Humka XI (K) sa lokaliteta Paulje: novi apsolutni datumi i poreklo najranijih nalaza ćilibara u Srbiji

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SADRŽAJ
CONTENTS

PAULJE, MOUND XI (MOUND K): NEW ABSOLUTE DATES AND PROVENIENCE OF THE EARLIEST AMBER FINDS IN SERBIA

HUMKA XI (K) SA LOKALITETA PAULJE: NOVI APSOLUTNI DATUMI I POREKLO NAJRANIJIH NALAZA ĆILIBARA U SRBIJI

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This paper presents three new absolute dates for the central grave of mound XI (K) at the Paulje necropolis in the lower Drina valley. Also, we present the results of FTIR spectroscopy for the amber finds from the 4 mounds in the necropolis, including mound XI (K). In general the results confirm the earlier assumed chronology of the site - the 14C AMS dates fit the timeframe – the central grave fits ideally the previous timeframe for the Brezjak culture, i.e. the 15th and 14th century BC, and all of the amber samples are definitely of Baltic origin. These two facts clearly suggest that the amber finds from the lower Drina could mark one of the earliest appearances of Baltic amber in the Central Balkans.

Key words: Late Bronze Age, Drina valley, amber, absolute dates, central grave, mound necropolis, FTIR spectroscopy

Rad prikazuje tri nova apsolutna datuma centralnog groba humke XI (K) na nekropoli Paulje u donjem slivu reke Drine. Takođe, prikazuju se rezultati FTIR spektroskopije ćilibarskih nalaza iz četiri humke sa nekropole, uključujući i tumul XI (K). Uopšte uzev, nije bilo iznenađujućih rezultata, tj. centralni grob idealno se uklapa u predloženi hronološki okvir tzv. Brezjačke kulture (15/14. stoleće pre n.e.), dok su ćilibarski nalazi zasigurno baltičkog porekla. Ove dve činjenice ukazuju da bi se u donjem toku reke Drine ćilibarski nalazi mogli okarakterisati kao jedno od najranijih pojava tzv. baltičkog ćilibra na prostoru centralnog Balkana.

Ključne reči: Pozno bronzano doba, Podrinje, ćilibar, apsolutni datumi, centralni grob, nekropola pod tumulima, FTIR spektroskopija

INTRODUCTION

As many as 426 amber beads datable to the Bronze Age (ca. 2nd millennium BC) are known from the territory of Serbia, Kosovo and Metohija (cf. Palavestra 1993; 1997; Ljuština 2019a; 2019b; Cwaliński 2020). Despite the fact that some of them were discovered more than fifty years ago, their chronology is still determined by associations with other accompanying archaeological finds, which in turn are dated within relative chronological systems. The problem is the general scarcity of absolute dates from the Serbian Bronze Age. Even though several contributions in this regard have been reported in recent years, no radiocarbon dates are available either for the contexts which yielded amber or for the Late Bronze Age contexts in the Central Balkans (e.g. Gligorić et al. 2016; Bulatović, Vander Linden 2017; Bulatović et al. 2018; 2021). The amber sources used by the Bronze Age communities are also problematic; until recently, only the amber finds from a single site – the Majdan hoard near Vršac – were submitted for a provenience analysis (Rašajski 1988). To improve the situation, a series of new analyses using IR

UVOD

Do danas, 426 ćilibarskih perli koje se mogu hronološki opredeliti u period bronzanog doba (2. milenijum pre n.e.) poznato je sa teritorije Srbije, i Kosova i Metohije (cf. Palavestra 1993; 1997; Ljuština 2019a; 2019b; Cwaliński 2020). Uprkos tome što su neke od njih otkrivene pre više od pola stoleća, njihova se hronologija i dalje opredeljuje na osnovu pratećih arheoloških predmeta, koji su, sa druge strane, opet opredeljeni u relativno-hronološke sisteme. Nedostatak apsolutnih datuma iz perioda bronzanog doba je širi problem u srpskoj arheologiji. Uprkos tome što je nekoliko radova na ovu temu objavljeno tokom poslednjih godina, nijedan datum nije se odnosio na kontekste u kojima je otkriven ćilibar, a malo je njih uopšte vezanih za pozno bronzano doba na teritoriji centralnog Balkana (e.g. Gligorić et al. 2016; Bulatović, Vander Linden 2017; Bulatović et al. 2018; 2021). Isto tako, postavlja se i pitanje izvorišta ćilibara korišćenog od strane zajednica bronzanog doba, s obzirom na to da je do relativno skoro, samo nalaz iz ostave Majdan kod Vršca bio podvrgnut analizi porekla (Rašajski 1988). Stoga, kako bi se ova situacija popravila,

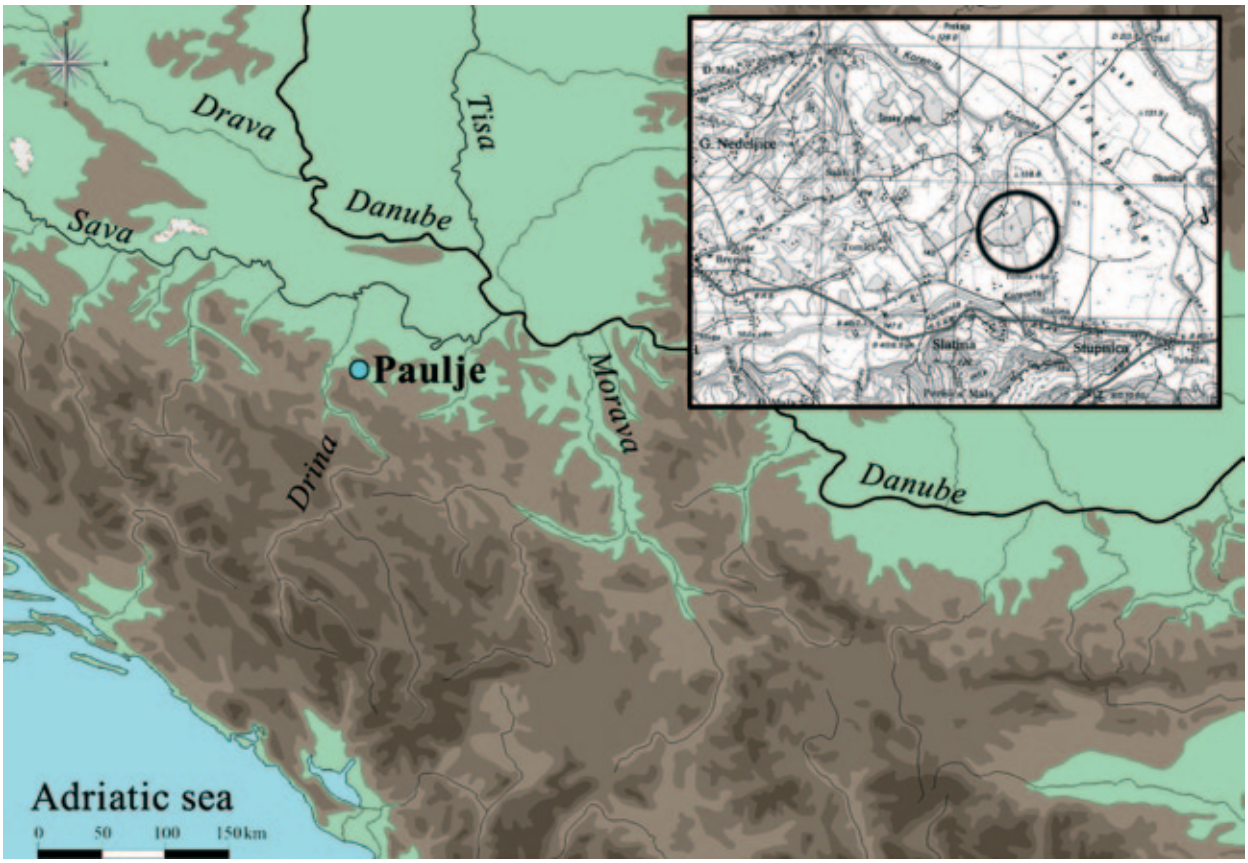

Fig. 1 Location of the Paulje necropolis (Military topographic map 427-4-4 Cer-south, 1 : 25000; made by: V. Filipović)
Sl. 1 Položaj nekropole Paulje (Vojna topografska karta 427-4-4 Cer-jug, 1 : 25000; priredio: V. Filipović)

spectroscopy were conducted on samples of amber beads recovered from mound cemeteries in Western Serbia, including tumulus XI (K) at Paulje (Brezjak). Combined with ^{14}C dating of wooden material obtained from the grave, this paper sheds light on the origin and chronology of one of the earliest amber artefacts in Serbia.

PAULJE, MOUND K – RELATIVE CHRONOLOGY BASED ON THE INVENTORY OF THE CENTRAL GRAVE

Mound XI (K) was situated in the southern part of the Paulje necropolis, in a group with five smaller mounds (Глигорић 2014: 14) (Fig. 1). It had a diameter of 16 m and a height of 1.5 m and was built of earth only, without construction elements of stone or wood. During the archaeological excavations, a central grave of a cremated individual occupying 2 m^2 was found inside the mound, approximately 3 m to the south from the midpoint. The grave contained many sumptuous objects of bronze and amber. One long pin was slightly apart from the inventory of the central grave and located closer to the assumed center of the mound (Fig. 2). The backfill of the mound contained only small fragments of prehistoric pottery.

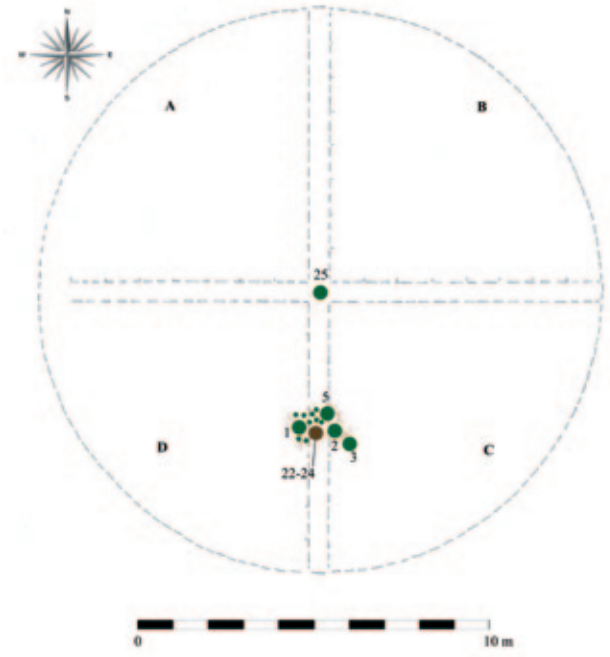

Fig. 2 Schematic plan of mound XI (K) at the Paulje cemetery showing the location of the finds (original documentation, prepared by: V. Filipović)
Sl. 2 Osnova humke XI (K) na nekropoli Paulje, sa pozicijama nalaza (originalna dokumentacija, priredio: V. Filipović)

primenjen je niz IC spektroskopskih analiza ćilibarskih nalaza otkrivenih u humkama nekropola u zapadnoj Srbiji, uključujući tu i tumul XI (K) na nekropoli Paulje (Brezjak). Zajedno sa AMS datumima drvene podloge groba, u ovom radu biće reči o poreklu i hronologiji jednog od najranijih ćilibarskih nalaza sa teritorije Srbije.

