessels, the process of incorporating an older vessel into a new object symbolizes the maintenance of continuity and identity of individual and community practices. Such a practice is recorded in pottery traditions in ethnological and archaeological communities as an integral part of their culture.[47] The use of grog in pottery production in the Trogir area, i.e. central Dalmatia, during the Bronze Age can therefore be interpreted as a technological choice that emerged under the influence of complex sociocultural factors. In fact, grog as a dominant temper is found exclusively in the samples analysed (Fig. 8) with stylistic features of Early Bronze Age Cetinska pottery (the Bristivica - Šupljak site) and on an Early Bronze Age pot from around Trogir (sample 110). The preliminary results of the ceramic petrography of Cetinska pottery also from the area of central Dalmatia (mounds at the sites of Brnjice, Poljakuša and Vučevica) have shown similar results, where grog is mentioned as the only tempering material.[48] In addition to

45 Cannavó, Levi 2018, 48.

46 Shepard 1957, 164; Rice 1987, 118; Michelaki, Minc, O`Shea 2002; Gosselain, Livingstone Smith 2005; Kreiter 2007; Gosselain 2008; Albero Santacreu *et al.* 2014.

47 DeBoer 1974, 336; Smith 1989, 61; Spindel 1989: 69; Chapman 2000; Brück 2006.

48 Gori *et al.* 2019.

45 Cannavó, Levi 2018, 48.

46 Shepard 1957, 164; Rice 1987, 118; Michelaki, Minc, O`Shea 2002; Gosselain, Livingstone Smith 2005; Kreiter 2007; Gosselain 2008; Albero Santacreu *et al.* 2014.

47 DeBoer 1974, 336; Smith 1989, 61; Spindel 1989: 69; Chapman 2000; Brück 2006.

48 Gori *et al.* 2019.

s kalcitom i usitnjenim stijenama, a od kasnoga brončanog doba kalcit postaje dominantna lončarska primjesa.

Rezultati stoga ukazuju na vezu između odabira primjesa i kronoloških obrazaca, odnosno takva praksa mogla je biti povezana s periodičnim utjecajima različitih društvenih faktora.

Tehnike izrade

Dokazi i interpretacija tehnika izrade keramičkih posuda uglavnom se temelje na makroskopskoj analizi površine posuda, međutim, pojedini dokazi o tehnikama oblikovanja mogu se pronaći i u mikrostrukturi materijala promatrajući tanki izbrusak keramike.

Kod nekoliko uzoraka (62, 63, 69 i 74) u matriksu su prisutne zaobljene finozrnate glinovite mase, bez krupnijih mineralnih inkluzija i bez primjesa koje zauzimaju između 10 te najviše 15% površine uzorka (Sl. 9). Njihov je mineralni sastav uglavnom sličan sastavu matriksa, ili su mineralne inkluzije finije. Takve finozrnate mase ukazuju na korištenje dviju glinovitih smjesa: jedne s dodanom primjesom vrlo uglatog kalcita, veličine između 0,1 i 3 mm, te relativno visoke zastupljenosti, između 25 i 30%, dok druga masa predstavlja izvornu sirovinu bez dodanih primjesa. To može biti posljedica nedovoljno izmiješane lončarske smjese,[50] međutim, takve su glinovite mase uglavnom smještene uz vanjsku stijenku posude pa se pretpostavlja da je riječ o tragovima popravaka, odnosno popunjavanja praznina[51] nastalih ispadanjem grubih primjesa tijekom postupka gradnje posude ili obrade njezine površine. U tom slučaju, za popunjavanje takvih praznina lončar je koristio izvornu sirovinu, a ne sirovinu s primjesom kako bi izbjegao ponavljanje „greške".

