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10.7 LITOSTRATIGRAFSKA ANALIZA KAMNITIH NAJDB IZ PODZEMLJA

10.7 LITHOSTRATIGRAPHIC ANALYSIS OF THE STONE FINDS FROM PODZEMELJ

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UVOD

Opravljena je bila makroskopska analiza redkih kamnitih najdb z grobišča na Pezdirčevi njivi in izbranih najdb iz pripadajočega naselja na Kučarju (Dular et al. 1995; Grahek, Kovač 2020). Pri ugotavljanju izvora posameznih litofaciesov je bilo v študijo zajeto širše raziskovalno območje, geografsko omejeno na porečje Kolpe. Na severu je bila meja širšega območja raziskav hribovje Kočevskega roga in Gorjancev. V ožje raziskovalno območje je bila uvrščena bližnja okolica železnodobnega središča v Podzemlju z utrjenim naseljem na Kučarju. V tem območju je bila izdelana geološka karta v merilu 1 : 5.000. Dodatno so bila makroskopsko pregledana lokalna prodišča reke Kolpe.

Cilj raziskave je na podlagi makroskopske analize prepoznati izvorne litostratigrafske enote, uporabljene za izdelavo posameznih kamnitih izdelkov. Pričakujemo, da bo iz teh podatkov mogoče ugotoviti geografske meje gospodarskih povezav tedanjih prebivalcev. Dodatni cilj raziskave je ugotoviti oziroma opredeliti povezavo med litološkimi lastnostmi kamnitega izdelka in njegovo namembnostjo.

GEOLOŠKA UMESTITEV

Severovzhodni in vzhodni del širšega raziskovalnega območja pripada prehodnemu območju med Notranjimi in Zunanjimi Dinaridi (Poljak et al. 2005; Placer 2008). Tega na začetku mezozoika opredeljujejo plitvomorska karbonatna zaporedja, pozneje, v juri ali kredi, pa se sedimentacijsko območje tektonsko poglobi in začne se globljemorska sedimentacija (Gerčar et al.

INTRODUCTION

A macroscopic analysis was conducted on the rare stone finds from the burial site at Pezdirčeva njiva and selected artefacts from the associated settlement of Kučar (Dular et al. 1995; Grahek, Kovač 2020). To determine the provenance of individual lithofacies, the investigation covered a broader area, geographically limited to the Kolpa River basin, delineated in the north by the hills of Kočevski Rog and Gorjanci, while the examination was primarily focused on the Iron Age centre in Podzemelj with the fortified settlement on Kučar. This area was mapped at a scale of 1:5,000. Additionally, local gravel deposits of the Kolpa River were examined macroscopically.

Based on macroscopic analysis, the study aims to determine the lithostratigraphic provenance of the rocks used in the production of individual stone artefacts. This is expected to help define the geographical extent of economic connections among the inhabitants of the time. Furthermore, the study will also examine the relationship between the lithological properties of the stone artefacts and their intended use.

GEOLOGICAL SETTING

The north-eastern and eastern parts of the broader research area are part of the transitional zone between the Inner and Outer Dinarides (Poljak et al. 2005; Placer 2008), characterized by Mesozoic shallow-marine carbonate successions. During the Jurassic or Cretaceous, the sedimentary area underwent tectonic subsidence, initiating deeper marine sedimentation (Gerčar et al. 2022). The

2022). Preostali del širšega raziskovalnega območja se razprostira na severovzhodnem delu Zunanjih Dinaridov (Poljak et al. 2005; Placer 2008), ki so paleogeografsko pripadali najprej Slovenski (sensu Buser 1989) oziroma Južnotetidini megaplatformi in pozneje Jadranski karbonatni platformi (sensu Vlahović et al. 2005).

Najstarejše kamnine širšega raziskovalnega območja pripadajo karbonskim in permskim klastičnim kamninam (Buser 2010; Velić, Vlahović 2009), ki v spodnjem triasu zvezno preidejo v značilno menjavanje klastičnih in karbonatnih kamnin Werfenske formacije (Aljinović et al. 2006; Aljinović et al. 2018). Preostali del mezozojskega zaporedja opredeljujejo karbonatna zaporedja (Dragičević, Velić, 2002). Za plitvomorska zaporedja Jadranske karbonatne platforme značilna spodnjekredna okopnitev (Jurkovšek et al. 2013) se na širšem raziskovalnem območju kaže z brečo in boksiti.

Boksiti so aluminijeva ruda (Bardossy 1982), ki je lahko povezana z železovo »bobovo« in pizolitno rudo ter poleg glinice (Al_2O_3) vsebuje tudi precejšen delež železovih oksidov (v Beli krajini 8–30 odstotkov FeO (GZS 1962)). Boksite v Beli krajini najdemo v Hrastu pri Vinici, na Belčjem vrhu in Perudini. Po Osnovni geološki karti so terciarne starosti (Bukovac et al. 1984), ob upoštevanju novejših raziskav kredne litostratigrafije severnega dela Jadranske karbonatne platforme in boksitov kot mineralnih surovin pa zgodnjekredne starosti (Jež, Otoničar 2018; Mencinger 2023). V zgornjem delu pozne krede so kompresijske razmere zajele tudi severni rob Jadranske karbonatne platforme (Vlahović et al. 2005). Oblikoval se je predgorni bazen, v katerem so se odlagali flišni sedimenti (Brajkovič et al. 2014). Ob koncu krede ali na začetku paleogena je širše območje verjetno večinoma okopnelo in karbonatne kamnine je zajelo intenzivno zakrasevanje. Lokalno neogenska sedimentna zaporedja diskordantno prekrivajo mezozojsko podlago (Bukovac et al. 1984). V zgornjem delu miocena so se v lokalno poglobljeni del odložili sladkovodni sedimenti (glina, melj) ter organsko bogate plasti, ki danes izdanjajo na območju Kanižarice, kjer so v preteklosti izkoriščali lignit. Temu se po palinoloških raziskavah pripisuje zgornjemiocenska starost (Žepič 1991; Markič 1995). Izvor odloženih pliokvartarnih sedimentov (prod, kremenov pesek in glina) na proučenem območju do zdaj še ni bil obravnavan. Debelina teh sedimentov je ocenjena na od nekaj metrov pa do nekaj deset metrov (Bukovac et al. 1984). Ob večjih vodotokih so se odložili še najmlajši aluvialni sedimenti, ki so ob kraških rekah drobnozrnati (glina, melj), medtem ko reka Kolpa na svojih poplavnih ravnicah odlaga predvsem pesek in prod. V teh litostratigrafskih enotah se pogosto pojavlja tudi železova ruda (Streffleur 1856). V Beli krajini je je (po današnjih pojmovanjih in zahtevah proizvodnje – predvsem količinske) zanemarljivo malo (Danzer 2016). Če pa pogledamo v kontekstu sredine železne dobe in takratne potrebe po železu, so tudi nahajališča v Beli krajini dovolj izdatna za izkoriščanje.

remainder of the broader research area is located in the north-eastern part of the Outer Dinarides (Poljak et al. 2005; Placer 2008), which initially palaeogeographically belonged to the Slovenian (sensu Buser 1989) or South Tethyan megaplatform, and later to the Adriatic carbonate platform (sensu Vlahović et al. 2005). Carboniferous and Permian clastic rocks are the oldest in the area (Buser 2010; Velić, Vlahović 2009). In the Lower Triassic, they gradually transition into the characteristic alternation of clastic and carbonate rocks of the Werfen Formation (Aljinović et al. 2006; Aljinović et al. 2018). The remainder of the Mesozoic succession is dominated by carbonates (Dragičević, Velić 2002). The shallow-marine succession of the Adriatic carbonate platform is characterized by the emersion of Lower Cretaceous limestones (Jurkovšek et al. 2013), reflected in the research area by the presence of breccias and bauxites.