PAULJE, TUMUL K – RELATIVNA HRONOLOGIJA PREMA INVENTARU CENTRALNOG GROBA

Humka XI (K) nalazila se u južnom delu nekropole Paulje, u grupi sa još pet manjih tumula (Глигорић 2014: 14) (sl. 1). Njen prečnik iznosio je 16 m, visina 1,5 m, i bila je nasuta isključivo zemljom, bez drugih konstruktivnih elemenata od kamena ili drveta. Tokom arheoloških istraživanja registrovan je centralni grob spaljene individue koji je zauzimao oko 2 m^2, otprilike 3 m ka jugu od zamišljenog centra humke. U zoni groba registrovani su brojni prilozi (nakit) od bronze i ćilibara, dok je jedna dugačka igla bila, na neki način, malo odvojena od inventara centralnog groba i pozicionirana bliže pretpostavljenom centru tumula (sl. 2). U nasipu humke registrovani su samo sitniji ulomci praistorijske keramike.

Fig. 3 Photo of the central grave of mound XI (*in situ*) (source: Jadar Museum photo archive)
Sl. 3 Centralni grob humke XI (*in situ*) (izvor: Muzej Jadra, fotoarhiva)

Inventory Catalogue of the central grave (Fig. 3; Pl. 1)

1. Hollow cast bronze torque with open ends and rounded cross-section. The torque tapers to the thinned spirally twisted ends. It is decorated with a composite motive, similar to the patterns often found on hollow cast bronze adornments from Brezjak. The ornamental motive, made by incision and puncture techniques, consists of three fields separated by bands of vertical parallel lines, with the widest bands clearly marked by small horizontal and parallel lines. In the middle of the largest field there are five circles, each composed of four smaller concentric circles and a punctured dot in the middle. Between each of the five circles there is a motive of four parallel oblique dashes that do not touch any of the other incised ornaments. The circles are connected by a punctured line that follows their form and spans the entire field. Under this motive there is a punctured line that also spans the entire field. The two lateral fields were probably identical to each other, but it is not noticeable at the first glance because one is more abraded than the other. Towards the terminals, the lateral fields are further divided into three sections by bands of vertical parallel lines. The largest sections are the ones closest to the centre. They are decorated with a sequence of obliquely hatched triangles that are connected by their bases, which is mirrored below by another sequence, where the triangles are accompanied by a zigzag line folling them. A little lower, on the level of the punctured line of the central field, there is another punctured line also spanning the entire field. The next field is narrow and decorated with two opposite motifs, with four parallel semicircular incisions, while the final field of the torque there is only a single motif of this kind. Diameter: 14.5 cm. Mass: 358 g.

2. Bracelet of hollow cast bronze, ellipsoid in diameter and semi-circular in cross-section, with separated and flat ends. The ornamental motif is executed with incisions forming two fields separated by another two smaller fields in-between. All field separations are accentuated by vertical parallel lines. In the two smaller central fields, there are two hatched triangles that adjoin each other with the apexes, forming four triangular fields - two hatched and two empty. In the two largest fields, there is a decoration in the form of a series of hatched triangles joined at the vertices; there are tiny punctures in places. Each end of the bracelet has a narrow field with an eroded fish-bone

Katalog inventara centralnog groba (sl. 3; T. 1)

1. Otvoreni masivni šupljeliveni bronzani torkves, kružnog preseka. Torkves se sužava ka krajevima i ima stanjene i spiralno uvijene krajeve. Ukrašen je kompozitnim motivom nalik onima kakve često nalazimo na brezjačkim šupljelivenim grivnama. Ornamentalni motiv izveden je u tehnici urezivanja i punktiranja, a čine ga tri polja međusobno odvojena jednom trakom sastavljenom od niza uspravnih paralelnih linija, od kojih su, uslovno rečeno, najšire trake jasno označene sitnim horizontalnim i paralelnim linijama. Unutar najvećeg polja je pet krugova sa po četiri kružnice unutar najvećeg kruga i malim puntom u sredini. Između krugova se nalazi motiv četiri kose paralelne linije koje ne dodiruju ostale ureze, a krugovi su spojeni pomoću punktirane linije koja prati njihov oblik i pruža se od kraja do kraja polja. Ispod ovako komponovanog motiva je punktirana linija, takođe od kraja do kraja polja. Krajnja polja su verovatno izgledala istovetno, ali su na jednom polju motivi više istrveni nego na drugom, pa se to ne uočava na prvi pogled. Krajnja polja podeljena su na još tri polja pomoću uspravnih paralelnih linija, a najveća polja su ona najbliža centru. Ono je bilo ukrašeno nizom koso šrafiranih trouglova koja se dodiruju temenima, dok se ispod nalazi istovetan ukras u „ogledalu“, pojačan sa cik-cak linijom koja prati donji niz trouglova. Nešto niže, u ravni sa punktiranom linijom centralnog polja je punktirana linija, takođe od kraja do kraja polja. Sledeće polje je usko i ukrašeno je sa dva naspramna motiva, sa po četiri paralelna polukružna ureza, dok je u krajnjem polju torkvesa samo jedan ovakav motiv. Prečnik 14,5 cm. Masa 358 g.

2. Bronzana šupljelivena grivna elipsastog oblika, polukružnog preseka, sa razmaknutim i ravno završenim krajevima. Ornamentalni motiv izveden je u tehnici urezivanja i sastoji se iz dva polja koja na sredini odvajaju dva manja međupolja. Sva odvajanja polja naglašena su pomoću upravnih paralelnih linija. U dva manja centralna polja nalaze se dva šrafirana trougla koja se dodiruju vrhovima i tako formiraju četiri trougaona polja – po dva šrafirana i nešrafirana. U dva najveća polja je ukras u vidu koso šrafiranih trouglova koji su spojeni uglovima, dok se ponegde javljaju i sitni punktovi. Na krajevima grivne po jedno usko polje sa istrvenim motivom riblje kosti. Prečnik 9 x 8 cm. Masa 141 g.

3. Bogato ukrašena bronzana šupljelivena grivna, par sa prethodnom (kat. 2), sa skoro identičnom ornamentikom. Prečnik 9 x 8 cm. Masa 152 g.

decoration. Diameter: 9 x 8 cm. Mass: 141 g.

3. Richly decorated bracelet of hollow cast bronze, forming a pair with the previous one (cat. no. 2), with an almost identical ornamentation. Diameter: 9 x 8 cm; Mass: 152 g.

4. Undecorated small bronze ellipsoid bracelet, almost rectangular in cross-section, with thinned and adjacent ends. Diameter: 6.5 x 5.3 cm. Mass: 79 g.

5. Extremely long bronze pin, round in cross-section, with conically profiled head and a prong on the top. The transition from the head to the neck is emphasized with an expansion with two ribs. The upper part of the body of the pin is decorated with a series of incised lines organized in zones. The first zone from the top consists of horizontal parallel lines and is followed by two narrower zones with a zigzag upright line; this pattern is repeated three more times. The motif ends in the same manner as it started – with horizontal parallel lines. Length: app. 80 cm. Head diameter: 3.5 cm.

6. Bracelet made of coiled bronze wire with round cross-section and spirally twisted ends. Diameter: 5 cm.

7. Bracelet made of coiled bronze wire with round cross-section and spirally twisted ends. Probably pair with cat. no. 6. Diameter: 5.1 cm.

8. Fragmented bracelet made of coiled bronze wire with semi-circular cross-section. The ends are missing. Diameter: 5.7 cm.

9. Large heart-shaped lunular bronze sheet pendant, only slightly damaged in the lower part, with a vertical central suspension arm and an inner branched part. The upper part ends with a spirally coiled eyelet for hanging. Dimensions: 7.5 x 7 cm. Mass: 25 g.

10. Large heart-shaped lunular bronze sheet pendant, with a vertical central suspension arm and an inner branched part. The upper part used to end with a spirally coiled eyelet for hanging. Dimensions: 7.5 x 7.5 cm. Mass: 26 g.

11. Large heart-shaped lunular bronze sheet pendant, with a vertical central suspension arm and an inner branched part. The lower right part is damaged. The upper part ends with a spirally coiled eyelet for hanging. Dimensions: 7.5 x 7 cm. Mass: 28 g.

12. Small heart-shaped lunular bronze sheet pendant, with a vertical central suspension arm and an inner branched part. A bronze hoop hangs on the lower part. Dimensions: 3.5 x 3.5 cm. Mass: 5 g.

13. Small heart-shaped lunular bronze sheet pendant, with a vertical central suspension arm

4. Neukrašena mala bronzana grivna elipsoidnog oblika i skoro pravougaonog preseka, sa razmaknutim i suženim krajevima. Prečnik 6,5 x 5,3 cm. Masa 79 g.

5. Izrazito dugačka bronzana igla, kružnog preseka, sa profilisanom koničnom glavom i vrhom koji se završava trnom. Prelaz iz glave u vrat naglašen je zadebljanjem sa dva rebra. Gornji deo tela igle ukrašen je snopovima urezanih linija raspoređenih u zone. Odozgore posmatrano, prvo se nalazi zona sa horizontalnim paralelnim linijama, zatim dve uže zone sa cik-cak uspravnom linijom i takva šema se ponavlja još tri puta, da bi se motiv završio kako je i započet – sa horizontalnim paralelnim linijama. Dužina oko 80 cm. Prečnik glave 3,5 cm.

6. Bronzana narukvica od uvijene žice kružnog preseka sa spiralno uvijenim krajevima. Prečnik 5 cm.

7. Bronzana narukvica od uvijene žice kružnog preseka sa spiralno uvijenim krajevima. Verovatno par sa kat. 6. Prečnik 5,1 cm.

8. Fragmentovana bronzana narukvica od uvijene žice polukružnog preseka, oštećenih krajeva. Prečnik 5,7 cm.

9. Veliki lunulasti, u donjem delu neznatno oštećen srcoliki privesak od bronzanog lima sa vertikalnom središnjom prečagom i unutrašnjim razgranatim delom. Gornji deo završava se spiralno uvijenom ušicom za kačenje. Dimenzije 7,5 x 7 cm. Masa 25 g.

10. Veliki lunulasti srcoliki privesak od bronzanog lima sa vertikalnom središnjom prečagom i unutrašnjim razgranatim delom. Gornji deo završavao se spiralno uvijenom ušicom za kačenje. Dimenzije 7,5 x 7,5 cm. Masa 26 g.

11. Veliki lunulasti, u desnom donjem delu oštećen srcoliki privesak od bronzanog lima sa vertikalnom središnjom prečagom i unutrašnjim razgranatim delom. Gornji deo završava se spiralno uvijenom ušicom za kačenje. 7,5 x 7 cm. Masa 28 g.

12. Manji lunulasti srcoliki privesak od bronzanog lima sa vertikalnom središnjom prečagom i unutrašnjim razgranatim delom. Na donjem delu prikačena bronzana karičica. Dimenzije 3,5 x 3,5 cm. Masa 5 g.

