Analiza kamnin rimskih nagrobnih stel iz Podkraja in z Iga

Rock analysis of Roman tombstones from Podkraj and Ig near Ljubljana

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Izvleček

Naravni kamen so v okolici Ljubljane (Emona) izkoriščali in uporabljali že v rimskem obdobju. Na tem območju so ohranjeni številni kamniti spomeniki iz tistega časa. V članku je predstavljena analiza kamnine dveh nagrobnih stel, najdenih na južnem obrobju Ljubljanskega barja, na Ižanskem: nagrobnik za Kviemonija in njegovo družino iz cerkve sv. Janeza Krstnika v Podkraju pri Tomišlju in nagrobnik za Petona z Marofa na Igu (sekundarni najdišči). Na podlagi makroskopskega in mikroskopskega opisa sklepamo, da je spomenik iz Podkraja izklesan iz litiotidnega apnenca spodnjejurske starosti, spomenik z Iga pa iz ooidnega apnenca, ki po starosti sodi v vrhnji del spodnje jure ali v srednjo juro. Oba litološka različka najdemo na južnem obrobju Ljubljanskega barja, pri čemer je najbolj verjetno nahajališče litiotidnega apnenca okolica Podpeči.

Ključne besede: Slovenija, Podkraj pri Tomišlju, Ig, nagrobne stele, naravni kamen, rimski kamnolomi, analiza kamnine