Bauxites are aluminium ores (Bardossy 1982), which may be associated with ferruginous "beans" and pisolitic ores, which, in addition to alumina (Al2O3), also contain a significant proportion of iron oxides (in Bela Krajina between 8 and 30% FeO (GZS1962). Bauxites in Bela Krajina occur at Hrast pri Vinici, Belčji Vrh and Perudina (Bukovac et al. 1984), and date from the Early Cretaceous (Jež, Otoničar 2018; Mencinger 2023). In upper of the Late Cretaceous, compressive conditions also affected the northern margin of the Adriatic carbonate platform (Vlahović et al. 2005). A foreland basin formed in which flysch sediments were deposited (Brajkovič et al. 2014). By the end of the Cretaceous or the beginning of the Paleogene, the region likely surfaced significantly, leading to intensive karstification of carbonate rocks. Neogene sedimentary successions locally discordantly overlie the Mesozoic basement (Bukovac et al. 1984). In the upper part of the Miocene, freshwater sediments (clay, silt) and organic rich layers were deposited in locally deepened areas, which today outcrop in the Kanižarica area, where lignite was mined in the past. Based on palynological studies, the lignite is estimated to date from the Upper Miocene (Žepič 1991; Markič 1995). The origin of the deposited Plio-Quaternary sediments (gravel, quartz sand, and clay) in the investigated area has not yet been studied. The thickness of these sediments is estimated to range from several metres to several dozen metres (Bukovac et al. 1984). The youngest alluvial sediments, which in karst rivers primarily occur as fine-grained deposits (clay, silt), were deposited along larger watercourses, while the Kolpa River mainly deposited sand and gravel in its floodplains. Iron ore is also frequently found in these lithostratigraphic units (Streffleur 1856). According to today's concepts and production requirements – especially in quantitative terms, Bela Krajina has very small quantities of ore (Danzer 2016). However, if one considers the context of the Middle Iron Age and the demand for iron at that time, the deposits in Bela Krajina are rich enough for extraction.

Ožje raziskovalno območje označujejo spodnjekredna karbonatna zaporedja, ki paleogeografsko pripadajo severnemu robu Jadranske karbonatne platforme. Ta zaporedja so pogosta v jugovzhodni Sloveniji (Buser 2010). Litostratigrafska razdelitev spodnje krede je oblikovana na območju Krasa. Spodnjekredni karbonati na tem območju pripadajo valanginijsko-aptijski Brski formaciji in aptijsko-cenomanijski Povirski formaciji (Jurkovšek et al. 2013; Jurkovšek et al. 2016). Obe formaciji sta bili odloženi v notranjem lagunskem delu Jadranske karbonatne platforme (Jurkovšek et al. 1996; Jurkovšek et al. 2013). Facies in mikrofosile v apnencih primerljive starosti so podrobno opisali Šribar (1979), Cousin (1981) ter Dozet in Šribar (1997). Za zgornji del valanginijsko-aptijskega zaporedja so značilni predvsem peloidni bioklastični apnenci in intraklastični apnenci strukturnega tipa wackestone do packstone. Prisotni so tudi nivoji, kjer je pogosto opazna tekstura bacinella (Šribar 1979; Cousin 1981; Dozet, Šribar 1997). Zaporedje plastnatega apnenca je odloženo v notranjem delu plitvega šelfa z lastnostmi lagune (Šribar 1979; Dozet, Šribar 1997).

METODOLOGIJA

Območje geološkega kartiranja je bilo omejeno na bližnjo okolico najdišč Kučar in Pezdirčeva njiva v velikosti 4,3 kvadratnega kilometra. Temelj za terenske preglede je bila priprava visokoresolucijskih topografskih osnov in lidarskih modelov površja (Tarolli 2014), ki so bili podlaga za natančno geološko kartiranje v merilu 1 : 2.500. Kartiranje je potekalo po metodi sledenja geoloških mej, na pokritih terenih pa po metodi vseh izdankov (Compton 1985). Geološka karta je bila izdelana v merilu 1 : 5.000 (*sl. 1*).