13. Manji lunulasti srcoliki privesak od bronzanog lima sa vertikalnom središnjom prečagom i unutrašnjim razgranatim delom. Gornji deo završavao se spiralno uvijenom ušicom za kačenje. Dimenzije 3,5 x 3,5 cm.

14. Manji lunulasti srcoliki privesak od bronzanog lima sa vertikalnom središnjom prečagom i

and an inner branched part. The upper part used to end with a spirally coiled eyelet for hanging. Dimensions: 3.5 x 3.5 cm.

14. Small heart-shaped lunular bronze sheet pendant, with a vertical central suspension arm and an inner branched part. The upper part ends with a spirally coiled wrapped eyelet for hanging. Dimensions: 4 x 3.5 cm.

15. Small heart-shaped lunular bronze sheet pendant, with a vertical central suspension arm and an inner branched part. The upper part ends with a spirally coiled eyelet for hanging. Dimensions: 3.5 x 3.5 cm.

16. Small heart-shaped lunular bronze sheet pendant, with a vertical central suspension arm and an inner branched part. The upper part ends with a spirally coiled eyelet for hanging. Dimensions: 3.5 x 3.2 cm.

17. Small heart-shaped lunular bronze sheet pendant, with a vertical central suspension arm. The upper part used to end with a spirally coiled eyelet for hanging. Dimensions: 3.2 x 3 cm.

18. Small crescent-shaped pendant, with an expansion and vertical perforation in the middle, rhomboid in cross-section. Cast in "white bronze". Dimensions: 3 x 2.6 cm.

19. Small crescent-shaped pendant, with a flat area and vertical perforation in the middle, rhomboid in cross-section. Cast in "white bronze". Dimensions: 4 x 4 cm. Mass: 6 g.

20. Small crescent-shaped pendant, with a tubeular expansion and a vertical perforation in the middle, rhomboid in cross-section. Cast in "white bronze". Dimensions: 3 x 3 cm. Mass: 4 g.

21. Small crescent-shaped pendant, with an expansion and vertical perforation in the middle, rhomboid in cross-section. In the upper corner there is a stylised bird on the prong. Cast in "white bronze". Dimensions: 3.2 x 3.3 cm. Mass: 3 g.

22. Six amber perforated beads of different sizes and shapes, found inside a vessel with a lid (cat. no. 23–24). Diameter: 1–1.5 cm.

23. Small baked clay amphora, poorly made, reddish to grey in colour, with bulb-like belly and everted rim. The neck is ornamented with shallow horizontal parallel grooves. On the shoulder, the transition between the neck and the belly is accentuated with shallow grooves. The belly has four small knobs; between them there are groups of vertical grooves and, in one place, an empty space with two lines forming an X. On the shoulder there are the visible remains of two strap handles that ended at the rim. Height: 8.5 cm. Diameter of the opening: 6 cm. Diameter of the bottom: 3.5 cm.

unutrašnjim razgranatim delom. Gornji deo završava se spiralno uvijenom ušicom za kačenje. Dimenzije 4 x 3,5 cm.

15. Manji lunulasti srcoliki privesak od bronzanog lima sa vertikalnom središnjom prečagom i unutrašnjim razgranatim delom. Gornji deo završava se spiralno uvijenom ušicom za kačenje. Dimenzije 3,5 x 3,5 cm.

16. Manji lunulasti srcoliki privesak od bronzanog lima sa vertikalnom središnjom prečagom i unutrašnjim razgranatim delom. Gornji deo završava se spiralno uvijenom ušicom za kačenje. Dimenzije 3,5 x 3,2 cm.

17. Manji lunulasti srcoliki privesak od bronzanog lima sa vertikalnom središnjom prečagom. Gornji deo završavao se spiralno uvijenom ušicom za kačenje. Dimenzije 3,2 x 3 cm.

18. Manji polumesečasti privesak sa zadebljanjem i vertikalnom perforacijom po sredini, romboidnog preseka. Izrađen od tzv. „bele bronze". Dimenzije 3 x 2,6 cm.

19. Manji polumesečasti privesak sa zaravnjenim i vertikalno perforiranim središnjim delom, romboidnog preseka. Izrađen od tzv. „bele bronze". Dimenzije 4 x 4 cm. Masa 6 g.

20. Manji polumesečasti privesak sa cevastim proširenjem i vertikalnom perforacijom po sredini, romboidnog preseka. Izrađen od tzv. „bele bronze". Dimenzije 3 x 3 cm. Masa 4 g.

21. Manji polumesečasti privesak sa zadebljanjem i vertikalnom perforacijom po sredini, romboidnog preseka. U gornjem uglu stilizovana ptica na trnu. Izrađen od tzv. „bele bronze". Dimenzije 3,3 x 3,2 cm. Masa 3 g.

22. Šest ćilibarskih perforiranih perli različitih dimenzija i oblika. Otkrivene u posudi sa poklopcem (kat. 23–24). Prečnik 1–1,5 cm.

23. Mala amfora od pečene zemlje, loše fakture, sivo do crvene boje, lukovičastog trbuha, izraženog vrata i visokog oboda povijenog na spoljnu stranu. Vrat je ukrašen plitkim horizontalnim paralelnim kanelurama, dok je na ramenu prelaz naglašen plitkim kanelurama. Na trbuhu se nalaze četiri manja bradavičasta ispupčenja između kojih su grupisani snopovi vertikalnih kanelura i na jednom mestu prazan prostor ukrašen je urezom u vidu duple paralelne trake koje se seku na sredini, u obliku slova X. Na ramenu ostaci korena dve trakaste drške koje su se završavale na obodu. Visina 8,5 cm, prečnik otvora 6 cm, prečnik dna 3,5 cm.

24. Manji kružni keramički poklopac crne do crvene boje i loše fakture. Na sredini se nalazi plastično modelovano ispupčenje postavljeno na platformu istaknutu pomoću dva plastična rebra,

24. Small rounded ceramic lid, poorly made, black to reddish in colour. In the middle there is a knob on a platform highlighted by two relief ribs. On the edge there are two opposite groups of two perforations each. Diameter: 7.8 cm.

25. Long bronze pin with partially deformed nail-shaped head and slightly bent end, round in cross-section. The upper part of the pin stem, below the head, is decorated with a series of five alternating fields of incised lines. The extreme upper field, the middle field, and the extreme lower field are covered with horizontal parallel lines; in between them, there are zones with vertical zigzag lines. A similar motif appears on the first pin from this funerary complex, albeit of a different type (cat. no. 5). The pin was discovered closer to the centre of the mound, separated from other finds. Length: 63 cm.

In terms of inventory, the central grave in mound XI (K) is definitely one of the richest Late Bronze Age burials in the Central Balkans and the neighbouring areas. For that reason, and because of the fact that the bronze items in this grave were accompanied by amber artefacts, special attention will be focused on the formal-typological classification of the bronze objects and the assessment of their origins.

Firstly, the two extremely long bronze pins[1] are unique finds from the Late Bronze Age period in the Jadar river valley and the surrounding area. More than 20 bronze pins with a length exceeding 50 cm have been registered,[2] among them several specimens measuring more than 1 m in length. Pins with profiled conical heads and a prong on top (cat. no. 5) were found in the following contexts: the central grave of mound O at Paulje (Цанић-Тещановић, Глигорић 2001), the central grave of mound 19 at the Šumar site (Garašanin, Garašanin 1962), mound 1 at the Banjevac necropolis (Vasić 2003), the fill of mound 1 at the Šundinovača necropolis on the left bank of the River Drina (Kosorić 1976: Pl. XXIII: 1), the probable secondary grave of mound 1 at the Karavlaške Kuće necropolis on the left bank of the Drina River (Kosorić, Krstić 1988: Pl. IV: 3), the fill of the same mound (Kosorić, Krstić 1988: Pl. V: 5), grave 2 of mound 8 at the Karavlaške Kuće necropolis (Kosorić, Krstić 1988: Pl. VIII: 1), grave 4 of mound 4 at the Jezero necropolis on the left

1 From the formal-typological standpoint, these objects can be regarded as pins, but their extreme length makes it difficult to imagine their use as everyday costume items.

2 Two long pins were found in mounds 32 and 33 at the Paulje necropolis during the 2020 excavations.

dok je na četiri mesta, sa po dve grupisane rupice, poklopac probušen. Prečnik 7,8 cm.

25. Dugačka bronzana igla sa delimično deformisanom glavom u obliku eksera i blago povijenog kraja, okruglog preseka. Gornji deo tela igle, ispod glave, ukrašen je poljima urezanih linija raspoređenih u pet zona. Na početku, u sredini i na kraju su zone sa horizontalnim paralelnim linijama, dok su između njih zone sa cik-cak uspravnim linijama. Slična ornamentalna šema javlja se i na prvoj igli iz ove grobne celine, doduše drugog tipa (kat. 5). Igla je otkrivena bliže centru humke, izdvojena od ostalih nalaza. Dužina 63 cm.

U pogledu intventara, centralna sahrana humke XI (K) zasigurno predstavlja jednu od najbogatijih sahrana iz poznog bronzanog doba na prostorima centralnog Balkana i okolnih oblasti. Iz tog razloga, kao i zbog činjenice da je bronzani nakit iz ovog groba otkriven zajedno sa ćilibarskim perlama, posebna pažnja biće usmerena na formalno-tipološku klasifikaciju bronzanih predmeta i pitanje njihovog porekla.

Na prvom mestu, tu su dve izrazito dugačke bronzane igle,[1] koje predstavljaju jedinstvene nalaze iz perioda poznog bronzanog doba u oblasti toka Jadra i susednih teritorija. Do danas, otkriveno je više od 20 primeraka ovih igala sa dužinama koje prevazilaze 50 cm,[2] a neke od njih dugačke su i preko 1 m. Igle sa profilisanom koničnom glavom i vrhom koji se završava trnom (kat. 5) otkrivene su i u centralnom grobu humke O na Pauljama (Цанић-Тещановић, Глигорић 2001), centralnom grobu humke 19 na lokalitetu Šumar (Garašanin, Garašanin 1962), humci 1 na nekropoli u Banjevcu (Vasić 2003), u nasipu humke 1 na nekropoli Šundinovača na levoj obali Drine (Kosorić 1976: Pl. XXIII: 1), možda sekundarnom grobu humke 1 na nekropoli Karavlaške kuće takođe na levoj obali Drina (Kosorić, Krstić 1988: Pl. IV: 3), zatim u nasipu iste humke (Kosorić, Krstić 1988: Pl. V: 5), grobu 2 humke 8 na nekropoli Karavlaške kuće (Kosorić, Krstić 1988: Pl. VIII: 1), grobu 4 humke 4 nekropole Jezero na levoj obali reke Drine (Kosorić 1976: Pl. XXIII: 3) i u grobu 6 humke 9 iste nekropole (Kosorić, Krstić 1988: Pl. XVII: 5). Određena sličnost može se povući i sa tzv. *Spindelkopfnadeln* koje su karakteristične u oblastima gde se oseća uticaj *Hügelgräber* kul-

1 Sa formalno-tipološkog aspekta, ovi predmeti se mogu posmatrati kao igle, ali zbog njihove ekstremne dužine teško je pretpostaviti i rekonstruisati kako bi se mogle koristiti kao deo svakodnevne nošnje.