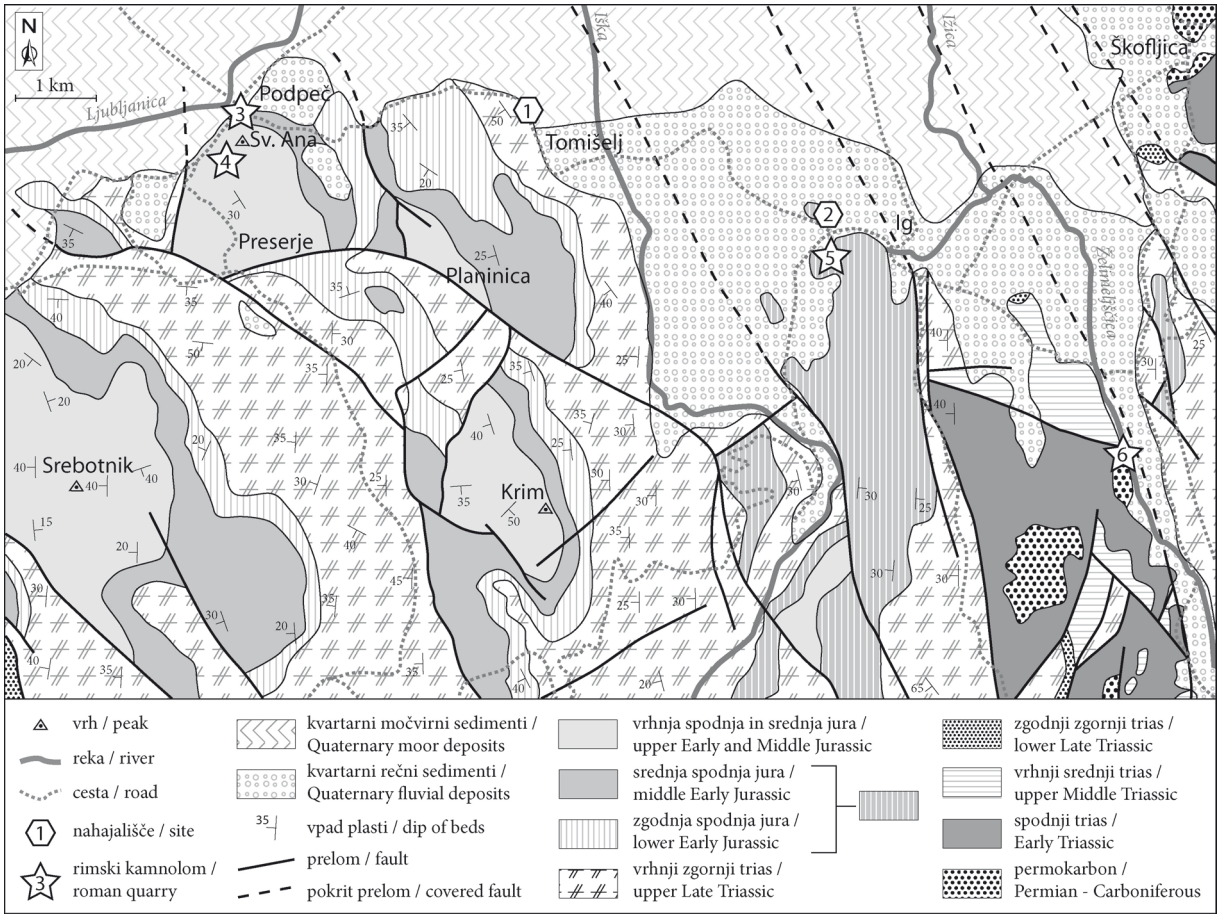
Abstract

Natural stone around Ljubljana (Emona) was exploited and used at the time of the Roman Empire. Numerous stone monuments from this time remain in the area. The article provides rock analysis of two tombstones that have been found on the southern outskirts of Ljubljansko barje: the tombstone of Quiemonis and his family from the St. John the Baptist Church in Podkraj near Tomišelj and the Petto tombstone from Marof at Ig (both in secondary position). Based on the macroscopic and microscopic descriptions, the rock of the tombstone from Podkraj is considered to be Lower Jurassic lithiotid limestone, and the rock of the tombstone from Ig is made of ooidal limestone which is upper Lower and Middle Jurassic in age. Considering the spatial distribution of identified rocks on the southern outskirts of Ljubljansko barje and the potential sites of Roman quarries, the source of both rocks is local, and both tombstones most likely originated from the surrounding of Podpeč.

Keywords: Slovenia, Podkraj near Tomišelj, Ig, Roman tombstones, natural stone, Roman quarries, rock analysis

UVOD

Začetek pridobivanja naravnega kamna za gradbeno-arhitektonske namene na območju današnje Slovenije sega v prvi dve stoletji našega štetja, v čas razširitve rimskega imperija prek Ljubljanske kotline (Gaspari 2014). Po dosedanjih podatkih so v emonskem prostoru naravni kamen domnevno pridobivali v šestih kamnolomih. Emoni najbližji in najbolj uporabljen je bil kamnolom peščenjaka ob vznožju Grajskega griča (Gaspari 2014), apnenec pa so pridobivali na obrobju Ljubljanske kotline (Buser



Sl. 1: Geološka karta južnega obrobja Ljubljanskega barja. Formacije, ki vsebujejo ooidne apnence, so označene z odtenki sive barve. (Prirejeno po: Buser, Grad, Pleničar 1967; Buser 1968).
Fig. 1: Geological map of the southern outskirts of the Ljubljansko barje. Formations containing ooidal limestone are marked by shades of grey. (Modified from: Buser, Grad, Pleničar 1967; Buser 1968).
Sekundarni najdišči nagrobnikov / The locations of tombstones: **1** – Podkraj; **2** – Ig.
Potencialni rimski kamnolomi / Potential Roman quarries: **3** – Podpeč, **4** – Sv. Ana, **5** – Staje, **6** – Skopačnik.

1987; Ramovš 2010). Poleg kamnoloma podpeškega apnenca v Podpeči so bili v rabi še kamnolomi Sv. Ana pri Podpeči, Staje pri Igu, Skopačnik pri Želimljah in Glince pri Podutiku (Šašel Kos 1997, 17–19, sl. 3). Med naštetimi je bil v preteklosti največ pozornosti deležen t. i. podpeški apnenec (Ramovš 1961; Buser 1965; Buser, Debeljak 1994–1995; Debeljak, Buser 1997; Ramovš 2000; Štukovnik 2008; Gale 2015), ki je bil zaradi značilnega nahajališča in kulturnega pomena nominiran kot "Global Heritage Stone Resource" (GHSR) (Kramar et al. 2015). Najbolj prepoznaven različek podpeškega apnenca je temno siv do črn apnenec z belimi lupinami litiotidnih školjk (Buser, Debeljak 1994–1995; Debeljak, Buser 1997; Ramovš 2000; Kramar et al. 2015). V kamnolomu v Podpeči nastopa poleg litiotidnega apnenca še več drugih litotipov apnenca, ki se od njega razlikujejo po barvi in fosilnih ostankih ter tudi po strukturnih lastnostih apnenca (Štukovnik 2008; Gale 2015). Omenjeni apnenec se pojavlja tudi v širši okolici kamnoloma na pobočjih Krima ter v okolici Iga (Buser, Grad, Pleničar 1967; Buser 1968).

Drugi natančneje opisani naravni kamen, ki so ga uporabljali v prvih stoletjih našega štetja, je svetlo siv gost apnenec (t. i. gliničan), ki so ga izkoriščali v okolici Podutika zahodno od Ljubljane (Ramovš 1990). Natančnejša lega preostalih treh domnevnih antičnih kamnolomov ni poznana.