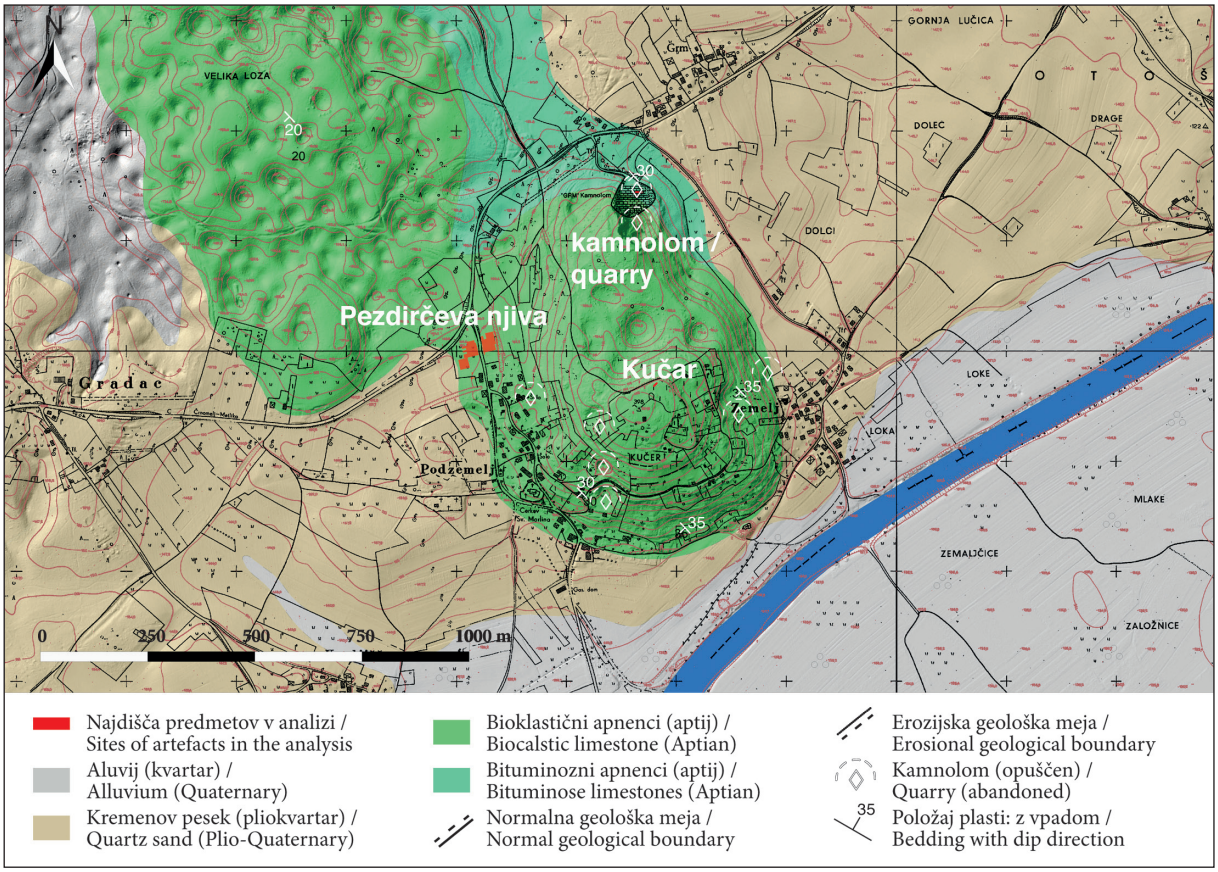
Da bi pridobili vpogled v vse litološke različke, ki so jih uporabljali železnodobni prebivalci, so bili najdeni kamniti izdelki makroskopsko opredeljeni. Popisni list je zajemal mere izdelka, opis litologije, pregled obdelave in določitev barve kamnine po standardni barvni lestvici (Geological rock-color charts 2011). Vsi vzorci so bili makroskopsko pregledani pod digitalnim mikroskopom Keyence VHX 7100-S750E. Klastične sedimentne kamnine so bile razvrščene na podlagi klasifikacij, ki jih je predlagal Folk (Folk 1980). Litofaciesi apnenca so bili poimenovani v skladu s posodobljeno klasifikacijo Dunhama (Lokier, Al Junaibi 2016) ter združeni na podlagi priporočil (D'Argenio et al. 1997; Buonocunto et al. 1999) v litofaciesne skupine. Skupno je bilo v makroskopski popis zajetih 67 kamnitih izdelkov različnih tipologij (glej *tab. 1*).

The narrow research area is characterized by Lower Cretaceous carbonate successions that palaeogeographically belong to the northern edge of the Adriatic carbonate platform. Lower Cretaceous carbonate successions, widespread in South-Eastern Slovenia (Buser 2010), are lithostratigraphically subdivided in the Kras area. The Lower Cretaceous carbonates in this area belong to the Valanginian-Aptian Brje Formation and the Aptian-Cenomanian Povir Formation (Jurkovšek et al. 2013; Jurkovšek et al. 2016). Both formations were deposited in the inner lagoonal part of the Adriatic carbonate platform (Jurkovšek et al. 1996; Jurkovšek et al. 2013). Facies and microfossils in limestones of comparable age have been described in detail by Šribar (1979), Cousin (1981), and Dozet and Šribar (1997). The upper part of the Valanginian-Aptian sequence is mainly characterized by peloidal bioclastic and intraclastic limestones ranging in texture from wackestone to packstone. Levels with frequent Bacinella texture are also present (Šribar 1979; Cousin 1981; Dozet and Šribar 1997). The bedded limestone succession was deposited in the inner part of a shallow shelf, characterized by lagoonal conditions (Šribar 1979; Dozet, Šribar 1997).

METHODOLOGY

Geological mapping was limited to the immediate area of the Kučar and Pezdirčeva njiva sites, covering an area of 4.3 km^2. Fieldwork was based on high-resolution topographic data and LiDAR-derived surface models (Tarolli 2014), which enabled precise geological mapping at a scale of 1:2,500. Mapping employed the method of tracing geological boundaries and, on covered terrain, the method of identifying all outcrops (Compton 1985). The final geological map was compiled at a scale of 1:5,000 (*Fig. 1*).

Stone artefacts were macroscopically identified to gain insight into all the lithological variants used by Iron Age inhabitants. The inventory sheet documenting each artefact records its dimensions, lithological descriptions, surface modifications, and rock colour using the standard colour chart (Geological Rock-Color Charts, 2011). A total of sixty-seven stone artefacts of various typologies were analysed (*Tab. 1*). All samples were examined macroscopically using a Keyence VHX 7100-S750E digital microscope. The clastic sedimentary rocks were classified according to the system proposed by Folk (1980). Limestone lithofacies were named following the updated Dunham classification (Lokier, Al Junaibi 2016) and categorized into lithofacies groups based on recommendations (D'Argenio et al. 1997; Buonocunto et al. 1999).



Sl. 1: Geološka karta bližje okolice Kučar v merilu 1 : 5.000 (tu pomanjšana) z označenima najdiščema Kučar in Pezdirčeva njiva.
Fig. 1: Geological map of the surroundings of the Kučar hill on a scale of 1:5,000 (here reduced) with marked archaeological sites Kučar and Pezdirčeva njiva.

REZULTATI

Za izdelavo geološke karte območja proučenih arheoloških najdišč (*sl. 1*) so bili poleg novih terenskih podatkov uporabljeni tudi podatki Osnovne geološke karte – list Črnomelj (Bukovac et al. 1984) in podatki paleontoloških preiskav na območju kamnoloma Grm (GZS 1992). Kartirano območje zajema vzpetino Kučar in bližnjo okolico. Večina kartiranega območja je antropogeno spremenjena, ravninski del območja pa je prekrit z debelo preperino.

Spodnji del kartiranega zaporedja pripada litofaciesni skupini bituminozni apnenci. Za to enoto je značilno pojavljanje tankoplastnatih temnosivih (N3–N4 po Geological rock-color charts 2011) laminiranih apnencev (debelina plasti do 20 centimetrov), ki se menjavajo s plastmi dolomita in dolomitiziranega apnenca. Značilni litofaciesi te enote so algni wackestone, laminirani karbonatni mudstone, laminirani sparitni dolomit in peloidni packstone. Predhodno določene foraminifere (GZS 1992) *Debarina hahounerensis* (Fourcade, Raoult, Vila), *Palorbitolina lenticularis* (Blumenbach) in Cuneo-

RESULTS

For the creation of the geological map of the area of the examined archaeological sites (*Fig. 1*), new field data were supplemented with information from the Basic Geological Map – Črnomelj sheet (Bukovac et al. 1984) and palaeontological investigation data from the Grm quarry area (GZS 1992). The mapped area includes the Kučar hill and its immediate surroundings. Most of the mapped area has been anthropogenically modified, and the flat part of the area is covered by thick residual soil.