Oblik i raspored pora i praznina u matriksu također mogu biti pokazatelji tehnike izrade. Većina uzoraka (66%) nema vidljive pore ili su one rijetko prisutne, što ukazuje na dobro homogeniziranu smjesu, bez vidljivih negativnih utjecaja postupka sušenja ili termalnog stresa prilikom pečenja posuda. Kod 16% uzoraka (57, 58, 59, 60, 81, 83) zabilježene su tanke, uglavnom paralelno orijentirane i gusto raspoređene pore. Njihov oblik i orijentacija ukazuju na izrazitiji pritisak vršen na stijenke zidova posude nastalih u fazi dok je glina još uvijek plastična, što ukazuje na teh-

Early Bronze Age pottery, grog has also been recorded in pottery from the site of Plano - Kraljeva Ograda, dated by the radiocarbon method to the end of the 17th century BC and the 16th: that is, to the Middle Bronze Age. Late Bronze Age ceramics that have the morphological characteristics of older, Middle Bronze Age pottery[49] were still made using a small proportion of grog along with calcite and crushed stone, and from the Late Bronze Age calcite became the dominant temper.

The results therefore indicate a correlation between tempering-material selection and chronological patterns: that is, such a practice could be related to the periodic influences of various social factors.

Manufacturing techniques

The interpretation of manufacturing techniques is based mainly on the macroscopic analysis of the vessel's surface; however, some evidence can also be found in the microstructure of the material by observing the thin sections of ceramics.

In several thin sections (samples 62, 63, 69 and 74), there are parts of the clayey matrix which contain much fewer and much smaller inclusions than the other parts, forming a kind of rounded clayey mass that occupies between 10% and, at most, 15% of the sample's surface (Fig. 9). Their mineral composition is mainly similar to that of the matrix, or the mineral inclusions are finer. These clayey masses indicate use of two clay pastes: one with an added temper of very angular commonly present (25–30%) calcite, between 0.1 and 3 mm in size, while the second paste represents the original raw material without added non-plastic temper. This may result from an insufficiently mixed clay paste;[50] however, such clay masses are located mostly along the outer wall of the vessel, so it is assumed that these are traces of repairs,[51] i.e. the filling of gaps created by the falling out of coarse tempering material during the building of a vessel or the treatment of its surface. In this case, the potters used the original raw material to fill such gaps, not the raw material with added temper, to avoid repeating the 'mistake'.

The shape and arrangement of the pores and voids in the matrix can also be indicative of the manufacturing technique. In most of the samples (66%), pores are either not visible or rarely present, indicating a well-homogenized paste with no visible negative effects of drying or thermal stress during the firing process. In 16% of the samples (57, 58, 59, 60, 81, 83), thin pores, mostly densely distributed and oriented in parallel, were recorded. Their shape and orientation indicate a more pronounced pressure exerted

49 Kriteriji podrazumijevaju način oblikovanja otvora (oštar prijelaz vrata u tijelo) i ruba otvora posude (horizontalno proširen, ravan rub) te strukturu keramike koja ne odgovara značajkama glavnine keramičke građe iz određenog konteksta ili nalazišta.

50 Quinn 2013, 175.

51 Sličan način popravka zabilježen je na videu Richarda Carltona kojim je dokumentiran tradicijski lončar iz Potravlja u Dalmaciji (Pottery-making at Potravlje near Sinj in Dalmatia, Croatia 1990 & 1994; https://www.youtube.com/watch?v=Hr5FKs52_q8).

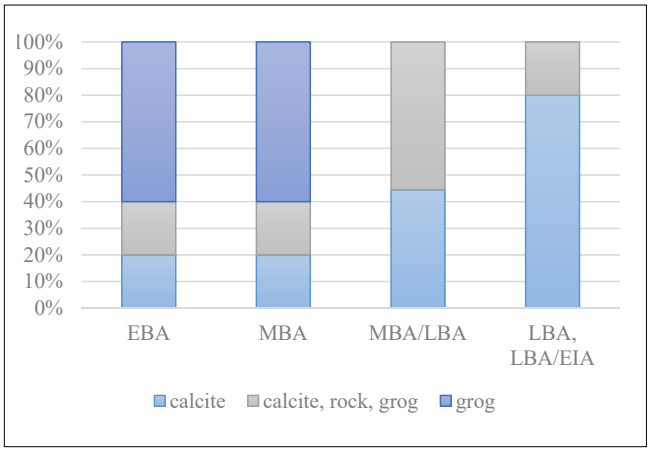
49 The criteria include the way of shaping the orifice (sharp transition of the orifice into the body) and the edge of the orifice of the vessel (horizontally widened, flat edge), and a ceramic fabric that does not match the characteristics of other ceramics from the same context or site.