V prispevku predstavljamo litološki opis dveh antičnih kamnitih nagrobnih stel. Obe sta bili odkriti v sekundarni legi, ločeno sta predstavljeni v tej številki Arheološkega vestnika. Prvi nagrobnik – postavljen za Kviemonija in njegovo družino – je vzidan v vzhodno zunanjo steno cerkve sv. Janeza

Krstnika v Podkraju pri Tomišlju (Veranič, Repanšek 2016, 301–305, kat. št. 2, sl. 7), drugi – za Petona in družino – je bil leta 2014 odkrit med izkopavanji na Marofu na Igu, v poznoantični jami s še drugimi obdelanimi kamni (Ragolič 2016, sl. 3–7). Pri drugem smo makroskopski opis lahko dopolnili s petrološko in paleontološko analizo mikroskopskih preparatov, narejenih iz kamninskih drobcev nagrobnika. S pomočjo omenjenih raziskav smo poskušali izdelati strokovno oceno o litostratigrafski pripadnosti kamnine in s tem omejiti možno lego izvornega kamnoloma na območja južnega obrobja Ljubljanskega barja, kjer tovrstne kamnine izdanjajo na površju.

Omenjeni nahajališči in lege potencialnih antičnih kamnolomov vzdolž južnega obrobja Ljubljanskega barja so predstavljeni na *sliki 1*.

GEOLOŠKA ZGRADBA OKOLICE NAHAJALIŠČ
(*sl. 1*)

Območje Krimsko-Mokriškega hribovja sestavlja debela skladovnica srednjetriasnih do srednjejurskih karbonatnih kamnin. Na vzhodu se jim pridružujejo starejše kamnine, in sicer paleozojski klastiti ter klastično-karbonatno zaporedje spodnjetriasnih kamnin. Omenjene kamnine proti severu tonejo pod kvartarne rečne, jezerske in močvirske sedimente Ljubljanskega barja. Območje seka več močnejših prelomov, med katerimi prevladujejo SZ–JV (dinarsko) usmerjeni prelomi (Buser, Grad, Pleničar 1967; Buser 1968).

METODE DELA

Litološka analiza stel je bila narejena na podlagi makro- in mikrolitološkega opisa. Makroskopska analiza obsega opis kamnine na terenu, pri čemer nam zanesljivejše informacije poda svež lom. Za mikroskopsko analizo so bili iz odkruškov nagrobne stele z Iga narejeni zbruski, ti pa pregledani z optičnim mikroskopom. En zbrusek je bil za določitev karbonatnih mineralov obarvan z barvilom alizarin S-rdeče.

Rezultati makroskopske in mikroskopske analize kamnin so bili primerjani z že poznanimi in opisanimi kamninami južnega obrobja Ljubljanskega barja. Na podlagi tega je bil določen možen izvor kamnine raziskanih nagrobnikov.

REZULTATI IN DISKUSIJA

Nagrobnik za Kviemonija iz Podkraja

Makroskopski opis

Litološki opis je bil izdelan le na podlagi makroskopskega pregleda (*sl. 2*), ker ni bilo možno pridobiti koščka kamnine za mikroskopsko analizo. V osrednjem delu je plošča poškodovana v nekaj centimetrov širokem horizontalnem pasu, v katerem je posledično lepo vidna sveža kamnina. Kamnina je temno sive do črne barve z bolj ali manj pravilnimi belimi polji kalcita, ki domnevno predstavljajo različne preseke fosilnih ostankov. Na levi strani poškodovanega pasu je opaziti 1 cm široko in nekaj centimetrov dolgo vertikalno orientirano polje (tj. glede na lego vzidanega spomenika) kalcita, omejenega s približno 1 mm širokima robovoma. Domnevamo, da gre za lupino litiotidne školjke, kar je precej zanesljiv indikator, da je spomenik izdelan iz litiotidnega apnenca. Kamnino sekata dva sistema debelejših in tanjših kalcitnih žil, pri čemer so slednje deloma zapolnjene z rdečkastim materialom.