The lower part of the mapped sequence belongs to the bituminous limestone lithofacies group. This unit is characterized by the occurrence of thin-layered dark grey (N3–N4 according to the Geological Rock Color Charts 2011) laminated limestones (layer thicknesses up to 20 cm) alternating with layers of dolomite and dolomitized limestone. The characteristic lithofacies of this unit are algal wackestone, laminated carbonate mudstone, laminated sparitic dolomite and peloidal packstone. Previously identified foraminifera (GZS 1992) Debarina hahounerensis (Fourcade, Raoult & Vila), Palorbitolina lenticularis (Blu-

lina sp. nakazujejo starost spodnji aptij. Na podlagi alg, karbonatnega mudstone veziva in laminacije se okolje sedimentacije litofaciesne skupine bituminozni apnenci uvršča v mirno podplimsko restriktivno lagunsko okolje notranjega dela karbonatne platforme.

Zgornji del spodnjekrednega zaporedja se uvršča v litofaciesno skupino bioklastični apnenci. Ti so svetlejše barve (N5–N6 po Geological rock-color charts 2011), pojavljajo se v 30–100 centimetrov debelih plasteh, ki navzgor prehajajo v masivno plastnatost. Značilni litofaciesi, ki gradijo to litostratigrafsko enoto, so ooidni grainstone, rudistno intraklastični grainstone in bioklastično kortoidni grainstone ter kortoidni packstone. Značilna skeletna zrna so drobci rudistnih školjk, posamezne korale, lupine moluskov in ploščice ehinodermov. Od neskeletnih zrn se pojavljajo predvsem ooidi, kortoidi, intraklasti in večji plastiklasti ter redki onkoidi. Biostratigrafska umestitev te enote ni bila opravljena, na podlagi superpozicije pa se uvršča v zgornji aptij. Na podlagi abradiranih bioklastičnih zrn (predvsem rudistnih školjk), prevladujočega sparitnega veziva ter ooidov se enota bioklastični apnenci uvršča v odprto in dobro prezračeno laguno notranjega dela karbonatne platforme.

Pliokvartarni sedimenti so na območju kartiranja določeni kot kremenov pesek. Izdanki te enote so zelo redki, njeno razprostiranje pa je določeno na podlagi posameznih izkopov v brežine in ob upoštevanju predhodnih geoloških kart območja. Kvartarni sedimenti nastopajo v obliki debelih talnih horizontov terra rose ter ob reki Kolpi kot aluvialni nanosi peska in proda. Makroskopsko je bilo pregledano tudi večje prodišče pod slapom v vasi Podzemelj. Prodniki so dobro zaobljeni do pologlati, veliki do 40 centimetrov, indikativne litofaciese je mogoče litostratigrafsko korelirati z izvornimi formacijami, ki izdanjajo v zgornjem delu toka reke Kolpe.

Kamnite izdelke z grobišča na Pezdirčevi njivi in izbrane najdbe iz naselja, večinoma z raziskovanj na južnem vrhu Kučarja (Grahek, Kovač 2020), smo proučili z namenom razvrščanja v izvorne litostratigrafske enote. Prepoznanih je bilo 11 litofaciesov, ki se razvrščajo v sedem tipologij izdelkov (*tab. 1*).

Za gradnjo je bil tako na najdišču Kučar kot tudi na Pezdirčevi njivi uporabljen lokalni kamen, ki pripada litofaciesni skupini bituminozni apnenec. Gradbeni kamen, uporabljen na najdišču Pezdirčeva njiva, pripada tudi litofaciesni skupini bioklastični apnenec in litofaciesu breča z glinenim (terra rosa) vezivom. Izjemoma je bil na najdišču Pezdirčeva njiva uporabljen prod litofaciesa drobnozrnat kremenovo sljudnat peščenjak. Kamniti izdelki so grobo oblikovani, pogosto pa je njihovo obliko mogoče povezovati tudi s popolnoma naravnim nastankom. Litofacies breča z glinenim (terra rosa) vezivom je bil umetno izdelan material, saj ga v takšni obliki v naravi ni mogoče pričakovati.

menbach), and Cuneolina sp. indicate an age of Lower Aptian. Based on the presence of algae, carbonate mudstone matrix, and lamination, the sedimentary environment of the Bituminous Limestones lithofacies group is classified as a calm subtidal restrictive lagoonal environment of the inner part of the carbonate platform.

The upper part of the Lower Cretaceous sequence belongs to the Bioclastic Limestone lithofacies group. It is lighter in colour (N5–N6 according to the Geological Rock Color Tables 2011) and occurs in layers from 30 cm to 100 cm thick, which transition into massive bedding towards the top. The characteristic lithofacies forming this lithostratigraphic unit are ooid grainstone, rudist intraclastic grainstone, bioclastic cortoid grainstone, and cortoid packstone. The characteristic skeletal grains are fragments of rudist bivalves, individual corals, mollusc shells, and echinoderm plates. The non-skeletal grains include ooids, cortoids, intraclasts, and larger plastoclasts, as well as rare oncoids. This unit has not been biostratigraphically classified; however based on superposition, it is classified as Upper Aptian. Based on the presence of abraded bioclastic grains (mainly rudist bivalves), the predominant sparitic matrix, and the presence of ooids, the Bioclastic Limestones unit is classified as an open and well-ventilated lagoonal environment of the inner part of the carbonate platform.

The Plio-Quaternary sediments in the mapped area are identified as quartz sands. Outcrops of this unit are very rare and their distribution is determined based on individual slope excavations and the consideration of earlier geologic maps of the area. Quaternary sediments occur in the form of thick terra rossa soil horizons and along the Kolpa River as alluvial deposits of sand and gravel. A larger gravel deposit near the waterfall in the village of Podzemelj was also examined macroscopically. The pebbles range from well-rounded to sub-rounded, up to 40 cm in size. Their indicative lithofacies can be lithostratigraphically correlated with the source formations that outcrop in the upper course of the Kolpa River.

The stone finds from the burial site at Pezdirčeva njiva and a selection of artefacts from the settlement, primarily from excavations conducted at the southern summit of Kučar (Grahek, Kovač 2020) were analysed and then classified according to their source lithostratigraphic units. A total of eleven identified lithofacies are categorized into seven typologies of artefacts (*Tab. 1*).

Construction at both the Kučar and Pezdirčeva njiva sites utilised local stone belonging to the bituminous limestone lithofacies group. The construction stone used at the Pezdirčeva njiva site also belongs to the Bioclastic limestone lithofacies group and to the Breccia lithofacies with clay (terra rossa) matrix. Exceptionally, gravel from the fine-grained quartz micaceous sandstone was also used at the Pezdirčeva njiva site. The stone products are roughly shaped, while their shape can often be associated with a completely natural origin.