50 Quinn 2013, 175.

51 A similar method of repair is recorded in Richard Carlton's video documenting a traditional potter from Potravlje in Dalmatia (Pottery-making at Potravlje near Sinj in Dalmatia, Croatia 1990 & 1994; https://www.youtube.com/watch?v=Hr5FKs52_q8).

SLIKA 8. Zastupljenost lončarskih receptura u odnosu na dataciju lončarije, EBA: rano brončano doba; MBA: srednje brončano doba; MBA/LBA ulomci s morfološkim karakteristikama srednjeg brončanog doba; LBA: kasno brončano doba (izradila A. Kudelić).

FIGURE 8. Representation of potters' recipes in relation to pottery dating, EBA: Early Bronze Age; MBA: Middle Bronze Age; MBA/LBA fragments with morphological characteristics of the Middle Bronze Age; LBA: Late Bronze Age (made by A. Kudelić).



niku izrade posude. Međutim, 18% uzoraka (64, 66, 68, 73, 84, 96 i 97) porozne teksture ima izdužene, ali mnogo šire pore i praznine, djelomično orijentirane, pri čemu smjesa nije potpuno homogenizirana, što ukazuje na primjenu drugačije tehnike izrade.

Istraživanjem su prikupljene i informacije o temperaturama pečenja keramike. One se najčešće procjenjuju na temelju dvoloma matriksa te putem mineralnih faza prisutnih u određenom temperaturnom rasponu. U slučaju keramike s trogirskog područja dvolom matriksa je umjereno visok u većini uzoraka, što ukazuje na to da temperature vjerojatno nisu prelazile 800 – 850°C.[52] Na slične rezultate ukazuje i difrakcijski maksimum filosilikata 10Å (Mca) koji može odgovarati dehidroksilaciji ilitične faze prisutne na temperaturama do 900°C.[53] U skladu je s time i prisutnost kalcita (Cal) u većini uzoraka te vapna (Lime) u uzorku 75, čiji raspad uslijed visoke temperature započinje na oko 700°C, dok te mineralne faze u potpunosti izostaju na temperaturama iznad 800°C.[54] Ipak, prisutnost kalcita, odnosno takve mineralne faze, može odgovarati i sekundarno nastalom kalcitu iskristaliziranom u porama uzorka nakon odlaganja. Mineraloška analiza uzorka 72 s nalazišta Orioviščak ukazuje na prisutnosti mulita te istovremene odsutnosti filosilikata na 10 Å. Transformacija određenih filosilikata u mulit započinje na oko 800°C, dok su na temperaturama iznad 1150°C filosilikati u potpunosti zamijenjeni mulitom.[55] Stoga, za uzorak 72 procjenjuje se izlaganje temperaturi višoj od 1000°C, na što dodatno ukazuje i djelomično vitrificirani matriks niskog dvoloma. Međutim, s obzirom na to da procijenjene temperature pečenja za brončanodobnu keramiku na području Panonske nizine ne prelaze 800 – 850°C,[56] izlaganje tako visokim temperaturama vjerojatno je posljedica sekundarnog gorenja.

on the vessel walls created in the phase when the clay is still plastic, and indicating the manufacturing technique. However, 18% of the samples (64, 66, 68, 73, 84, 96 and 97) with a porous texture have elongated but much wider pores and voids, partially oriented, where the paste is not completely homogenized, which indicates the application of a different production technique.

The research also collected information on the firing temperatures of ceramics. They are often evaluated on the basis of matrix birefringence and mineral phases in a certain temperature range. In the case of ceramics from the Trogir region, the birefringence of the matrix is moderately high in most samples, which indicates that the temperatures probably did not exceed 800–850 °C.[52] Similar results are indicated by the diffraction maximum of phyllosilicate 10 Å (Mca), which may correspond to the dehydroxylation of the illitic phase present at temperatures up to 900 °C.[53] This is consistent with the presence of calcite in most samples and lime in sample 75, the decomposition of which, due to high temperature, begins at around 700 °C, while these mineral phases are completely absent at temperatures above 800 °C.[54] However, the presence of calcite, or such a mineral phase, may also correspond to secondary calcite crystallizing in the pores of the sample after deposition. Mineralogical analysis of sample 72 from the Orioviščak site indicates the presence of mullite and the simultaneous absence of phyllosilicate at 10 Å. Certain phyllosilicates transform into mullite at around 800 °C, while at temperatures above 1150 °C the phyllosilicates are completely replaced by mullite.[55] Therefore, for sample 72, exposure to a temperature higher than 1000 °C is estimated, which is additionally indicated by the partially vitrified matrix of low birefringence. However, given that the estimated firing temperatures for Bronze Age ceramics in the Pannonian Plain area do not exceed 800–850 °C,[56] exposure to such high temperatures is probably the result of the secondary firing of the ceramics.