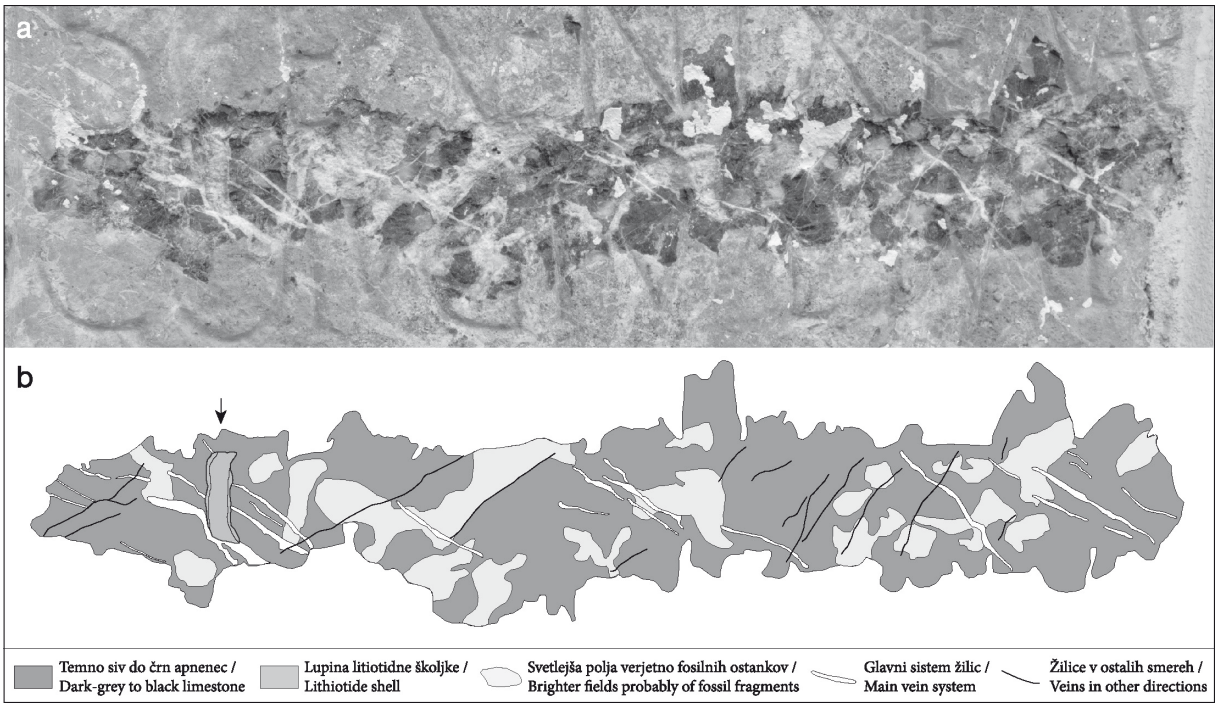
Sklep

Na podlagi prisotnosti litiotidnih školjk je kamnina identificirana kot litiotidni apnenec spodnjejurske starosti. Tovrstne kamnine se pojavljajo na več območjih južno od Ljubljanskega barja, tj. južno od naselja Ig do ostenij Iškega vintgarja, na Krimu, od koder jih prek Planince sledimo do Podpeči, ter na obronkih Srebotnika (Buser, Grad, Pleničar 1967; Buser 1968). Na teh območjih se kot potencialna rimska kamnoloma omenjata Podpeč in Staje pri Igu (Šašel Kos 1997, 17–19). Ker pri terenskem pregledu okolice Staj litiotidnega apnenca nismo zasledili, sklepamo, da je obravnavana nagrobna stela iz Podkraja izdelana iz apnenca iz Podpeči.

Nagrobnik za Petona z Iga

Makroskopski opis

Površina nagrobne stele je večinoma preperela (*sl. 3*). Sveže odlomljene površine so vidne le na spodnjem delu spomenika. Uporabljena kamnina je temno siv ooidni apnenec. Celoten nagrobnik sekajo različno usmerjeni sistemi kalcitnih žil.