2 Dve dugačke igle otkrivene su i prilikom iskopavanja nekropole Paulje 2020. godine u humkama 32 i 33.

bank of the River Drina (Kosorić 1976: Pl. XXIII: 3), and grave 6 of mound 9 at the same necropolis (Kosorić, Krstić 1988: Pl. XVII: 5). There is a certain degree of affinity with the *Spindelkopfnadeln* common in the areas under the influence of the Tumulus culture between Br C and early Br D or the later part of the IInd period of the Bronze Age (Gedl 1983: 59–65, Pl. XV–XVIII; Innenhofer 2000: 181). R. Vasić seeks their origin in the Drevenik-type pins from Slovakia which chronologically fit the Br C2–D period associated with the Serbian specimens of pins with a profiled conical head and a tip ending in a prong (Vasić 2003: 48–49; Innenhofer 2000: 143).

The second pin (cat. no. 25) is associated with the group of pins with a nail-shaped head (*Nagelkopfnadeln*), specifically the type with a stamp-shaped head and decorated upper part of the stem (*Petschaftkopfnadeln mit verzierten Schaft*). This particular kind of pins has a broad chronology, lowering its value as a precise dating indicator. They appeared in this part of Europe for the first time in Br C, but their basic design remained in use until the early stages of the Urnfield period (Br D/Ha A1) (Vasić 2003: 38–39).

The torque from the central grave (cat. no. 1) is almost identical to the one from grave 6 of mound IX at the Jezero necropolis (Kosorić, Krstić 1988: Pl. XVIII: 1), and similar specimens are known from the destroyed mound at the Grotnica – Guča necropolis (Dmitrović 2016: Fig. 10: 6–7), grave 5 of mound III at the Dubac (Jančići) necropolis (Dmitrović 2016: Fig. 55: 5), pyre 2 at the Ravnine (Jančići) necropolis (Dmitrović 2016: Fig. 85: 1), a chance find from a mound at Suva Česma in Lučani (Dmitrović 2016: Fig. 85: 1), mound I at the Šundinovača necropolis (Kosorić, Krstić 1988: Pl. III: 2), and grave 4 in mound II at the Jezero necropolis (Kosorić, Krstić 1988: Pl. XI: 1). Torques with different cross-sections, but lavishly decorated like the one from the Paulje necropolis, are often found in Glasinac graves (Benac, Čović 1956: Pl. XXX: 11; XXXI: 1; XXXII: 3), and dated to the Br C–D period. Such specific decorations can be observed on massive arm rings and bracelets with a triangular cross-section and open ends in western Serbia and eastern Bosnia and Herzegovina. R. Vasić assumes that the pattern of such ornamentation originates from the present-day Pannonia and Central Europe, within the so-called Koszider horizon (Vasić 2010: 27 ff.). All of the aforementioned torques can be associated with the Br D period, which provides a solid basis for dating the entire necropolis.

ture tokom perioda Br C i rane faze Br D, tj. kasnije faze drugog perioda bronzanog doba (Gedl 1983: 59–65, Pl. XV–XVIII; Innenhofer 2000: 181). R. Vasić ukazuje da bi poreklo ovih igala trebalo tražiti u tipu Drevenik iz današnje Slovačke, koje hronološki odgovaraju periodu Br C2–D, gde su hronološki opredeljene naše igle sa profilisanom koničnom glavom i vrhom koji se završava trnom (Vasić 2003: 48–49; Innenhofer 2000: 143).

Druga igla (kat. 25) može se pripisati iglama sa ekserastom glavom (*Nagelkopfnadeln*), tj. posebnom tipu sa pečatnom glavom i ukrašenim vratom (*Petschaftkopfnadeln mit verzierten Schaft*). Ova posebna vrsta igala obuhvata dugotrajniju hronologiju, tako da nije od posebne važnosti za hronološko opredeljenje. U ovom delu Evrope pojavljuju se po prvi put otprilike u periodu Br C, ali njihov osnovni izgled ostaje u upotrebi sve do ranih faza perioda polja sa urnama (Br D/Ha A1) (Vasić 2003: 38–39).

Torkves iz ovog groba (kat. 1) skoro je identičan primerku iz groba 6 humke IX na nekropoli Jezero (Kosorić, Krstić 1988: Pl. XVIII: 1), dok su slični primerci poznati iz uništene humke na nekropoli Grotnica – Guča (Dmitrović 2016: Fig. 10: 6–7), grobu 5 humke III na nekropoli Dubac (Jančići) (Dmitrović 2016: Fig. 55: 5), lomači 2 nekropole Ravnine (Jančići) (Dmitrović 2016: Fig. 85: 1), kao i slučajnom primerku iz humke Suva Česma u Lučanima (Dmitrović 2016: Fig. 85: 1), humke I na nekropoli Šundinovača (Kosorić, Krstić 1988: Pl. III: 2) i grobu 4 humke II na nekropoli Jezero (Kosorić, Krstić 1988: Pl. XI: 1). Torvesi sa drugačijim presekom, ali takođe bogato ukrašeni poput našeg primerka su čest nalaz u grobovima na Glasincu (Benac, Čović 1956: Pl. XXX: 11; XXXI: 1; XXXII: 3), a takođe se hronološki opredeljuju u period Br C–D. Ovakva specifična dekoracija može se videti i na masivnim grivnama i narukvicama sa trougaonim presekom i otvorenim krajevima koje su čest nalaz u zapadnoj Srbiji i istočnoj Bosni i Hercegovini. R. Vasić pretpostavlja da motivi za ovakvu vrstu ornamentike potiče iz oblasti današnje Panonije i centralne Evrope tokom tzv. Koszider horizonta (Vasić 2010: 27 ff.). Svi pomenuti torkvesi mogu se opredeliti u period Br D, što predstavlja dobru osnovu za datovanje cele nekropole.

Bronzane šupljelivene grivne otvorenih krajeva (kat. 2–3) predstavljaju uobičajenu formu nakita koja se pojavila na prostoru centralne Evrope već u tzv. horizontu Hajdúsámson Apa (Blajer 1984: Pl. 100B). Ovakvi i slični primerci nastavljaju svoj razvoj sve do sredine 1. milenijuma pre n.e., te sto-

Hollow cast bronze arm rings (cat. nos. 2–3) with open ends are a common form of jewellery which appeared in Central Europe as early as the Hajdúsámson Apa horizon (Blajer 1984: Pl. 100B). These and similarly produced objects developed until the middle of the 1st millennium BC, and therefore are not reliable for relative chronology or regional characteristics. However, it should be mentioned that similar lavishly decorated and fully cast bronze arm rings have been recorded in the region, usually inside the richest and most representative graves: the famous central grave of mound 19 from Šumar (Garašanin, Garašanin 1958: 57), which also contained the longest bronze pin recorded in the Brezjak culture, grave 1 of mound II at Karavlaške Kuće (eastern Bosnia) (Kosorić, Krstić 1988: Pl. V: 1–3), grave 6 of mound IX at the Jezero necropolis (Kosorić, Krstić 1988: Pl. XVII: 4), where a bronze torque and a long bronze pin were recorded as well. Based on the accompanying finds, these arm rings can be dated to the Br C–D period.

Bracelets made of spirally coiled thin wire with triangular or circular cross-section and spirally formed ends are a common type of jewellery from the Late Bronze Age graves in the territory of the Central Balkans and the neighbouring regions. On the other hand, this type of jewellery suggests a certain level of contacts and influence from Central Europe, where one should look for the origin of this kind of bronze bracelets (equally made of thin or thick bronze wire). Similar examples are known from mounds I, II and XIX at the Šumar necropolis (Garašanin 1954: 12, Pl. V: 2–3, 6–8).

Lunular or heart-shaped pendants with a central suspension arm and an inner branched part represent the next evolutionary phase of this kind of jewellery which originated in the territory of Central Europe during the Middle Bronze Age and gradually spread towards the territory of southern Pannonia (Mozsolics 1967: 86 ff.; 1973: Pl. 2; Васић 1997: 43 ff). In mound XI, we have at least 3 different types of these pendants – big and massive pendants (cat. nos. 9–11) with a vertical central suspension arm and a faceted inner branched part, smaller lunular bronze pendants with a vertical central suspension arm and an inner branched part (cat. nos. 12–17), and smaller crescent bronze pendants (cat. nos. 18–21) made in bronze with a large percentage of tin ("white bronze"). This kind of jewellery, which can be associated with the Br C period based on the accompanying finds, was recorded in grave 1 of mound III at the site of Bandera (Garašanin, Garašanin 1958: 40, Fig. 15), ga ne predstavljaju pouzdane primerke u pogledu relativne hronologije ili regionalnih karakterizacija. Ipak, treba pomenuti da su slične bogato ukrašene punolivene grivne registrovane takođe na ovim prostorima i to obično u najbogatijim i najreprezentativnijim sahranama: čuvenom centralnom grobu humke 19 sa Šumara (Garašanin, Garašanin 1958: 57), koja je takođe sadržala najdužu iglu do sada registrovanu na prostoru Brezjačke kulture, zatim grobu 1 humke II na Karavlaškim Kućama (istočna Bosna) (Kosorić, Krstić 1988: Pl. V: 1–3), grobu 6 humke IX nekropole Jezero (Kosorić, Krstić 1988: Pl. XVII: 4), gde su registrovani i bronzani torkves i dugačka bronzana igla. Prema pratećim nalazima, ove se grivne mogu opredeliti u period Br C–D.

Narukvice od spiralno uvijene tanje žice sa trougaonim ili okruglim presekom i spiralno formiranim krajevima predstavljaju uobičajen oblik nakita koji se mogu naći u grobovima iz perioda poznog bronzanog doba na teritoriji centralnog Balkana i okoline. Sa druge strane, ovaj tip nakita ukazuje na određeni nivo kontakata i uticaja iz oblasti centralne Evrope, gde svakako treba tražiti poreklo ovog tipa bronzanih narukvica (jednako pravljenih od tanje ili deblje bronzane žice). Slični primerci poznati su iz humki I, II i XIX na nekropoli Šumar (Garašanin 1954: 12, Pl. V: 2–3, 6–8).