52 Quinn 2013, 191.

53 Cultrone *et al.* 2001.

54 Gruver 1950; Cultrone *et al.* 2001; Rodriguez-Navarro *et al.* 2009; Quinn 2013, 191.

55 Cultrone *et al.* 2001.

56 Kreiter *et al.* 2007, 40; Kudelić *et al.* 2018, 49.

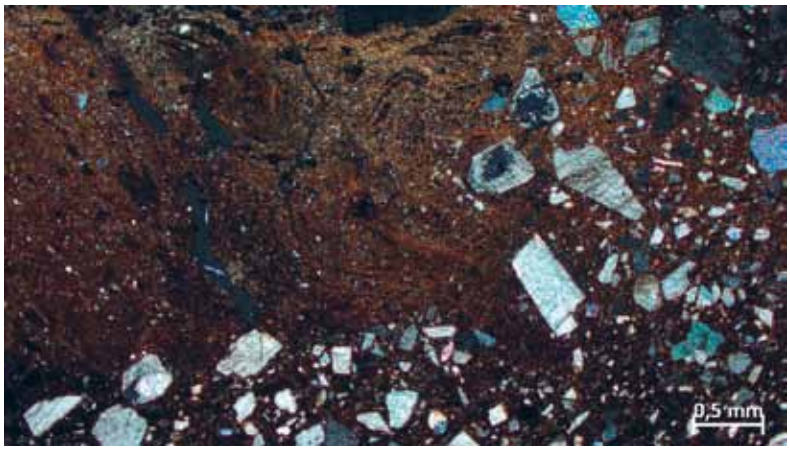
52 Quinn 2013, 191.

53 Cultrone *et al.* 2001.

54 Gruver 1950; Cultrone *et al.* 2001; Rodriguez-Navarro *et al.* 2009; Quinn 2013, 191.

55 Cultrone *et al.* 2001.

56 Kreiter *et al.* 2007, 40; Kudelić *et al.* 2018, 49.



SLIKA 9. Zaobljena finozrnata glinovita masa, uzorak 63 (snimila N. Neral).

FIGURE 9. Fine-grained rounded clay mass, sample 63 (photo by N. Neral).

Zaključak

Provedenim su istraživanjem prikupljene nove informacije o lončarskoj tehnologiji brončanog doba na području srednje Dalmacije, a one predstavljaju jedini set podataka o mineraloško-petrografskim značajkama lončarskih sirovina korištenih tijekom brončanog doba na području istočne obale Jadrana. Cilj je istraživanja ograničene količine uzoraka slijedio ideju prikupljanja podataka o sastavu lončarske smjese korištene za izradu keramičkih posuda u razdoblju između ranog i kasnoga brončanog na području srednje Dalmacije. Pretpostavka da priprema lončarske smjese, izbori sirovina, kao i tehnika izrade, koji čine dio lanca operacija unutar sustava lončarske proizvodnje, predstavljaju pokazatelje ne samo tehnoloških već i društveno orijentiranih značajki, ukazivala je na potencijalno dobar i do sada na ovim prostorima neprimijenjen istraživački smjer. Stoga, istraživačka su pitanja bila usmjerena na uočavanje karakteristika, ali i razlika u lončarskoj praksi između ranog i kraja kasnoga brončanog doba, a potencijalne bi razlike pružile mogućnost za razmatranja i interpretaciju rezultata u širem društvenom kontekstu.