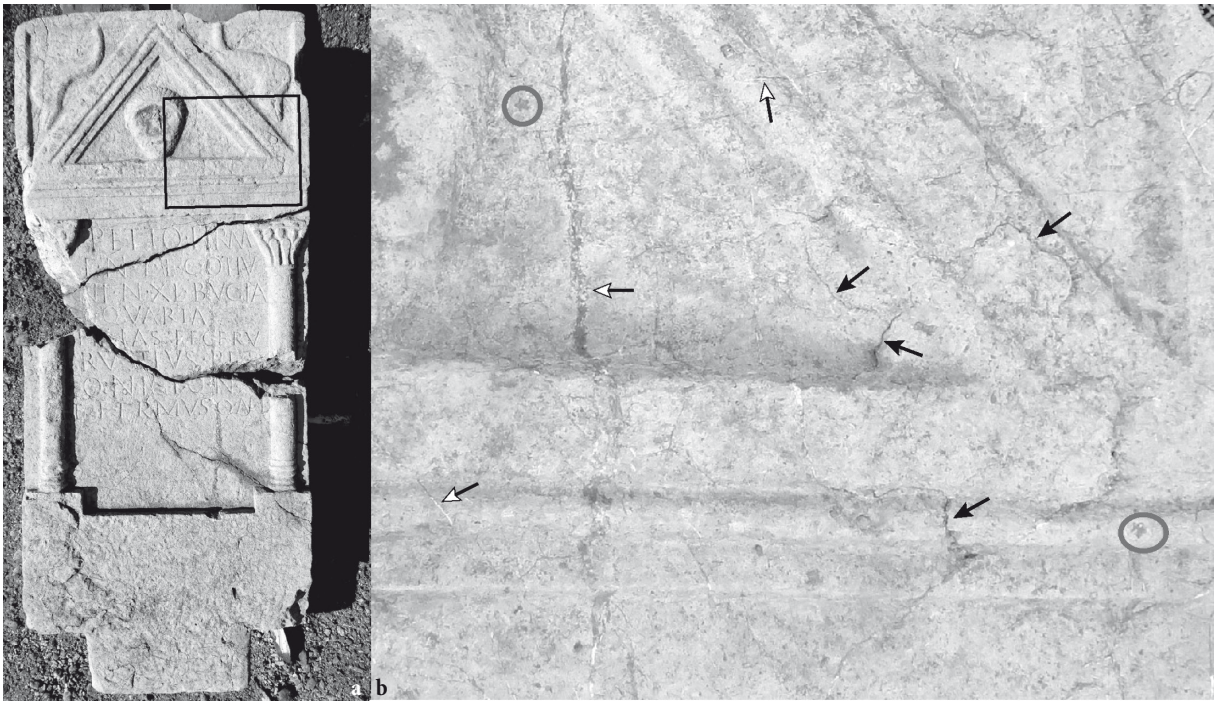
Sl. 2: Nagrobnik za Kviemonija iz Podkraja. **a** – Detajl poškodovanega dela iz spodnjega dela spomenika. **b** – Skica kamnine z označeno lupino litiotidne školjke (puščica), svetlejšimi kalcitnimi polji (verjetno preseki fosilnih ostankov) in dvema sistemoma žilic. (Foto: Dejan Veranič)
Fig. 2: Tombstone for Quiemonis from Podkraj. **a** – Detail of the damaged part from the lower part of the monument. **b** – Sketch of rock marked with lithiotid shell (arrow), lighter calcite fields (probably the intersection of fossil remains), and two systems of veins. (Photo: Dejan Veranič)

Nekatere žile so deloma zapolnjene z okrastim materialom. Najdebelejše žile potekajo vzdolž nagrobnika in so debele do nekaj centimetrov. Na površini so vidne tudi povite, močneje preperele linije (preseki ploskev). Ti morfološki elementi najverjetneje pripadajo disolucijskim šivom, ki so bili opaženi tudi pri mikroskopskem pregledu kamnine. Na prepereli površini je opazna drobna mrežasta tekstura, značilna za preperevanje ooidnih apnencev. Po celotni površini nagrobnika je opaziti posamezne ploščice morskih lilij. Te lepo vidimo tudi v obliki večjih peterokrakih zvezdic (do 1 cm) v zgornjem delu nagrobnika (*sl. 3*).

Mikroskopska analiza

Struktura preparatov je heterogena. Gre za menjavanje zrnatih apnencev (teksturni tipi delno izprani packstone, gost wackestone in grainstone, pri čemer prevladuje prvi). Prehodi med posameznimi strukturnimi tipi so večinoma postopni in nepravilni (*sl. 4:* 1). Zrna so dobro sortirana, povečini zaobljena in izometričnih oblik, nekateri bioklasti so podolgovati. Velikost zrn je v povprečju med 0,2 in 1,5 mm; večina zrn pa meri med 0,4 in 0,8 mm. Kontakti med zrni so točkovni.