Lunulasti ili srcoliki privesci sa centralnom prečagom i unutrašnjim razgranatim delom predstavljaju dalji evolutivni korak ovog tipa nakita nastalog na prostorima centralne Evrope tokom srednjeg bronzanog doba, koji se polako širio ka teritorijama južne Panonije (Mozsolics 1967: 86 ff.; 1973: Pl. 2; Васић 1997: 43 ff). U humci XI, registrovano je najmanje tri različita tipa ovih privezaka – veći i masivni privesci sa vertikalnom centralnom prečagom i razgranatim unutrašnjim delom (kat. 9–11), manji srcoliki privesci sa vertikalnom centralnom prečagom i razgranatim unutrašnjim delom (kat. 12–17) i mali lunulasti privesci (kat. 18–21) pravljeni od bronze sa većim procentom kalaja (tzv. bele bronze). Ovaj tip nakita, koji se na osnovu pratećih nalaza može opredeliti u period Br C, otkriven je i u grobu 1 humke III na lokalitetu Bandera (Garašanin, Garašanin 1958: 40, Fig. 15), dvojnom grobu humke 6a u Šumaru (Garašanin, Garašanin 1967: 7–9), kao i na severu u humci na lokalitetu Kačer u Cerovcu (Церовић 2009: Fig. 1), Metlik u Badanji (Bulatović et al. 2017: Pl. XXXIX: 9–10), grobu 194 (Todorović 1977: 56), grobu 197 (Todorović 1977: 57), grobu 285 (Todorović 1977: 101), grobu 301 (Todorović 1977: 110), i grobu 302 (Todorović 1977: 111) na nekropoli Karaburma u Beogradu, te

the double grave of mound 6a in Šumar (Garašanin, Garašanin 1967: 7–9); further to the north: the mound at the site of Kačer in Cerovac (Церовић 2009: Fig. 1), Metlik in Badanja (Bulatović et al. 2017: Pl. XXXIX: 9–10), graves 194 (Todorović 1977: 56), 197 (Todorović 1977: 57), 285 (Todorović 1977: 101), 301 (Todorović 1977: 110), and 302 (Todorović 1977: 111) at the Karaburma necropolis in Belgrade, grave 84 (Петровић 2006: 58, Pl. XIII: 3) at the Kaluđerske Livade necropolis near Belgrade; further to the west: grave 1 of mound II (Kosorić, Krstić 1988: Pl. IV: 4–5) at Karavlaške Kuće in Bosnia, and grave 7 (Kapuran 2019: Pl. 11: 1–6) and grave 11 (Kapuran 2019: Pl. 15: 2) at the Velebit necropolis near Senta in Vojvodina; further to the south: the Đuđevića Brdo necropolis in Pilatovići near Požega (Мандић, Домановић 2016: cat. no. 17), and the necropolis in Svračkovo near Požega (Zotović 1985: Pl. X: 8, 11–12).

CHRONOLOGY OF MOUND XI IN LIGHT OF THE NEW AMS DATES

In order to obtain the most accurate result of radiocarbon dating for mound XI, in the absence of usable samples of other kinds (bones, seeds, charcoal etc.) and the impossibility to carry out a dendrochronological analysis, three samples were taken from different parts of a single oak plank recovered from the central grave. The samples, named PAU_1, PAU_2, and PAU_3, were analysed in the Poznań Radiocarbon Laboratory with the AMS method, resulting in three dates: Poz-110879 (3195 ± 30 BP), Poz-110880 (3165 ± 30 BP) and Poz-110881 (3095 ± 35 BP) respectively, noting that the last one had a slightly lower amount of carbon (0.5 mg) than the other two. Upon calibration using the IntCal13 atmospheric curve (Reimer et al. 2013) in OxCal 4.2.3 (Bronk Ramsey 2013), all the dates fall approximately between 1517 and 1267 calBC (Tab. 1) with a 95.4% probability.

Overall, the results match the relative chronology of mound XI resulting from the typological overview of the bronze artefacts from the inventory of the central grave (Fig. 4). The slight differences in dates can be explained by the sampling method, which most probably caused the "old wood effect" (Warner 1990: 159–172). Since the dated material consisted of a wooden plank made of oak (a species characterised by considerable longevity), 1–2 cm thick, which was apparently cut so as to encompass different tree rings, i.e. both heartwood and sapwood, the results are expectedly not identical for all three dates.

grobu 84 (Петровић 2006: 58, Pl. XIII: 3) na lokalitetu Kaluđerske Livade kod Beograda, a ka zapadu, u grobu 1 humke II (Kosorić, Krstić 1988: Pl. IV: 4–5) na Karavlaškim Kućama u Bosni, kao i grobu 7 (Kapuran 2019: Pl. 11: 1–6) i grobu 11 (Kapuran 2019: Pl. 15: 2) na nekropoli Velebit kod Sente u Vojvodini, ali i ka jugu na nekropoli Đuđevića Brdo u Pilatovićima kod Požege (Мандић, Домановић 2016: cat. no. 17), i nekropoli Svračkovo takođe kod Požege (Zotović 1985: Pl. X: 8, 11–12).

HRONOLIGIJA HUMKE XI U SVETLU NOVIH AMS DATUMA

U cilju da se dobije najpreciznij mogući rezultat radiokarbonskog datovanja humke XI, kao i u odsustvu korisnih uzoraka druge vrste (kosti, semenke, ugljen), kao i nemogućnosti za dendrohronološku analizu, tri uzorka su uzeta sa različitih delova hrastove daske otkrivene u centralnom grobu. Uzorci, označeni kao PAU_1, PAU_2 i PAU_3 su analizirani u Radiokarbonskoj laboratoriji u Poznańu metodom AMS, čime su dobijena tri datuma, redom: Poz-110879 (3195 ± 30 BP), Poz-110880 (3165 ± 30 BP) i Poz-110881 (3095 ± 35 BP). Ovde treba pomenuti da je poslednji datum urađen iz nešto niže mase uzorka ugljena (0.5 mg) za razliku od prva dva. Nakon kalibracije pomoću IntCal13 atmosfersku krivu (Reimer et al. 2013) u programu OxCal 4.2.3 (Bronk Ramsey 2013), datumi sa 95.4% verovatnoće ukazuju otprilike na period između 1517 i 1267 calBC (Tab. 1).

Uopšte uzev, rezultati odgovaraju ranije definisanoj relativnoj hronologiji centralnog groba humke XI na osnovu tipološke analize nakita iz inventara groba (sl. 4). To što se datumi blago razlikuju, verovatno može biti objašnjeno metodom uzorkovanja koja je proizvela tzv. „efekat starog drveta" (Warner 1990: 159–172). S obzirom na to da se materijal za analizu sastojao od drvene hrastove (vrsta karakteristična po dugačkom životu) daske debljine 1 do 2 cm, isečene tako da obuhvata različite prstenove drveća, tj. i unutrašnje i spoljašnje delove, rezultati su očekivano neidentični u sva tri datuma.

U ovom slučaju, „efekat starog drveta" dolazi od raznolikih nivoa apsorpcije izotopa ^{14}C u različitim delovima drvne mase. Raniji datumi rezultat su analize uzoraka iz unutrašnjeg dela drveta („srce", nekada i nekoliko stoleća starije od najmlađeg dela drveta), dok su najmlađi datumi karakteristični za spoljni deo drvne mase (vidi: Borić 2009: 219–220; Palincaş 2017: 2–4).

Lab code / Šifra	Uncalibrated date (BP) / Nekalibrisan datum (BP)	Calibrated date (calBC) / Kalibrisan datum (calBC)	
		68.2%	95.4%
Poz-110879	3195 ± 30	1497–1440	1517–1414
Poz-110880	3165 ± 30	1494–1479 (15.4%) 1456–1414 (52.8%)	1503–1394 (94.8%) 1332–1329 (0.6%)
Poz-110881	3095 ± 35	1414–1374 (29.2%) 1356–1302 (39.0%)	1432–1267

Tab. 1 Uncalibrated and calibrated values for 14C AMS dates from the central grave in mound XI at Paulje (made by: M. Cwalinski)
Tab. 1 Nekalibrisane i kalibrisane vrednosti ^{14}C AMS datuma iz centralnog groba humke XI na lokalitetu Paulje (priredio: M. Cwalinski)

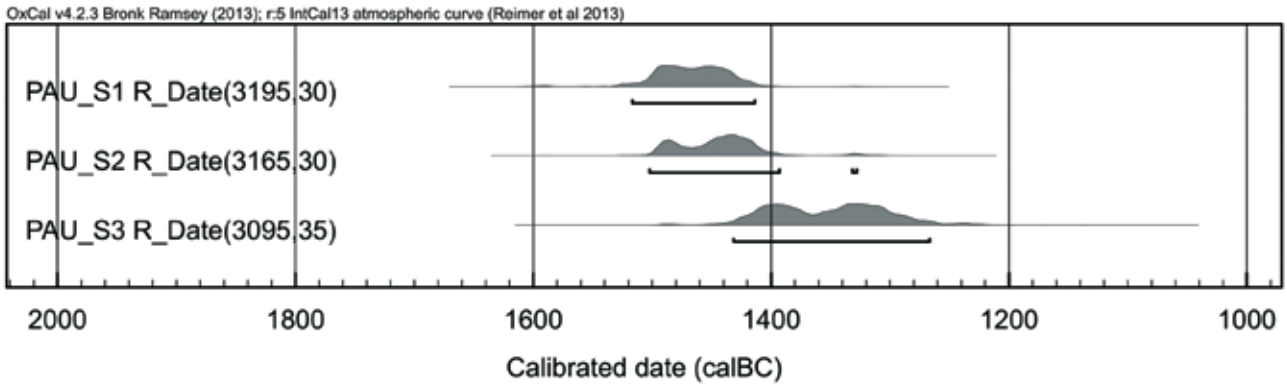

Fig. 4 Calibrated dates Poz-110879 (PAU_S1), Poz-110880 (PAU_S2), and Poz-110881 (PAU_S3), in chronological sequence (made by: M. Cwalinski)
Sl. 4 Kalibrisani datumi Poz-110879 (PAU_S1), Poz-110880 (PAU_S2) i Poz-110881 (PAU_S3) u hronološkoj sekvenci (priredio: M. Cwalinski)

In this case the "old wood effect" stems from the different levels of ^{14}C absorption in different parts of the tree trunk: the earlier dates result from samples obtained from the inner part of the wood (heartwood, sometimes even several centuries older than the youngest part of the tree), while the younger dates characterize samples obtained from the outer parts of the wood (sapwood) (see: Borić 2009: 219–220; Palincaş 2017: 2–4).

Apparently, this is the case with the results presented here. The two older dates (Poz-110879 and Poz-110880) actually indicate the time when the tree was still young, while the youngest one

Očigledno, čini se da je ovo slučaj sa datumima koji se prikazuju u ovom radu. Dva starija datuma (Poz-110879 i Poz-110880) u stvari pokazuju vreme kada je drvo bilo i dalje mlado, dok najmlađi datum (Poz-110881) najverovatnije ukazuje na vreme kada je drvo posečeno i iskorišćeno za pravljenje daske (dasaka). Postoji takođe mogućnost da je daska i mlađa, tj. da se čekalo neko veme kako bi ona bila iskorišćena, ili da je pak uzorak koji je dao najmlađi datum nije uzet sa spoljnog dela drveta. Ipak, iako se najmlađi datum (Poz-110881) dobro uklapa u apsolutne datume iz drugih humki i sahrana na nekropoli (Gligorić et al. 2016 i dru-

(Poz-110881) probably points to the time when the tree was cut down and turned into planks. There is also the possibility that the plank is even younger, i.e. that it has waited for some time to be used, or that the sample which gave the youngest date was not taken from the most external part of the tree. However, since the youngest date (Poz-110881) matches very well the absolute dates of the other mounds in the necropolis (Gligorić et al. 2016 and other unpublished dates), we assume that this date indicates the time when the mound was made, i.e. the time span between the end of the 15th and the end of the 14th century, roughly corresponding to phase Br C2 (cf. Müller, Lohrke 2009).[3]

COMPARATIVE ANALYSIS OF AMBER FINDS FROM THE PAULJE NECROPOLIS

The collection of amber artefacts from the Paulje cemetery seemingly consists of amorphous beads that do not differ from each other. Indeed, a clear definition of these artefacts within the existing typologies of amber products may be difficult. However, there are several objects among them that require more attention because of their morphology and method of perforation.