U nastojanju da se prikupi relevantan uzorak, kriteriji izbora bili su usmjereni na već objavljenu građu, dijagnostičke ulomke ili kontekst koji je datiran radiokarbonskom metodom te su oni odabrani sa šest različitih nalazišta na trogirskom području. Iz rezultata se doznaje da je za izradu posuda korištena lokalna, lako dostupna glina. Također, razvidna je dugotrajna tradicija upotrebe kalcita kojeg lončari namjerno dodaju glini i koji u posljednjoj fazi brončanog doba postaje dominantna primjesa. S druge strane, od ranoga brončanog doba lončari smjesi dodaju i grog, samostalno ili s kalcitom, te rjeđe usitnjenim sedimentnim stijenama, a takva se praksa izgleda polako napušta od kasnoga brončanog doba. Premda su obje vrste lončarske primjese dio prirodnog, odnosno antropogenog okruženja, pretpostavlja se da razlike u odabiru primjesa nisu produkt samo dostupnosti sirovine ili pozitivnih utjecaja na mehaničkih svojstava, one proizlaze iz složenijih društvenih i kulturnih sfera. Osim toga, način života i smjerovi kretanja stanovništva u lokalnom okruženju također predstavljaju niz faktora koji su mogli utjecati na tehnološke izbore tijekom prošlosti.

Conclusion

The conducted research gathered new information about the pottery technology of the Bronze Age in the area of central Dalmatia, and it represents the only set of data on the mineralogico-petrographic features of pottery raw materials used during the Bronze Age on the eastern Adriatic coast. The goal of researching a limited number of samples followed the idea of collecting data on the composition of the clay paste for making ceramic vessels in the period between the early and late Bronze Age in central Dalmatia. The preparation of the clay paste, and the choice of raw materials, as well as the manufacturing techniques, form part of the chain of operations within the pottery production system, and these are assumed to represent a basis for the interpretation of not only technological but also socially-oriented decisions, and this indicates a potentially good and so far unapplied direction of research in these areas. Therefore, the research questions were aimed at noticing the characteristics and variability in pottery practice between the Early and the end of the Late Bronze Age, and the potential differences would provide an opportunity for consideration and interpretation of the results in a wider social context.

In an effort to collect a relevant sample set, the selection criteria focused on material already published, diagnostic fragments or contexts dated by the radiocarbon method, and these were selected from six different sites in the Trogir area. The results show that local, easily available clay was used for the production of the vessels. A long-standing tradition of using calcite, which potters added to the clay, and which becomes the dominant tempering material in the last phase of the Bronze Age, is also evident. On the other hand, from the Early Bronze Age, potters added grog to the paste, alone or with calcite, a practice that seems to have been slowly abandoned after the Late Bronze Age. Although both types of tempering materials belong to natural or anthropogenic environments, it is assumed that the choice of such materials is not only influenced by their availability or positive effects on the mechanical properties of the vessels, but also arises from more complex social and cultural spheres. In addition, the way of life and the direction of movement of the population in the local environment also represent a number of factors that could have influenced technological choices during the past.