Kamnina je v celoti apnenec. Njegova sestava se nekoliko spreminja glede na njegov strukturni tip, vendar v vseh močno prevladujejo ooidi, ki dosežejo velikost do 1,3 mm. Ooidi so večinoma precej mikritizirani, vendar je še prepoznavna prvotna radialna in tangencialna struktura (*sl. 4:* 2). Redki so sestavljeni (kompozitni) in proto-ooidi. Jedra ooidov so večinoma mikritna; redkeje jih predstavljajo bioklasti, med katerimi prevladujejo drobci iglokožcev. Razmerje med ovoji in jedrom niha med 0,14 in 42,0 in v povprečju znaša 7,53, lepo razviti ooidi pa štejejo do 25 ovojev. Ostala zrna so peloidi, intraklasti in bioklasti (*sl. 4:* 3). Med slednjimi prevladujejo iglokožci, polži in drobci školjčnih lupin. Precej pogoste so tudi bentoške luknjičarke: razmeroma pogosti so primerki družine Vaginulinidae ter rod *Everticyclammina* (vrsta *E. praevirguliana* ali *E. virguliana; sl. 4:* 7,8). Prepoznani so bili še primerki naddružine Cornuspiracea (*Ophthalmidium* sp. ali *Vidalina* sp.), *Trocholina* sp. ter skorjaste luknjičarke (*sl. 4:* 4).



Sl. 3: Nagrobnik za Petona z Iga. **a** – Nagrobnik z vidno debelejšo kalcitno žilo vzdolž daljše osi. **b** – Detajl z vidnimi večjimi peterokrakimi krinoidnimi ploščicami (sivimi krogi), različnimi sistemi kalcitnih žilic (bele puščice) in disolucijskimi šivi (črne puščice). (Foto: Matija Lukić [a], Anja Ragolič [b])
Fig. 3: Tombstone for Petto from Ig. **a** – Tombstone with visible thick calcitic vein along its longer axis. **b** – Detail with visible large five-sided crinoidal plates (grey circles), various systems of calcitic veins (white arrows), and dissolution seam (black arrows). (Photo: Matija Lukić [a], Anja Ragolič [b])

Nekaj večjih intraklastov ima tanek onkoidni ovoj. V gostem mikritnem apnencu (wackestone) se pojavljajo drobna (od 0,05 do 0,1 mm) biogena sferična kalcitna polja.

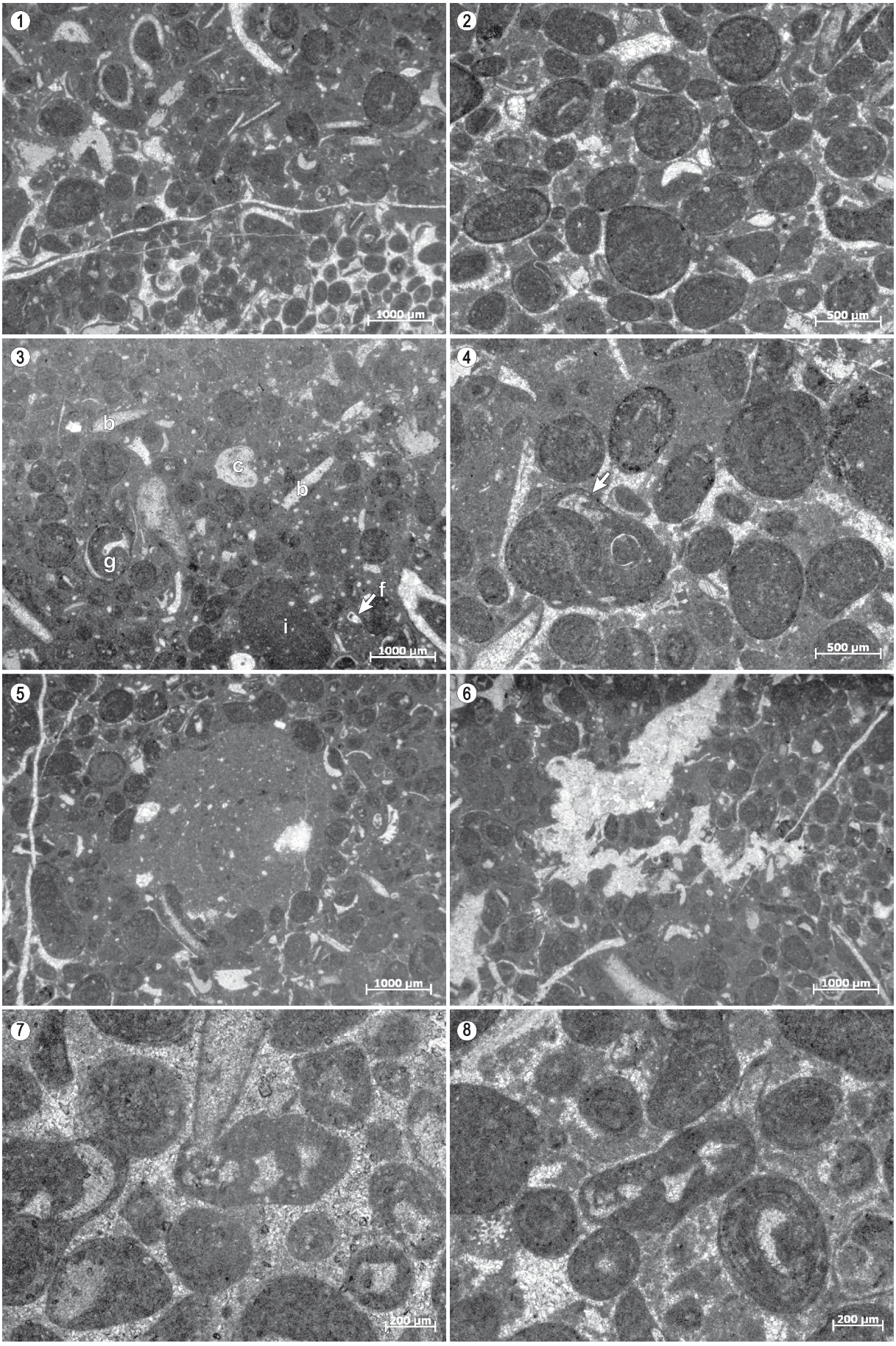
V preparatih je vidna bioturbacija sedimenta, s tem da so bioturbacijske izvrtine zapolnjene z drobnozrnatim apnencem tipa bioklastični wackestone (*sl. 4:* 5). V bioturbacijskih izvrtinah se pojavljajo drobni sparitni bioklasti in peleti.