Mound I (A) contained a quite unique piece of processed amber which can be described, according to definitions traditionally used in archaeology, as a button (Fig. 5). It has a conical shape with a round cross-section and a flattened triangular profile. The suspension hole consists of a V-shaped perforation with a single outlet on the upper side and a double outlet on the lower surface. Amber buttons with a V-shaped perforation are a specific category of finds, showing quite a large distribution across Europe, with the oldest specimens known from the Late and Final Neolithic cultures of the south-eastern Baltic zone: the Globular Amphora culture (Szmyt 1996: 53–56, Fig. 17: 9–10, 27), the Rzucewo/Bay Coastal culture (Mazurowski 1984: 6, 12–14, Fig. 2; Butrimas et al. 2018), and the Narva culture (Butrimas 2016: 35–37, Fig. 14–16). From there they were dispersed to the west and south-west at the end of the 3rd millennium BC thanks to the Bell Be-

3 The fact that this sample contained less carbon (0.5 mg) than the others also indicates that it comes from the outer younger part of the wood (sapwood), which is usually much less preserved than the inner part (see: Palincaş 2017: Fig. 2).

gi nepublikovani datumi), pretpostavljamo da ovaj datum ukazuje na vreme formiranja humke, tj. vremenski okvir između kraja 15. i kraja 14. stoleća, koji odgovaraju fazi Br C2 (cf. Müller, Lohrke 2009).[3]

UPOREDNA ANALIZA ĆILIBARSKIH NALAZA SA NEKROPOLE PAULJE

Ćilibarski nalazi sa lokaliteta Paulje najčešće su predstavljeni amorfnim perlicama koje se međusobno posebno ne ralzikuju. U stvari, jasno tipološko određenje u postojeće tipološke matrice ćilibarskih artefakata može biti izazovno. Sa druge strane, može se izdvojiti nekoliko predmeta po morfologiji i metodi perforacije koji zaslužuju veću pažnju.

U okviru humke I (A) otkriven je poprilično jedinstveni komad obrađenog ćilibara koji, po tradicionalnim arheološkim definicijama, može biti opisan kao dugme (sl. 5). Ima konični oblik sa kružnim presekom i ravnim trougaonim profilom. Rupa za kačenje napravljena je u formi V perforacije koja se na gornjem delu završava jednom, a na donjem sa dve rupe. Ćilibarska dugmad sa V perforacijom predstavlja specifičnu formu nalaza, koja pokazuje široku distribuciju na teritoriji cele Evrope, sa najranijim nalazima poznatim iz kultura poznog i finalnog neolita na jugoistočnom Baltiku: kulture loptastih amfora (Szmyt 1996: 53–56, Fig. 17: 9–10, 27), kulture Ručevo (Mazurowski 1984: 6, 12–14, Fig. 2; Butrimas et al. 2018) i kulture Narva (Butrimas 2016: 35–37, Fig. 14–16). Iz ove oblasti, dugmad ovog tipa su se raširila ka zapadu i jugozapadu krajem 3. milenijuma pre n.e. preko kulture zvonastih pehara (Czebreszuk, Makarowicz 1993). Geografski i hronološki bliže analogije za dugme sa Paulje dolaze iz severne Italije, poput nalaza iz Cattaragna (Massari et al. 1996: Fig. B: 1), Fossa Nera di Porcari (Andreotti, Zanini 1996: Fig. 2: 12), Lagazzi di Vho (Negroni Catacchio 1970: Fig. 13) i Olmo di Nogara, grob 154 (Salzani 2005: Pl. XVI: E). Osim izuzetka na lokalitetu Olmo di Nogara, većina njih otkrivena je u nesigurnim kontekstima koji se u najširim hronološkim okvirima mogu datovati u period bronzanog doba. S obzirom na to da je dugme sa Paulja jedinstveno na teritoriji Balkana, verovatno njegovo poreklo teba tražiti izvan ove oblasti, a Italija se u ovom slučaju čini kao jedno od najverovatnijih proizvodnih mesta.

3 Činjenica da je ovaj uzorak sadržao manje ugljena (0.5 mg) nego ostali takođe ukazuje da dolazi iz najmlađeg dela drveta, koji je obično mnogo lošije očuvan nego unutrašnji deo (see: Palincaş 2017: Fig. 2).

Fig. 5 Amber button from the Paulje necropolis, mound I (A) (photo by: V. Filipović)
Fig. 5 Ćilibarsko dugme sa nekropole Paulje, humka I (A) (snimio: V. Filipović)

aker culture (Czebreszuk, Makarowicz 1993). Geographically and chronologically closer analogies for the amber button from Paulje come from the area of Northern Italy: Cattaragna (Massari et al. 1996: Fig. B: 1), Fossa Nera di Porcari (Andreotti, Zanini 1996: Fig. 2: 12), Lagazzi di Vho (Negroni Catacchio 1970: Fig. 13), and Olmo di Nogara, grave 154 (Salzani 2005: Pl. XVI: E). With the exception of Olmo di Nogara, most of them were recovered from unspecified contexts, so they can be only generically dated to the Bronze Age. As the button from Paulje is unique within the Balkans, perhaps its origins should be sought outside this area, and Italy seems to be one of the more likely production places.

The amber beads from mounds XI (K) and XIV (N) are less specific than the described button from tumulus I (A). They are generally devoid of regularity in form which could otherwise enable a clear-cut classification. Most of them exhibit non-circular or non-oval cross-sections as well as profiles, instead giving an impression of being polygonal, combining rectilinear and curved surfaces. At least two beads from mound XI

Ćilibarske perle iz humki XI (K) i XIV (N) su manje specifične nego gore opisano dugme iz humke I (A). One su uglavnom lišene pravilnosti u obliku koje bi, moguće, pružile jasnu klasifikaciju. Većina njih ima ne-kružne ili ne-ovalne preseke, te stoga odaju utisak poligonalnosti, pri čemu su neke površine pravolinijske, a druge zakrivljene. Barem dve perlice iz humke XI (K) približavaju se tipu 8a po tipologiji A. Palavestre – ravno-diskoidne forme sa kružnim ili ovalnim presekom, ravne osnove i konveksnih strana (Palavestra 1993: Tab. 1, Fig. 7). Ovo je ujedno i jedna od najomiljenijih formi ćilibarskih predmeta tokom cele praistorije, koje se stoga ne mogu tačno opredeliti u hronološkom i geografskom pogledu. Analogije iz susednih nekropola Pađine – Ročević i Belotić – Bela Crkva u Podrinju pokazuju da primerci sa Paulja nisu usamljeni nalazi u manjem geografskom okviru (Palavestra 1993: 110–111, 139–140). Na kraju, jedna od perli iz humke XIV (N) ima ravnu cilindričnu formu sa kružnim presekom i ravnu osnovu i stranice, pa otuda podseća na tip 18c po A. Palavestri (Palavestra 1993: Tab. 2, Fig. 7). Ravne cilindrične perle su prilično rasprostranjene tokom bronzanog doba, posebno u oblastima karpatskog basena (Sprincz, Beck 1981: Fig. 6,

Fig. 6 Flattened discoidal beads from Paulje, mound XI (K) (source: National Museum, Belgrade, photo archive)
Sl. 6 Zaravnjene diskoidne perle iz humke XI (K) na Pauljama (izvor: Narodni muzej, Beograd, fotoarhiva)

(K) are close to type 8a in the typology of A. Palavestra – a flattened discoidal form with a circular or oval cross-section, a rectilinear flat base, and convex sides (Palavestra 1993: Tab. 1, Fig. 7). This was one of the most popular forms of amber artefacts throughout prehistory, so it cannot be precisely defined in terms of space and time. Analogies from the nearby cemeteries of Pađine – Ročević and Belotić – Bela Crkva in Podrinje show that the specimens from Paulje are not isolated finds in a small geographical area (Palavestra 1993: 110–111, 139–140). Finally, one of the beads from tumulus XIV (N) has a flattened cylindrical form with a circular cross-section and rectilinear base and sides, resembling type 18c after Palavestra (Palavestra 1993: Tab. 2, Fig. 7). Flattened cylindrical beads were quite widespread during the Bronze Age, especially in the area of the Carpathian Basin (Sprincz, Beck 1981: Fig. 6, Tab. 1) and in Vojvodina (Rašajski 1988: Fig. 63); in the Balkans, they are found in Kosovo and Metohija (Palavestra 1997: Pl. 1: 16), and Albania (Kurti 2017: Pl. XCIX: g). It appears that the Paulje necropolis stood on the distribution route of such amber beads from the north to the south.

Fig. 7 Flattened cylindrical bead from Paulje, mound XIV (N) (drawing by: J. Kotlajić)
Sl. 7 Ravna cilindrična perla iz humke XIV (N) na Pauljama (crtež: J. Kotlajić)

Tab. 1) i u Vojvodini (Rašajski 1988: Fig. 63), dok ih na Balkanu srećemo na prostorima Kosova and Metohije (Palavestra 1997: Pl. 1: 16), kao i Albanije (Kurti 2017: Pl. XCIX: g). Čini se da je nekropola u Paulju mogla biti postavljena na mesto preko koga su perle ovog tipa distribuirane od severa ka jugu.

Amber provenience analysis

The question of the source of the amber known to and used by Balkan Bronze Age communities has been a point of discussion for a long time. Baltic amber (succinite) did not seem an obvious choice to everyone, as some early scholars argued that local, unspecified fossil resins, but younger than succinite, might have been exploited at that time (Bošković 1961; Lebez 1968). Others considered Sicilian (simetite) or Romanian (rumanite) ambers as potential alternatives (Hedinger 1903). Research conducted in the 1970s by C.W. Beck and his co-workers (Beck, Liu 1973; 1974; Todd et al. 1976) confirmed that Baltic amber (succinate) was the most common fossil resin of the samples analysed. However, these studies considered only a small number of finds, mostly recovered from Iron Age contexts.

With the aim to clarify this issue, amber artefacts collected from older and more recent excavations were sampled and analysed in the Amber Research Laboratory at Vassar College. In September 2017 seven samples of amber beads from the tumuli cemetery of Paulje were taken from the Museum of Jadar in Loznica: four from tumulus XI (K) and one each from mounds I (A), XIV (N), and XV (O). Each sample was given a separate number that corresponds to a specific object within the individual inventory lot in the museum (Tab. 2).