Napomena

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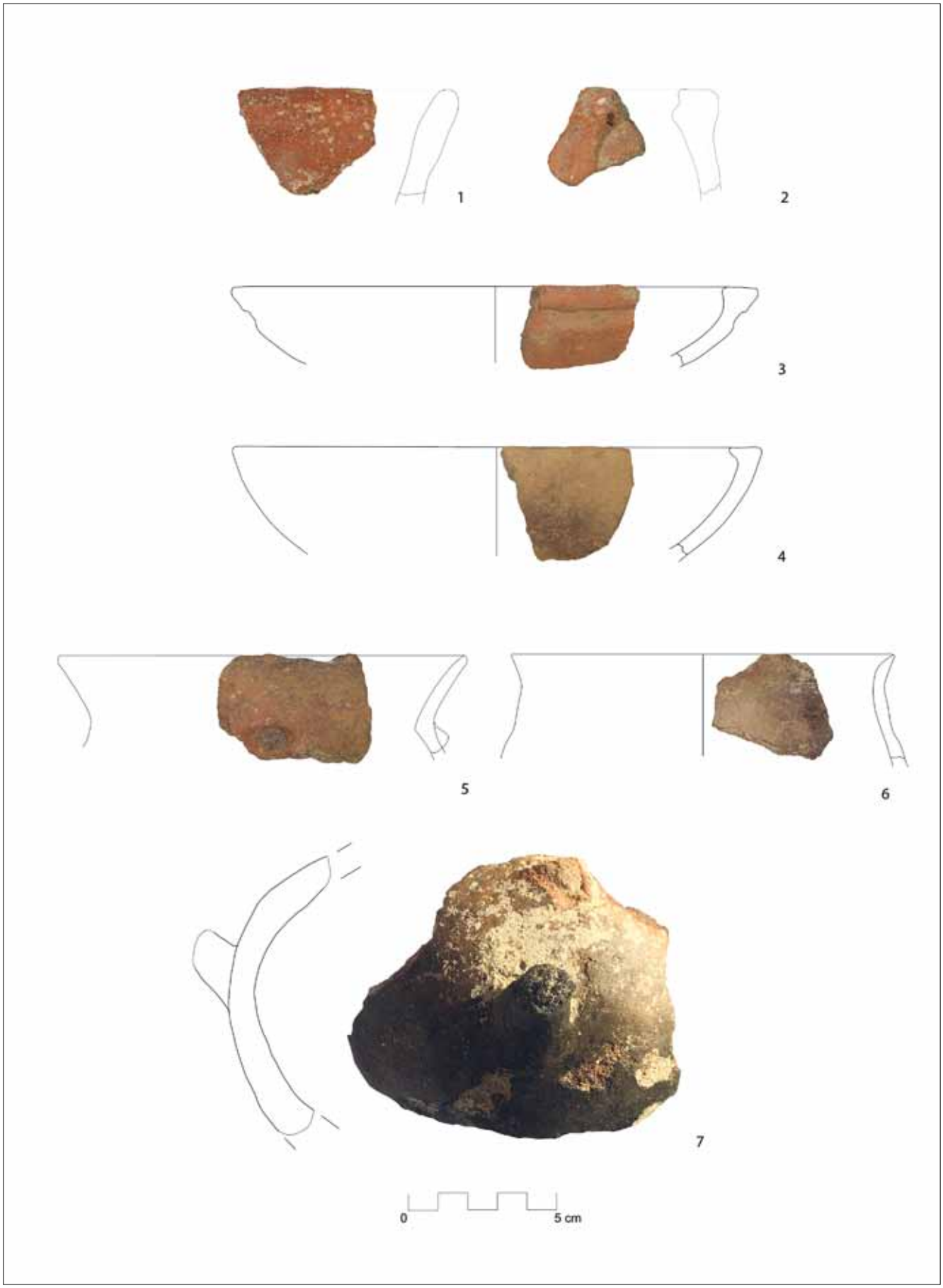

TABLA 1 Ulomci keramičkih posuda s nalazišta u Trogiru: 1: uzorak 59; 2: uzorak 60; 3: uzorak 61; 4: uzorak 62; 5: uzorak 58; 6: uzorak 63; 7: uzorak 57 (izradila A. Kudelić).

PLATE 1 Fragments of ceramic vessels from the site of Trogir: 1: sample 59; 2: sample 60; 3: sample 61; 4: sample 62; 5: sample 58; 6: sample 63; 7: sample 57 (made by A. Kudelić).