Vezivo v tipu packstone in wackestone je mikrit, ki je pogosto prekristaljen v mikrosparit. Opažena je bila korozijska votlinica, zapolnjena z mozaičnim cementom. Vezivo v tipu grainstone je druzimozaični cement (*sl. 4:* 6). V tipu packstone se pojavljajo redki disolucijski šivi. Kamnino sekajo kalcitne žilice.

Sklep

Na območju Krimsko-Mokriškega hribovja se ooidni apnenci pojavljajo v več formacijah, (Buser, Grad, Pleničar 1967; Buser 1968; Miler, Pavšič 2008; Mušič 1990; Gale 2015), zato zgolj na podlagi prisotnosti ooidov ne moremo zožiti izbora možnih antičnih kamnolomov. Luknjičarke potrjujejo jursko starost ooidnega apnenca (Velić 2007; BouDagher-Fadel 2008). Glede na velikost in dobro razvitost ooidov gre najverjetneje za kamnino toarcijske (zgornje spodnjejurske) ali srednjejurske starosti. Ooidi pliensbachijskega (srednja spodnja jura) podpeškega apnenca so po Galetu (2015) manjši od 0,55 mm in imajo mnogo slabše razvite ovoje (9–10 ovojev, razmerje med ovojem in jedrom znaša 0,41–0,56). Prav tako je v podpeškem apnencu v večini primerov prisotna luknjičarka vrste *Meandrovoluta asiagoensis* (glej Gale 2014), ki v preparatih stele z Iga ni bila opažena.

Da gre za toarcijske ali srednjejurske ooidne apnence, namigujejo tudi velike peterokrake krinoidne ploščice, saj so bile identične fosilne oblike opisane iz toarcijskih apnencev na Krimu (Miler, Pavšič 2008). Na geološki karti (*sl. 1*) so te plasti v spodnjem (starejšem) delu enote označene kot vrhnji del spodnje jure in srednja jura. Izdanjajo v vzhodnih ostenjih Iškega vintgarja, na Krimu, pri zaselku Planinca, na Sv. Ani nad Podpečjo in na območju Srebotnika (Buser, Grad, Pleničar 1967;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Sl. 4: Nagrobnik za Petona z Iga. Mikroskopska analiza.
1 – Nepravilni in postopni prehodi med različnimi strukturnimi tipi apnenca (levo – delno izprani packstone; zgoraj desno – gost wackestone; spodaj desno – grainstone). **2** – Mikritizirani ooidi z delno vidno primarno strukturo s številnimi ovoji. Razmerje med jedrom in ovoji je povečini veliko. **3** – Ostala zrna poleg ooidov: peloidi in intraklasti (**i**), bioklasti polži (**g**), krinoidi (**c**), školjčne lupinice (**b**) in bentoške foraminifere (**f**). **4** – Skorjasta foraminifera obrašča ooida (označena s puščico). **5** – Bioturbacijska izvrtina, zapolnjena z apnencem tipa wackestone, z drobnimi bioklasti in peleti. **6** – Korozijska votlinica, zapolnjena z druzimozaičnim cementom. **7–8** – Foraminiferi rodu *Everticyclammina* (vrsta *E. praevirguliana* ali *E. virguliana*).
Fig. 4: Tombstone for Petto from Ig. Microscopic analysis.
1 – Irregular and gradual transitions between various limestone types (left – partly washed packstone; upper right – dense wackestone; lower right – grainstone). **2** – Micritized ooids with partly visible primary structure with numerous layers. The cortex:nucleus ratio is mostly high. **3** – Apart from predominant ooids, other grains are: peloids, intraclasts (**i**), and bioclasts: gastropods (**g**), crinoids (**c**), bivalve shells (**b**), and benthic foraminifera (**f**). **4** – Encrusting foraminifera (marked with an arrow) which grows over ooids. **5** – Bioturbation burrow filled with limestone of the wackestone type with fine bioclasts and pellets. **6** – Corrosive void filled with mosaic cement. **7–8** – Foraminifer *Everticyclammina praevirguliana* or E. *virguliana*.