Vzorec / Sample	Lokacija najdbe / Location of find	Uporaba / Use	Barva / Colour	Litofaciesna skupina / Lithofacies group	Litofacies / Lithofacies	Geološka starost / Geological age	Opombe / Notes
PN 193	Gr. 70	brus – gladilo / whetstone - polisher	5Y 7/2	/	sljudnat muljevec (prod) / micaceous siltstone (pebble)	T_1 ali / or P/C	t. / Pl. 28: 4
PN 241	Gr. 79	brus – gladilo / whetstone - polisher	5YR 7/4				t. / Pl. 34: 7
PN 303	Gr. 96	brus – gladilo / whetstone - polisher	5GY 6/1				t. / Pl. 43: 7
N 02	grobišče – sporadično / burial site – stray find	brus / whetstone	10YR 7/4	/	drobnozrnat kremenovo sljudnat peščenjak (prod) / fine-grained quartz micaceous sandstone (pebble)	T_1 ali / or P/C	t. / Pl. 85: 18; zglajeno s sledmi lipidov ? / polished with traces of lipids ?
PN 307	naselje / settlement	brus / whetstone	10R 4/2				Grahek, Kovač 2020, t. 4: 15; inv. št. / inv. no. BMM: A 10027 sledi lipidov? / traces of lipids ?
PN 339	naselje / settlement	brus / whetstone	5YR 6/4				inv. št. / inv. no. BMM: A 10059 sledi lipidov? / traces of lipids ?
PN 005	naselje / settlement	brus / whetstone	5YR 5/2				inv. št. / inv. no. BMM: A 9616
VZ 218	Gr. 167	pokrov/oznaka groba ? / grave cover/marker ?	5YR 7/4				preperela površina / weathered surface
PN 306	naselje / settlement	brus / whetstone	5GY 8/1	/	malo prodnat debelozrnat polilitnični peščenjak (prod in blok) / slightly gravelly polilithic sandstone (pebble and stone block)	P/C	inv. št. / inv. no. BMM: A 10026 zglajena površina / polished surface
PN 139	naselje / settlement	brus / whetstone	10YR 6/2				Grahek, Kovač 2020, t. 7: 27; inv. št. / inv. no. BMM: A 9807 zglajena površina / polished surface
PN 212	naselje / settlement	brus / whetstone	10YR 6/2				inv. št. / inv. no. BMM: A 9934
PN 322	naselje / settlement	brus / whetstone	10YR 6/6				inv. št. / inv. no. BMM: A 10042 zglajena površina / polished surface
A 12489	naselje / settlement	žrmlje / millstone	5YR 5/2				zglajena površina; **nelokalno** / polished surface; **non-local**
VZ 149	Gr. 133	pokrov/oznaka groba / grave cover/marker	5YR 8/1	bituminozni apnenci / bituminous limestones	algni wackestone / algal wackestone	K_1^5	sekundarno prežgano / secondary burned
VZ 6/1	naselje / settlement	gradbeni material / building stone	N 4				nad ognjišči SE 98 in 132 v hiši C / above fireplaces SE 98 and 132 in House C (Grahek, Kovač 2020, sl. 3)
VZ 130	Gr. 28 ?	pokrov/oznaka groba ? / grave cover/marker ?	5Y 4/4		laminiran karbonatni mudstone / laminated carbonate mudstone	K_1^5	
PN 317	Gr. 38	pokrov/oznaka groba ? / grave cover/marker ?	N 2				
VZ 165	Gr. 147	pokrov/oznaka groba / grave cover/marker	N 2				
VZ 6/2	naselje / settlement	gradbeni material / building stone	5Y 6/1				nad ognjišči SE 98 in 132 v hiši C / above fireplaces SE 98 and 132 in House C (Grahek, Kovač 2020, sl. 3)
VZ 4	naselje / settlement	ruda / ore	10R 4/6	/	limonit / limonite	Pl/Q	nad ognjišči SE 98 in 132 v hiši C / above fireplaces SE 98 and 132 in House C (Grahek, Kovač 2020, sl. 3)

Vzorec / Sample	Lokacija najdbe / Location of find	Uporaba / Use	Barva / Colour	Litofaciesna skupina / Lithofacies group	Litofacies / Lithofacies	Geološka starost / Geological age	Opombe / Notes
VZ 139	Gr. 18a	pokrov/oznaka groba ? / grave cover/marker ?	N 6	bioklastični apnenec / bioclastic limestones	rudistno intraklastični packstone / rudist intraclast packstone	K_1^5	sekundarno prežgano / secondary burned
VZ 126	Gr. 128	pokrov/oznaka groba / grave cover/marker	5YR 8/1				
VZ 151	Gr. 133	pokrov/oznaka groba / grave cover/marker	5YR 8/1				sekundarno prežgano / secondary burned
VZ 135	Gr. 137	pokrov/oznaka groba / grave cover/marker	5YR 8/1				
VZ 163	Gr. 142	pokrov/oznaka groba ? / grave cover/marker ?	5YR 8/1				
VZ 180	Gr. 171	pokrov/oznaka groba ? / grave cover/marker ?	N 6				
VZ 178	Gr. 176	pokrov/oznaka groba / grave cover/marker	5YR 8/1; 5YR 8/4				2 kosa / 2 pieces
VZ 179	Gr. 176	pokrov/oznaka groba / grave cover/marker	5YR 8/1				sekundarno prežgano / secondary burned
VZ 205	Gr. 176	pokrov/oznaka groba / grave cover/marker	5YR 8/1				
VZ 274	Gr. 177	pokrov/oznaka groba ? / grave cover/marker ?	5YR 8/1				
VZ 258	Gr. 179	pokrov/oznaka groba / grave cover/marker	5YR 8/1				sekundarno prežgano / secondary burned
VZ 187	Gr. 174	pokrov/oznaka groba ? / grave cover/marker ?	5YR 8/1		bioklastično kortoidni packstone / bioclastic cortoid packstone	K_1^5	
VZ 206	Gr. 176	pokrov/oznaka groba / grave cover/marker	5YR 8/1				sekundarno prežgano / secondary burned
VZ 188	Gr. 178	pokrov/oznaka groba / grave cover/marker	5YR 8/1				
VZ 246	Gr. 180	pokrov/oznaka groba ? / grave cover/marker ?	5YR 8/1				
VZ 187	Gr. 174	pokrov/oznaka groba / grave cover/marker	5YR 8/1	/	breča z glinenim (terra rosa) vezivom / breccia with clay matrix (terra rosa)	Q?	
VZ 12	naselje / settlement	gradbeni material (nasip) / building stone (rampart)	10YR 8/2 - 10YR 8/6	/	siga / calcite tuffa	Q?	sekundarno prežgano / secondary burned
VZ 11	naselje / settlement	gradbeni material (nasip) / building stone (rampart)	5R 3/4	/	limonitno "bobov" konglomerat / limonite "bean ore" conglomerate	Pl/Q	

Tab. 1: Litološka analiza vzorcev iz grobišča na Pezdirčevi njivi in naselja na južnem vrhu Kučarja.
Tab. 1: Lithological analysis of samples from the burial site on Pezdirčeva njiva and the settlement on the southern peak of Kučar.

Brusi kažejo jasna znamenja uporabe, kot so raze in močno zglajene površine. Na grobišču sporadično najdeni nepreluknjani brus (N 02; *sl. 2:* 1) ima na zglajeni površini ohranjeno tudi mastno svetlikajočo se temno tanko prevleko, najverjetneje ostanek maščob ali lipidov, kar je bilo sicer še pogosteje ugotovljeno pri podobnih, vedno nepreluknjanih brusih iz naselja (*sl. 2*). Brusi so izdelani iz dveh litofaciesov in jih najdemo

The lithofacial breccia matrix with clay (terra rossa) was an artificially produced material, as it is not expected to appear in this form naturally.