Analiza porekla ćilibara

Pitanje izvorišta ćilibara poznatog i korišćenog od strane zajednica bronzanog doba Balkana predmet je rasprave već duži niz godina. Baltički ćilibar (sukcinit) ne čini se kao prvi izbor za svaku praistorijsku zajednicu, s obzirom na to da su pojedini rani istraživači smatrali da nespecifične lokalne fosilne smole, mlađe od sukcinita, mogu biti eksploatisane u tom vremenu (Bošković 1961; Lebez 1968). Drugi su smatrali sicilijanski (simetit) ili rumunski (rumanit) ćilibar kao potencijalne alternative (Hedinger 1903). Istraživanja sprovedena tokom 70-ih godina 20. stoleća od strane C.W. Beck i saradnika (Beck, Liu 1973; 1974; Todd et al. 1976), pokazala su da je baltički ćilibar najčešće korićena fosilizovana smola od svih analiziranih uzoraka. Ipak, ove studije obuhvatile su manji broj nalaza i uzoraka, prvenstveno otkrivenih u kontekstima iz gvozdenog doba.

Sa ciljem da se istraži gorepomenuti problem, sakupljeni su uzorci ćilibara sa starih, ali i novih istraživanja i analizirani u Laboratoriji za ćilibarska istraživanja Vazar koledža. Tokom septembra 2017. godine, sedam uzoraka ćilibarskih perli iz grobova sa nekropole pod humkama Paulje uzeto je iz zbirke Muzeja Jadra u Loznici. Četiri uzorka su iz humke XI (K), dok je po jedan uzorak uzet iz humki I (A), XIV (N) i XV (O) i svaki od njih je dobio poseban broj koji odgovara posebnim objektima u muzejskom inventaru (Tab. 2).

Sample number / Broj uzorka	Context / Kontekst	Inv. number / Inv. broj	IR number / IR broj	Result / Rezultat
L001	Paulje, tum. A	A22	8485	Baltic amber (succinite) / Baltički ćilibar (sukcinit)
L002	Paulje, tum. K	A66-71	8484	
L003	Paulje, tum. K	A66-71	8471	
L004	Paulje, tum. K	A66-71	8474	
L005	Paulje, tum. K	A66-71	8483	
L006	Paulje, tum. N	A98, A100-104, A107	8470	
L007	Paulje, tum. O	A111-118	8473	

Tab. 2 List of amber samples from the cemetery of Paulje collected at the Museum of Jadar in Loznica (made by: M. Cwalinski)
Tab. 2 Spisak ćilibarskih uzoraka sa nekropole Paulje iz Muzeja Jadra u Loznici (priredio: M. Cwalinski)

Analysis

The amber samples collected for this study were analyzed by FTIR (*Fourier-transform infrared*) spectroscopy. FTIR spectroscopy was carried out on KBr (*potassium bromide*) amber pellets using the ThermoNicolet FTIR Nexus 670 model. The samples were prepared by grinding 1 mg of amber, mixing it with 100 mg of anhydrous KBr (99.999%), and pressing it into a pellet under high pressure in vacuum. The spectra were collected in transmittance mode with the wavelengths between 4000 and 400 cm^{-1}; 16 scans were collected for the KBr amber pellets using air as the background. The spectra of the amber samples were compared with previously studied spectra using an in-house database of the Amber Research Laboratory.

Analiza

Uzorci ćilibara iz ovog istaživanja analizirani su korišćenjem FTIR spektrometrisjke tehnike (infracrvena spektroskopija sa Furijeovom transformacijom). Analiza uzoraka je izvršena korišćenjem ThermoNicolet FTIR Nexus 670 spektrometra. Uzorci ćilibara, mase 1 mg, su samleveni i pomešani sa 100 mg anhidrovanog praha KBr (kalijum bromida, čistoće 99,999%). Ovako pripremljen prah tabletiran je pod visokim pritiskom u vakuumu. FTIR spektri dobijeni su u transmisionom modu u oblasti talasnih dužina od 4000–400 cm^{-1}, sa 16 skenova. Za kalibraciju je korišćen vazduh. Snimljeni spektri ćilibara poređeni su sa spektrima u bazi koja je napravljena u Laboratoriji za istrazivanje ćilibara Vazar koledža.

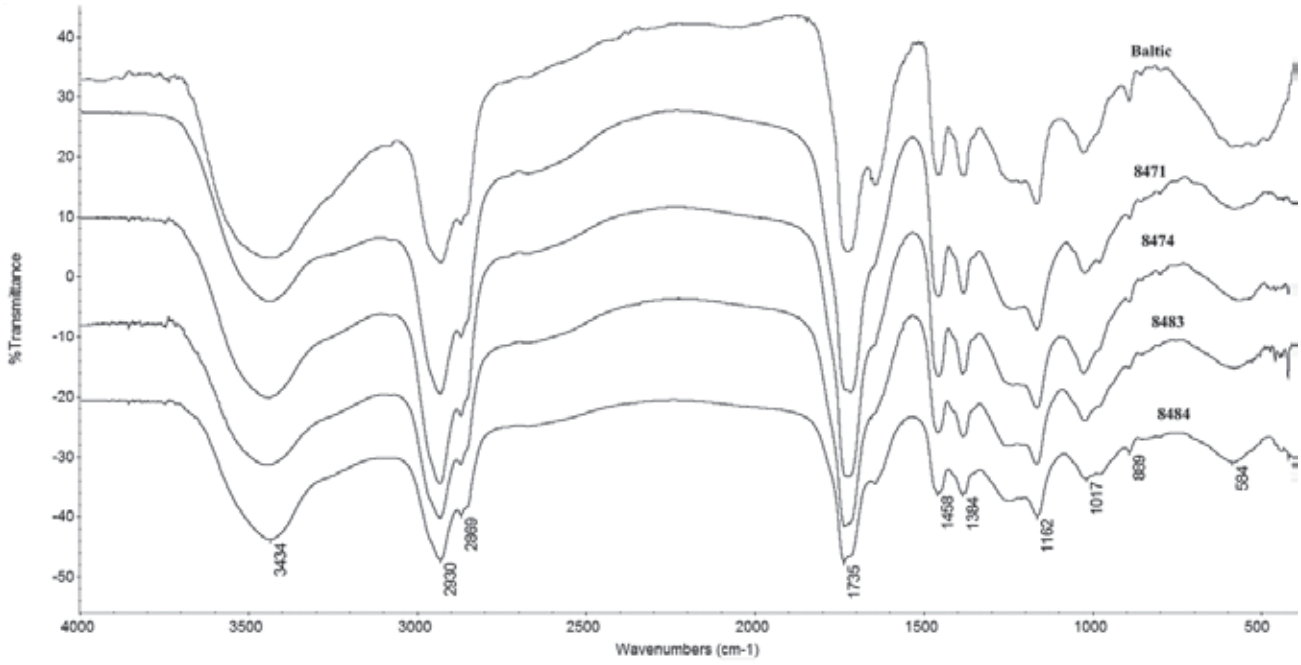

Fig. 8 FTIR spectra of Baltic amber and samples L002 (IR#8484), L004 (IR#8474), L005 (IR#8483), and L002 (IR#8484) (made by: M. Cwalinski)
Fig. 8 FTIR spektar baltičkog ćilibara i uzoraka L002 (IR#8484), L004 (IR#8474), L005 (IR#8483) i L002 (IR#8484) (priredio: M. Cwalinski)

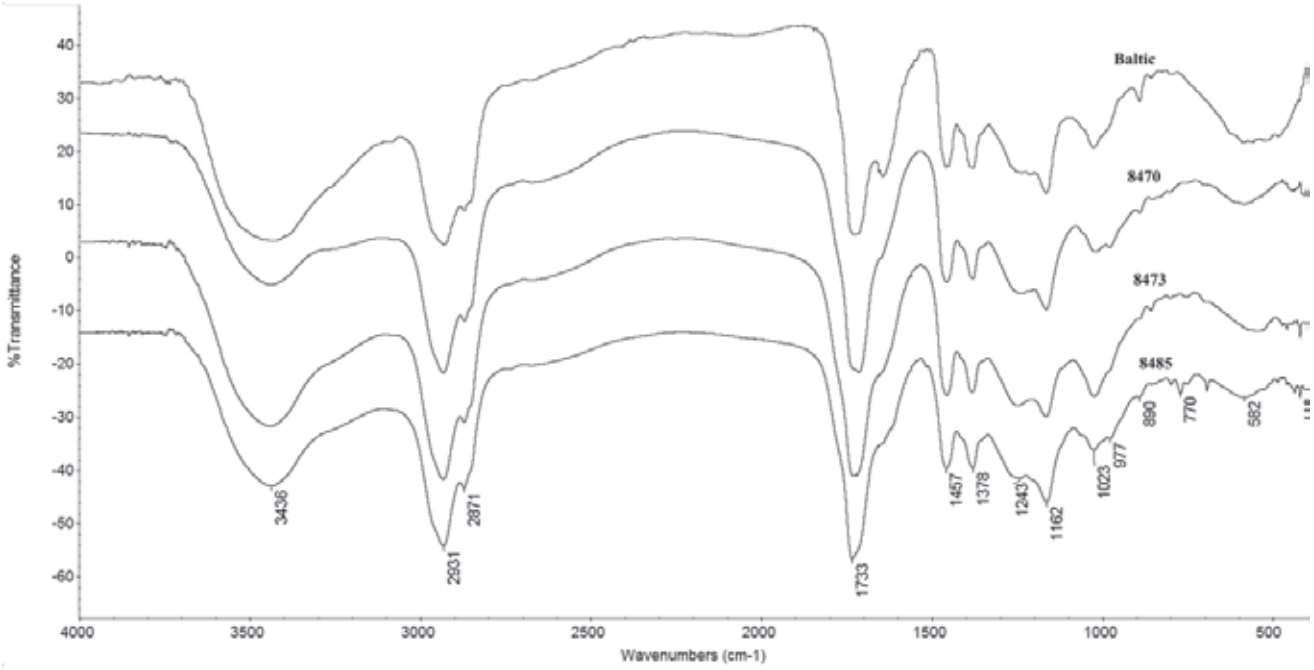

Fig. 9 FTIR spectra of Baltic amber and samples L006 (IR#8470), L007 (IR#8473), and L001 (IR#8485) (made by: M. Cwalinski)
Fig. 9 FTIR spektar baltičkog ćilibara i uzoraka L006 (IR#8470), L007 (IR#8473) i L001 (IR#8485) (priredio: M. Cwalinski)

RESULTS AND DISCUSSION

The results of the FTIR spectra show that all of the amber samples are consistent with succinate fossil resin, commonly known as Baltic amber (Tab. 2; Figs. 8–9). The main basis for classification is the presence of the 'Baltic pattern'– a characteristic feature in the carbon-oxygen single bond region of succinite spectrum, comprised of a horizontal shoulder between 1250 and 1175 cm^{-1} that is preceded by a peak of ~1160 cm^{-1}. This characteristic absorption pattern, which stems from the spreading C-O vibrations of succinic acid esters, is not shared by any other non-Baltic European fossil resin tested so far (Beck 1986: 73–74). Together with the absorption peak of 890 ± 5 cm^{-1} due to the exocyclic carbon-carbon double bond group (not always as prominent), they are widely regarded as reliable determinants of succinite fossil resin (cf. Mills et al. 1984; Beck 1986). The spectra of IR# 8473 and 8485, in comparison with other spectra, have a less pronounced peak of 890 ± 5 cm^{-1}, revealing disturbances in the 'Baltic shoulder' region. Still, these deviations from the pattern can be explained by contamination or even weathering of the collected samples.