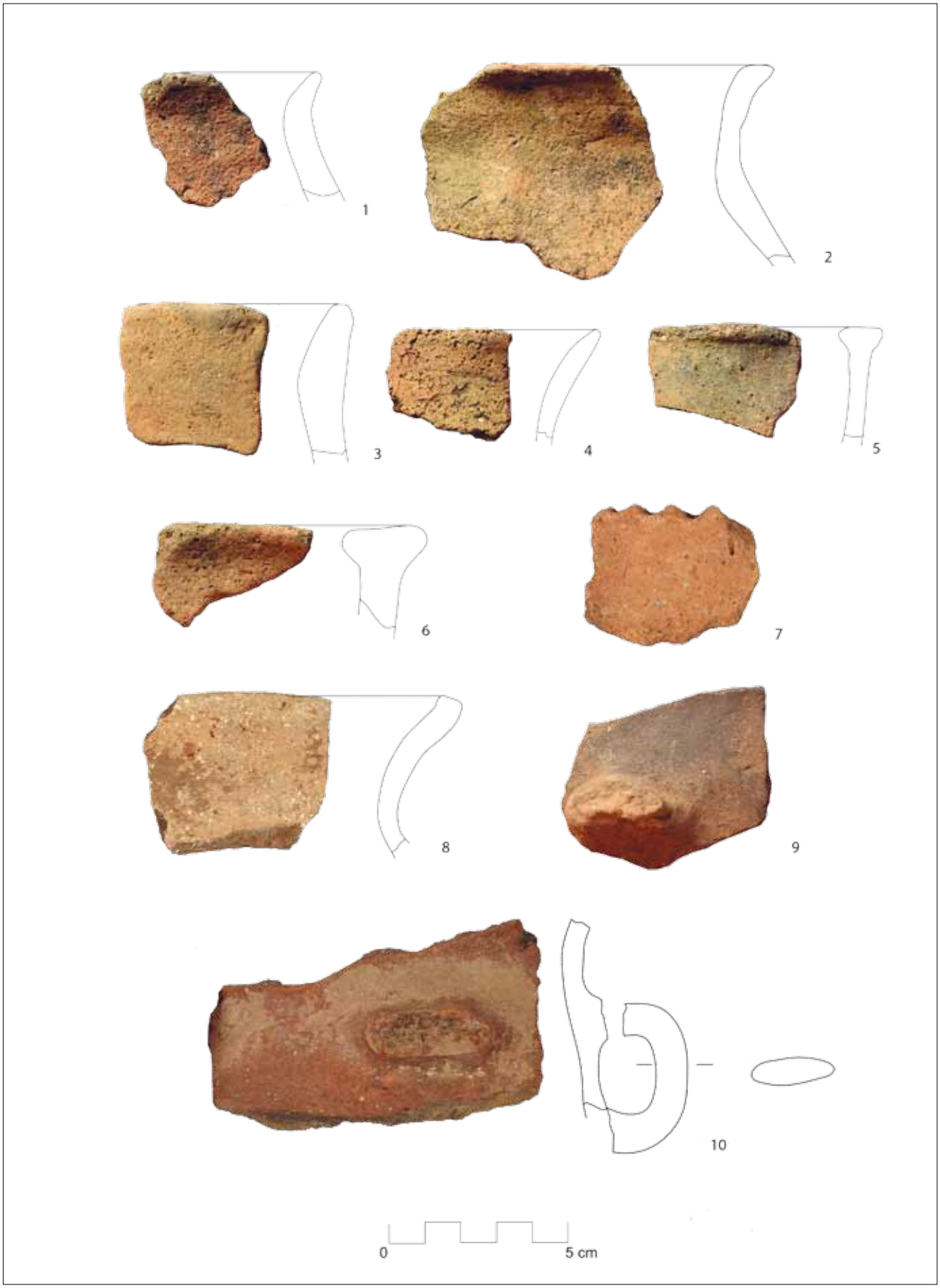

TABLA 2. Ulomci keramičkih posuda s nalazišta Vinišće-Oriovišćak: 1: uzorak 68; 2: uzorak 69; 3: uzorak 70; 4: uzorak 71; 5: uzorak 72; 6: uzorak 73 i nalazišta Marina – Drid: 7: uzorak 75; 8: uzorak 77; 9: uzorak 76 (izradila A. Kudelić).

PLATE 2. Fragments of ceramic vessels from the Vinišće-Oriovišćak site: 1: sample 68; 2: sample 69; 3: sample 70; 4: sample 71; 5: sample 72; 6: sample 73, and Marina – Drid site: 7: sample 75; 8: sample 77; 9: sample 76 (made by A. Kudelić).