Grinding stones exhibit clear signs of use, including scratches and heavily polished surfaces. A sporadically occuring, unperforated whetstone (N 02; *Fig. 2:* 1) from the burial site has a greasy, shiny, dark, thin coating on the polished surface, which is probably a residue of fats

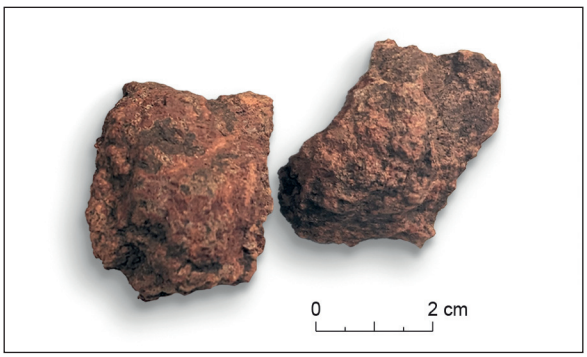
Sl. 2: Podzemelj, Pezdirčeva njiva (1 (sporadično) in Kučar (2–8). Brusni kamni. M. = 1 : 2.
Fig. 2: Podzemelj, Pezdirčeva njiva (1 (stray find)) and Kučar (2–8). Whetstones. Scale = 1:2.

na obeh obravnavanih najdiščih. Litofacies drobnozrnat kremenovo sljudnat peščenjak je odkrit v brusih s Kučarja in enem sporadično najdenem brusu s Pezdirčeve njive. Litofacies malo prodnat debelozrnat polilitični peščenjak je zaznan le v brusih s Kučarja. Dodatno se v ta litofacies uvršča večji blok, ki glede na oblikovanje in sledi rabe (polkrožne raze) predstavlja žrmlje. Medtem ko je bil material za bruse nabran na lokalnih prodiščih, so bile žrmlje izdelane iz kamninskega bloka (*sl. 3*), ki ga v takšni obliki in velikosti ne najdemo na bližnjem

or lipids. This is more frequently found on similar, consistently unperforated grinding stones from the settlement (*Fig. 2*). The whetstones come from two lithofacies and are present at both investigated sites. The lithofacies fine-grained quartz micaceous sandstone is present in the grinding stones from the Kučar site and the individual whetstone find from the Pezdirčeva njiva site.

The lithofacies of slightly gravelly coarse-grained polylithic sandstone is only present in the grinding stones from the Kučar site. This lithofacies also contains

Sl. 3: Podzemelj, Kučar. Žrmlje. M. = 1 : 4.
Fig. 3: Podzemelj, Kučar. Millstone. Scale = 1:4.



lokalnem območju. Tako predstavljajo edini uvoženi izdelek na obeh obravnavanih najdiščih.

Brusni kamni so izdelani tudi iz litofaciesa sljudnati muljevec (*sl. 4*). Ti izdelki zaradi fizikalnih lastnosti kamnine niso primerni za obdelavo ali brušenje tršihmaterialov, denimo kosov železnega orodja in orožja. Verjetneje je, da so tovrstni izdelki gladila, v arheološki literaturi večinoma poimenovana kar brusi, ki so jih uporabljali za obdelavo organskih materialov, kot so les, usnje ali krzno.

Litofaciesi siga, limonitni bobov konglomerat in limonit so bili najdeni med naselbinskimi izkopavanji na južnem vrhu Kučarja in ne kažejo znamenj človeške obdelave (*sl. 5*).

RAZPRAVA

Na podlagi makroskopske opredelitve litofaciesov izdelkov ter na terenu zaznanih litofaciesnih skupin je mogoče primerjati izdelke, ki so bili uporabljeni kot gradbeni kamen bodisi na grobišču bodisi v naselju z lo-

Sl. 4: Podzemelj, Pezdirčeva njiva. Brusi (gladila). 1 – grob 70, 2 – grob 79, 3 – grob 96. M. = 1 : 2.
Fig. 4: Podzemelj, Pezdirčeva njiva. Whetstones (polishers). 1 – Grave 70, 2 – Grave 79, 3 – Grave 96. Scale = 1:2.

← Sl. 5: Železna ruda (limonit) iz lokalnih virov.
Fig. 5: Localy sourced iron ore (limonite).

a larger block that represents a millstone due to its shape and signs of use (semi-circular scratches). While the material for the whetstones was collected from local gravel deposits, the millstone (*Fig. 3*) was made from a boulder of a shape and size that does not occur in the immediate vicinity and is therefore the only imported object found at both examined sites.

Whetstones are also made from lithofacies micaceous siltstone (*Fig. 4*). Due to this rock's physical properties, these products are not suitable for processing or grinding harder materials, such as iron tools and weapons. It is more likely that these products are polishers, often referred to in the archaeological literature as whetstones, and were used for working organic materials such as wood, leather, or fur. The lithofacies calcite-tufa, limonite 'bean' conglomerate and limonite were found during settlement excavations on Kučar's southern peak and show no signs of human processing (*Fig. 5*).

DISCUSSION

Based on comparing the macroscopic identification of the lithofacies of the products and the lithofacies groups observed in the field, it is possible to correlate the products used as building stones either at the burial ground or in the settlement with the locally present lithofacies groups Bituminous limestones and Bioclastic Limestones, which

kalno prisotnima litofaciesnima skupinama bituminozni apnenci in bioklastični apnenci, ki se razvrščata v spodnji aptij ter ustrezata Brski formaciji (Jurkovšek et al. 1996) oziroma palorbitolinskim apnencem (Masse et al. 2004). Izbira je najverjetneje temeljila na dostopnosti materiala. Odsotnost kamnoseške obdelave pri teh izdelkih kaže na "nabiralniški" način pridobivanja kamna. Najdba antropogeno ustvarjene breče z glinenim (terra rosa) vezivom potrjuje, da so za gradnjo uporabljali različne lokalno dostopne materiale. Uporaba izključno lokalnega kamna, brez želje po posebnih lastnostih kamnine, je ugotovljena tudi pri grobnih konstrukcijah (pokrivnih ploščah ali oznakah grobov) na Pezdirčevi njivi.

Drugačno sliko kažejo kamnita orodja, kot so različni brusi in žrmlje, saj sta pri izbiri kamnine za njihovo izdelavo ključnega pomena trdota in zrnavost. Brusni kamni ali pestila iz naselja in žrmlje so izdelani iz kamnin z večjo trdoto (relativna trdota 5 ali več) ter so bolj grobozrnati. Drugače velja za bruse, najdene v grobovih. Ker so bile za njihovo izdelavo uporabljene kamnine z relativno manjšo trdoto (do 2,5), so lahko bili uporabljeni le za brušenje ali glajenje mehkejših, organskih materialov, kot so les, krzno ali usnje. Vsi brusni kamni (brusi iz naselja in gladila iz grobov) so bili izdelani iz prodnikov iz bližnjih prodišč reke Kolpe in so lokalno izdelani.