REZULTATI I DISKUSIJA

Rezultati FTIR spektra pokazuju da svi uzorci pripadaju fosilnoj smoli sukcinitu, odnosno baltičkom ćilibaru (Tab. 2; sl. 8–9). Glavna osnova za određivanje porekla jeste prisustvo tzv. „baltičkog obrazca" – posebne karakteristike jednostruke veze u spektru sukcinita, koji se nalazi u vrednostima između 1250 i 1175 cm^{-1} i kojoj prethodi vrhunac vrednosti od ~1160 cm^{-1}. Ovaj karakteristični obrazac apsorpcije, koji proizilazi iz rasprostiranja vibracija kiseonika i ugljenika iz estera ćilibarne kiseline, nema nijedna druga analizirana evropska ne-Baltička fosilna smola (Beck 1986: 73–74). Zajedno sa apsorpcionim vrhuncem na vrednosti 890±5 cm^{-1}, usled egzocikličnе grupe dvostrukih veza ugljenika i ugljenika (nisu uvek tako jasno istaknute), oni se široko smatraju pouzdanim za određivanje sukcinitne fosilne smole (cf. Mills et al. 1984; Beck 1986). Spektar uzoraka IR# 8473 i 8485, u poređenju sa preostalim vrednostima ima manje izražen vrhunac vrednosti 890±5 cm^{-1} čime se pokazuju nepravilnosti u vrednostima tzv. „baltičkog ramena". Ipak, ova odstupanja od normala mogu biti objašnjena kontaminacijom, ili čak atmosferskim uticajima na prikupljene uzorke.

CONCLUSIONS

The long break since the last amber provenience studies conducted in the 1970s and 1980s makes the above results a welcome contribution to the state of knowledge on the origins of the oldest artefacts made of fossil resins that were used in the present-day territory of Serbia. The clear determination of the analysed amber finds from the Paulje necropolis as succinite confirms the earlier findings and indicates the involvement of the communities inhabiting the Jadar valley and the lower course of the Drina in the middle of the 2nd millennium BC in an exchange network, perhaps even reaching the Baltic coast (cf. Palavestra 1993; Ljuština 2019a; 2019b; Ljuština, Dmitrović 2020). Equally important are the three absolute radiocarbon dates from mound XI (K) at Paulje, which may seem insubstantial, but significantly expand the pool of absolute dates for the Serbian Bronze Age. Furthermore, they are a reliable indication of the earliest horizon of the appearance of Baltic amber in the form of handmade jewellery in the Central Balkans. Until now, radiocarbon dates in the context of amber finds mostly came from archaeological sites located along the Balkan Adriatic coast (see: Cwaliński 2020: 136–138). Interestingly, they all indicate similar timespans beginning with the 16th century BC, but are often burdened with errors resulting from the disturbance of the context from which a sample was collected, or the marine reservoir effect (MRE). Geographically the closest, and at the same time the safest, determination of the age of amber imports into the Balkans was obtained from the site of Alilovci – Lipje in Požega (Croatia), and points to the turn of the 16th and 15th centuries BC (Cwaliński 2020: 136), so roughly a century earlier than seemingly indicated by the dates from Paulje, mound XI (K). However, the single amber bead from Alilovci – Lipje appears to be an isolated case within inland Croatia. Meanwhile, the amber finds from Podrinje and Western Serbia dated to the regional Late Bronze Age (Br C–D) are much more numerous, amounting to no fewer than 234 beads. They presumably reflect a rather short-lived phenomenon of intense amber import to the area that was coeval with the existence of mound cemeteries belonging to the so-called Brezjak culture (Bulatović et al. 2017; Филиповић 2013). The amber inflow to this part of the Balkans ceased at the end of the 13th century BC, when the impact of dynamic social and economic changes resulted in the reshuffling of the previous network of interregional contacts and led to the emergence of the Urnfield-type cultural units.

ZAKLJUČAK

S obzirom na relativno dugačku pauzu od poslednjih studija porekla ćilibara tokom 70-ih i 80-ih godina prošlog stoleća, rezultati ovoga rada predstavljaju doprinos poznavanju porekla najstarijih predmeta od fosilnih smola koje su korišćene na prostoru današnje Srbije. Jasno opredeljenje analiziranih nalaza ćilibara sa nekropole Paulje kao sukcinita, potvrđuje ranije rezultate i ukazuje da su populacije iz doline Jadra i donjeg toka Drine tokom sredine 2. milenijuma pre n.e. bile uključene u mrežu razmene, dosežući možda i same obale Baltika (cf. Palavestra 1993; Ljuština 2019a; 2019b; Ljuština, Dmitrović 2020). Od jednake važnosti su i tri apsolutna datuma iz humke XI (K) na Pauljama, koji, iako se možda čine nevažnim, realno proširuju bazu apsolutnih datuma vezanih za bronzano doba Srbije. Isto tako, oni su sigurno svedočanstvo o najranijoj pojavi baltičkog ćilibara u obliku ručnopravljenog nakita na prostorima centralnog Balkana. Do sada, apsolutni datumi konteksta sa ćilibarom najčešće su poticali sa lokaliteta istočne obale Jadranskog mora (vidi: Cwaliński 2020: 136–138). Zanimljivo je i da svi oni ukazuju na približno iste vremenske okvire počinjući sa 16. stolećem pre n.e., dok su sa druge strane, opterećeni greškama koje potiču iz nepouzdanih konteksta iz kojih su uzorci uzeti, ili usled tzv. efekta morskog rezervoara (MRE). Geografski gledano, a u isto vreme i najpouzdaniji datum koji može odrediti vreme prvih doprema ćilibara na prostor Balkana dolazi sa lokaliteta Alilovci – Lipje u Požegi (Hrvatska) i ukazuje na prelaz iz 16. u 15. stoleće pre n.e. (Cwaliński 2020: 136), tj. otprilike stotinu godina ranije nego naši datumi iz humke XI (K) na Pauljama. Ipak, jedna ćilibarska perla sa lokaliteta Alilovci – Lipje čini se da predstavlja usamljeni slučaj u celoj unutrašnjoj Hrvatskoj. U skoro isto vreme, ćilibarski nalazi iz Podrinja i zapadne Srbije hronološki se opredeljuju u regionalno pozno bronzano doba (Br C–D), ali su mnogo brojniji, ukupno uzev, ne manje od 234 perle. One najverovatnije predstavljaju kratkotrajan fenomen intenzivnog uvoza ćilibara na ove prostore tokom pojave nekropola pod humkama koje su pripadale tzv. Brezjačkoj kulturi (Bulatović et al. 2017; Филиповић 2013). Dopremanje ćilibara u ovaj deo Balkana trajalo je do kraja 13. stoleća pre n.e., kada su dinamične društvene i ekonomske promene prekinule i preuredile ranije međuregionalne kontakate i dovele do pojave brojnih kulturnih pojava proizašlih iz kompleksa kulture polja sa urnama.

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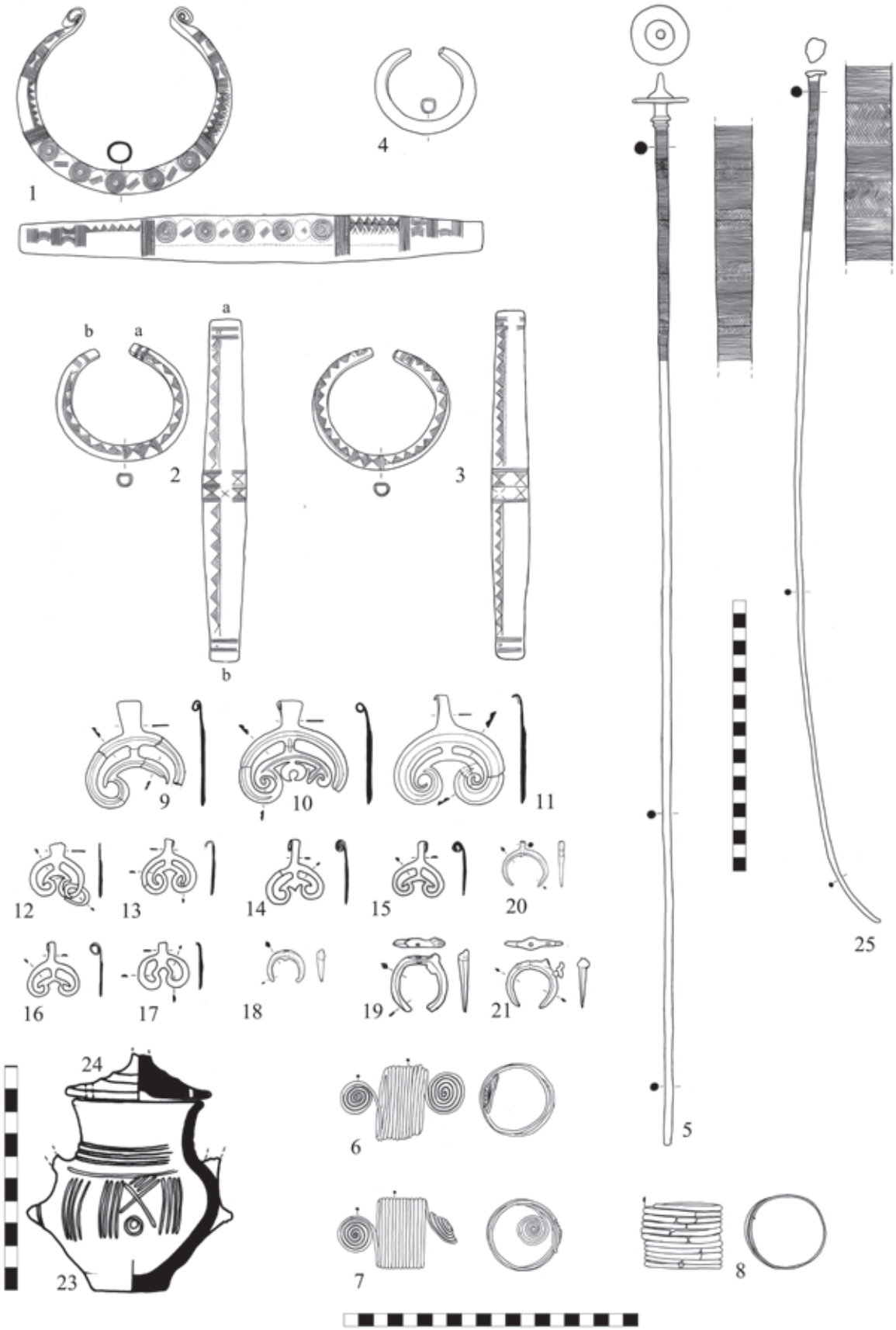

Pl. 1 Inventory of the central grave of mound XI (K). Amber finds are presented in Fig. 6 (made by: V. Filipović)
T. 1 Nalazi iz centralnoga groba humke XI (K). Nalazi ćilibara prikazani su na sl. 6 (priredio: V. Filipović)