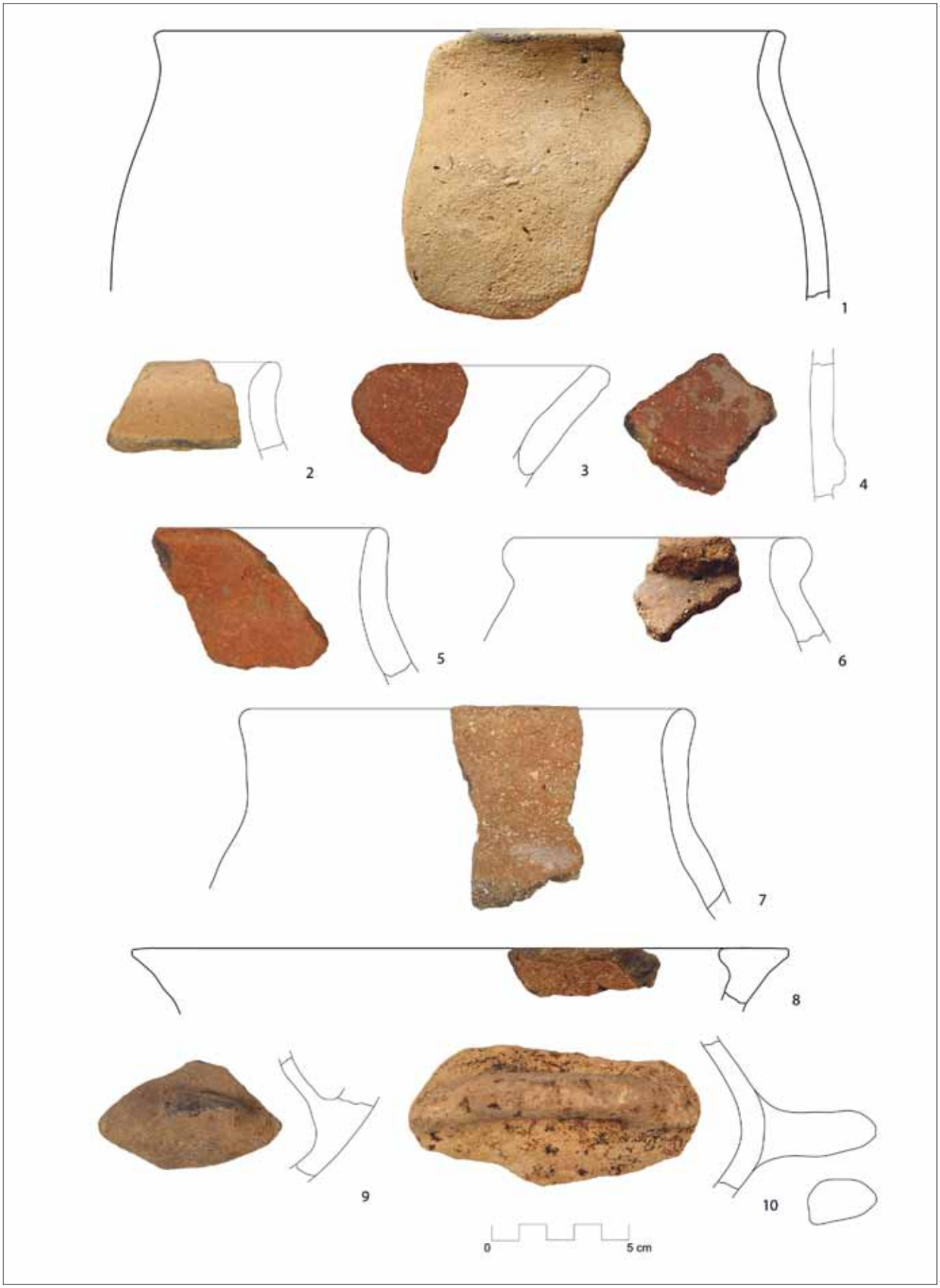

TABLA 3. Ulomci keramičkih posuda s nalazišta Seget Gornji-Sutilija: 1: uzorak 78; 2: uzorak 79; 3: uzorak 80; 4: uzorak 81; 5: uzorak 82; 6: uzorak 83; 7: uzorak 84; 8: uzorak 86; 9: uzorak 87; 10: uzorak 98 (izradila A. Kudelić).

PLATE 3. Fragments of ceramic vessels from the Seget Gornji-Sutilija site: 1: sample 78; 2: sample 79; 3: sample 80; 4: sample 81; 5: sample 82; 6: sample 83; 7: sample 84; 8: sample 86; 9: sample 87; 10: sample 98 (made by A. Kudelić).