Geološka provenienca ter starost analiziranih vzorcev in kamnitih predmetov sta bili določeni na podlagi primerjave z indikativnimi litologijami (Buser 2010; Velić, Vlahović 2009). Drobnozrnat kremenovo sljudnati peščenjak ne predstavlja indikativne litologije (Buser 2010; Velić, Vlahović 2009) za posamezno litostratigrafsko enoto in tako lahko pripada karbonskim, permskim ali spodnjetriasnim klastitom (*sl. 6*). Litofacies maloprodnat debelozrnat polilitični peščenjak in litofacies sljudnati muljevec predstavljata indikativno litologijo, ki je prisotna v litostratigrafski enoti zgornjekarbonskih (Velić, Vlahović 2009) ter spodnjepermskih klastitov (Buser 2010). V teh enotah so zastopane siliciklastične kamnine, med katerimi prevladujejo temno siv drobnozrnati kremenov peščenjak, kremenov konglomerat ter temno zelen sljudnati meljevec in sivo zelen glinavec (Mlakar 1993; Mlakar 2003).

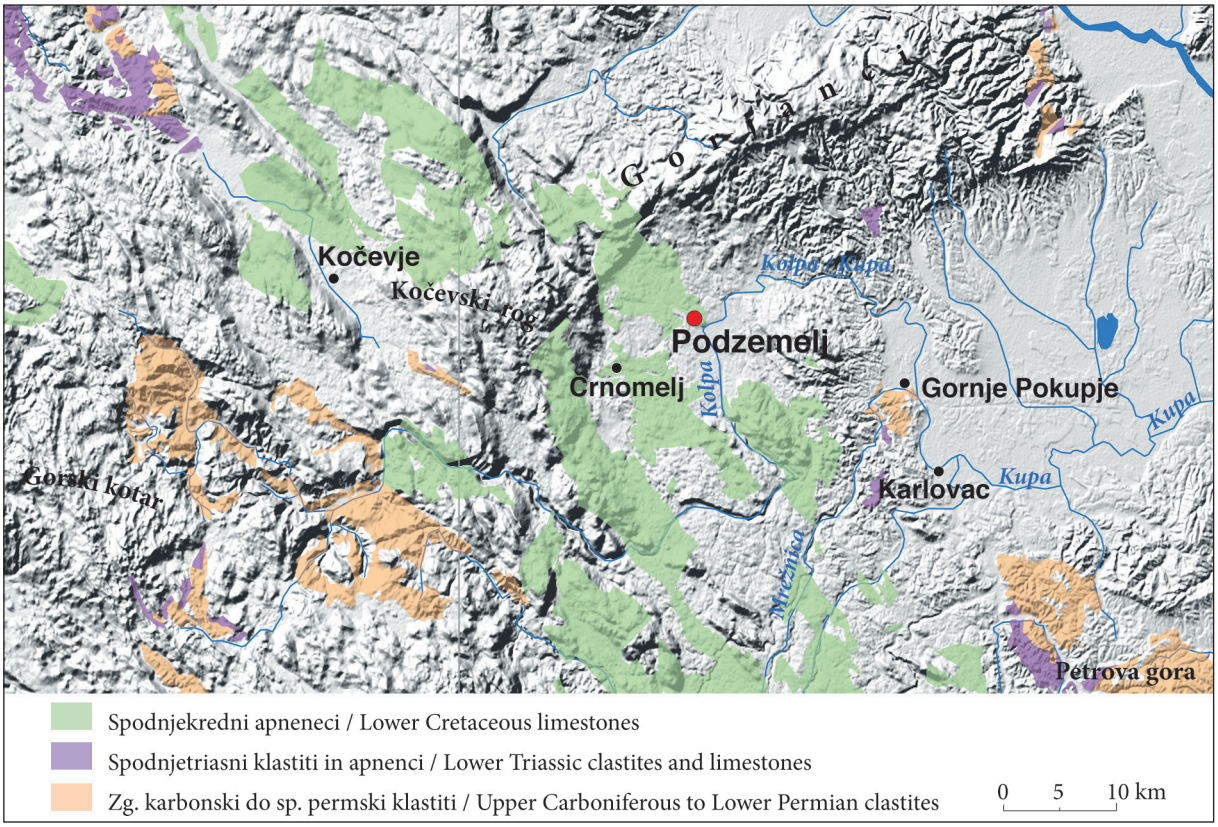
Edini prepoznani uvoženi izdelek med obravnavanimi predmeti so žrmlje (inv. št. BMM: A 12489) iz hiše B na severnem vrhu Kučarja (Dular et al. 1995, 39 ss, sl. 18, 20). Izdelane so iz večjega kamnitega bloka, ki pripada litofaciesu maloprodnat debelozrnat polilitični peščenjak zgornjekarbonske (Velić, Vlahović 2009) do spodnjepermske starosti (Buser 2010). Geografsko najbližji poligon primerljivih kamnin, ki je z najdiščem povezan z možnostjo rečnega transporta, se pojavlja ob sotočju Kolpe in Mrežnice ter severozahodno od Petrove gore. Primerljive litologije se pojavljajo tudi na vzhodnem delu hribovja Gorjanci, na Kočevskem in v Gorskem Kotarju (*sl. 6*: oranžna barva).

are assigned to Lower Aptian and correspond to the Brje Formation (Jurkovšek et al. 1996) or Palorbitolina (equivalent) limestones (Masse et al. 2004). The selection was most likely based on availability of material. The absence of stone working from these products indicates stone acquisition through collection. The discovery of anthropogenically produced breccia with clay (terra rossa) matrix indicates that various locally available materials were used in construction. This use of exclusively local stone, with no preference for specific rock properties, can also be observed in the grave constructions (cover slabs or grave markers) at Pezdirčeva njiva.

Stone tools such as various whetstones and millstones present an entirely different picture, as their selection was based on hardness and grain size of the stone. Grinding stones or pestles from the settlement and millstones are made of harder rocks (relative hardness of 5 and more) of coarser grain size. Whetstones found at graves are a different matter. Since rocks with a relative hardness of less than 2.5 were used for their production, they could only be used for grinding or polishing softer, organic materials such as wood, fur or leather. All grinding stones (whetstones from the settlement and polishers from the graves) were made exclusively from pebbles from nearby gravel deposits of the Kolpa River.

The geological provenance and age of the analysed samples and stone objects were determined through comparison with indicative lithologies (Buser 2010; Velić, Vlahović 2009). Fine-grained quartz-micaceous sandstone does not represent an indicative lithology (Buser 2010; Velić, Vlahović 2009) for a specific lithostratigraphic unit and may therefore belong to Carboniferous, Permian, or Lower Triassic clastics (*Fig. 6*). The lithofacies of slightly gravelly, coarse-grained polylithic sandstone and micaceous siltstone represent the indicative lithology found in the lithostratigraphic unit of the Upper Carboniferous (Velić, Vlahović 2009) and Lower Permian clastics (Buser 2010). These units contain siliceous rocks, among which dark gray fine-grained quartz sandstone, quartz conglomerate, dark green micaceous siltstone, and gray-green claystone prevail (Mlakar 1993; Mlakar 2003). The only imported item identified among the studied products is a quern (inv. no. BMM: A 124889) from House B on the northern peak of Kučar (Dular et al. 1995, 39 ff., Figs. 18, 20). It is made from a larger stone block belonging to the lithofacies of slightly gravelly, coarse-grained polylithic sandstone dated to the Upper Carboniferous (Velić, Vlahović 2009) to Lower Permian (Buser 2010). The geographically closest area with comparable rocks, possibly connected to the site via river transport, lies at the confluence of the Kolpa and Mrežnica rivers and to the southwest of Petrova Gora. Comparable lithologies also occur in the eastern part of the Gorjanci Hills, in Kočevski Rog, and in Gorski Kotar (*Fig. 6,* orange).

The lithofacies of limonite, limonite bean conglomerate, and calcite tuff are raw materials: The first two are



Sl. 6: Stratigrafsko litološka karta širšega raziskovalnega območja prilagojena po Buserju (2010) ter Veliću in Vlahoviću (2009)
Fig. 6: Stratigraphic lithological map of broader research area adapted after Buser (2010) and Velić and Vlahović (2009)

Litofaciesi limonit, limonitni bobov konglomerat in siga so surovine: prva dva sta železovi rudi (Bardossy 1982), medtem ko je bila siga za tisto obdobje najčistejši vir kalcijevega karbonata, ki se ga uporablja tudi pri prečiščevanju železa iz železove rude v talilnih pečeh. Karbonat kalcinira v peči in situ. Iz njega nastane kalcijev oksid, ki veže žlindro z različnimi nečistočami in tako loči nečistoče od prečiščenega železa (Harding 2017). Limonitno in bobovo rudo najdemo v (plio?)kvartarnih plasteh (torej najmlajših sedimentih rek in pobočnih procesov) kot ledvičasto oblikovane limonitne konkrecije premera do 20 centimetrov (Streffleur 1856; Bukovac et al. 1984), ki je nastala v jezerih, močvirjih in kraških jamah oziroma breznih ter je zato ležala zelo blizu površja, večinoma v tankih lečah (Danzer 2016). Bobovce in limonit so nabirali po površini (Danzer 2016), jih zbirali med obdelovanjem njiv, mogoče pa je, da so pri tem odkrili tudi nahajališča z večjo koncentracijo bobove rude, pri čemer je mogoče pričakovati, da so jo nekdanji naseljenci pridobili s površinskimi razkopi. Po poljih je še vedno najti bobovo rudo, vendar ni ohranjenih sledi o rudarjenju, kar nakazuje nabiralniški način rudarjenja. Medtem ko siga lahko izvira tudi iz neposredne okolice najdišča, je bil limonit na vrh Kučarja nedvomno prinesen iz okolice. Limonit in limonitno bobov konglomerat se namreč

iron ores (Bárdossy 1982), while calcite tuff represents the purest source of calcium carbonate available at the time, which was also used to purify iron from iron ore in smelting furnaces. The carbonate was calcined in situ in the furnace, producing calcium oxide that binds the slag with various present impurities, separating the impurities from the purified iron (Harding 2017). Limonite and "bean" ore are found in (Plio?)Quaternary strata (i.e. the youngest sediments of rivers and slope processes) as kidney-shaped limonite concretions up to 20 cm in diameter (Streffleur 1856; Bukovac et al. 1984), formed in lakes, swamps, and karst caves/pits and are therefore very close to the surface, usually in thin lenses (Danzer 2016). Bean ore and limonite were gathered from the surface (Danzer 2016), collected during field cultivation, and it is possible that this led to the discovery of deposits with higher concentrations of bean ore, where former settlers may have performed surface-level excavations . Bean ore can still be found in fields, but there are no preserved traces of mining, which indicates acquisition through extraction. While calcite tuff may have come from the immediate vicinity of the site, limonite was undoubtedly brought to the top of Kučar from the surrounding area. Limonite and limonitic bean conglomerate do not appear

ne pojavljata v sedimentnem zaporedju neposredno na območju utrjenega naselja na Kučarju.

Poleg uporabe povsem primerljivega lokalnega kamna kot gradbenega materiala tako v naselju kot na grobišču kažejo na neposredno povezavo med najdiščema predvsem brusi ali pestila litofaciesa drobnozrnat kremenovo sljudnat peščenjak (prod), na katerih so pogosto vidne sledi najverjetneje lipidov (*tab. 1*: N 02, PN 307, PN 339, PN 005).

SKLEP

Železnodobni prebivalci naselja na Kučarju, ki so svoje pokojne pokopavali tudi na grobišču Pezdirčeva njiva, so praviloma uporabljali lokalni kamen, predvsem spodnjekredni (spodnjeaptijski) apnenec. Kamen so pridobili iz neposredne okolice najdišč ali iz prodišč reke Kolpe. Trdota in delno tudi zrnavost uporabljene litologije sta imeli pomembno vlogo pri izbiri kamna za posamezno orodje. Brusi ali pestila in žrmlje so izdelani iz litologij, v katerih prevladuje kremen, medtem ko so za bruse iz grobov ali gladila uporabljali mehke drobnozrnate klastične kamnine. Žrmlje s severnega vrha Kučarja so edini uvoženi izdelek – ta je bil verjetno pridobljen iz primarnih zaporedij zgornjekarbonskih do spodnjepermskih klastitov, ki jih najdemo na območju južno od Gornjega Pokupja – in tako dokaz o povezanosti tedanjih prebivalcev z bližnjimi naselbinami v porečju Kolpe.

in the sedimentary succession present directly in the area of the fortified settlement on the top of Kučar.

The direct connection between the two sites is indicated in the use of completely comparable local stone as building material both in the settlement and at the burial ground, as well as and above all by whetstones or pestles made of lithofacies fine-grained quartz-mica sandstone (pebbles), which often show visible traces of lipids (*Tab. 1:* N 02, PN 307, PN 339, PN 005).

CONCLUSION

The Iron Age inhabitants of the Kučar settlement, who also buried their dead at the Pezdirčeva njiva burial ground, generally used local stone, especially limestone from the Lower Cretaceous (Lower Aptian). The stone was sourced either in the immediate vicinity of the burial sites or at the gravel deposits of the Kolpa River. The hardness and, to some extent, grain size of the lithology used played an important role in the selection of material for individual tools. Whetstones or pestles and millstones were made from lithologies in which quartz predominates, while softer, fine-grained clastic rocks were used for the grinding stones (likely polishers) found in graves. The millstones from Kučar's northern peak represent the only imported artefacts likely obtained from the primary succession of Upper Carboniferous to Lower Permian clastics that outcrop in the area south of Gornje Pokupje; they indicate a connection between the local population of the time and nearby settlements in the Kolpa River basin.

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