1968). Med naštetimi območji se je do sedaj kot potencialno mesto rimskega kamnoloma omenjal le hrib Sv. Ana (Šašel Kos 1997, 17–19), vendar točna lokacija kamnoloma še ni določena niti ni bila informacija preverjena s podrobnim geološkim kartiranjem.

ZAKLJUČKI

Na podlagi makroskopskega pregleda in mikroskopske analize lahko sklenemo:

– Nagrobna stela za Kviemonija in njegovo družino iz cerkve sv. Janeza Krstnika v Podkraju pri Tomišlju je verjetno izdelana iz litiotidnega apnenca spodnjejurske starosti.

– Nagrobna stela za Petona in njegovo družino z Iga je verjetno izdelana iz ooidnega apnenca iz vrhnjega dela spodnje jure ali srednje jure.

– Izvor obeh kamnin je lokalen. Upoštevajoč prostorsko razširjanje ugotovljenih formacij in trenutno védenje o lokacijah potencialnih rimskih kamnolomov, kamnina najverjetneje izvira iz okolice Podpeči.

Zahvale

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Rock analysis of Roman tombstones from Podkraj and Ig near Ljubljana

Translation

INTRODUCTION

The extraction of natural stone for construction and architectural purposes on the territory of present-day Slovenia dates back to the first two centuries AD, the time of the extension of the Roman Empire across the Ljubljana Basin (Gaspari 2014). According to current data in Emona area, natural stone was acquired in six quarries: Emona's closest and the most used was sandstone quarry at the foot of Castle Hill (Gaspari 2014), whereas on the outskirts of the Ljubljana Basin limestone was extracted (Buser 1987; Ramovš 2000). In addition to the limestone quarry in Podpeč, the quarries of Sv. Ana in Podpeč, Staje at Ig, Skopačnik near Želimlje and Glince in Podutik were also in use (Šašel Kos 1997, 17–19, Fig. 3). Of these quarries the greatest scholarly attention has been devoted to the study of the Podpeč limestone (Ramovš 1961; Buser 1965; Buser, Debeljak 1994–1995; Debeljak, Buser 1997; Ramovš 2000; Štukovnik 2008; Gale 2015), which has been nominated as a "Global Heritage Stone Resource" (GHSR) due to its specific location and cultural significance (Kramar et al. 2015). This stone is characterized by a conspicuous dark grey or nearly black colour, with which contrast white lithiotid bivalves (Buser, Debeljak 1994–1995; Debeljak, Buser 1997; Ramovš 2000; Kramar et al. 2015). Even within the Podpeč quarry, several other limestone lithotypes were identified that differ from it in colour, the type of fossils, and/or the structural properties of the limestone (Štukovnik 2008; Gale 2015). It is important to emphasise that the Podpeč limestone with lithiotid shells is not limited to the Podpeč quarry but also occurs in the surrounding area of Mt Krim and in the vicinity of Ig (Buser, Grad, Pleničar 1967; Buser 1968).

Another prominent and well researched natural stone, which was evidently used in the first centuries AD, is the light grey dense limestone (known as *gliničan*), which was exploited near Podutik, west of Ljubljana (Ramovš 1990). The locations and lithological composition of the remaining three alleged ancient limestone quarries are rather poorly defined.

In this article, lithological descriptions of two stelae are presented, which are published in separate articles in this volume of Arheološki vestnik. Both are found in secondary positions. The first (tombstone for Quiemonis and his family) is integrated into the eastern wall of the St. John the Baptist Church in Podkraj near Tomišelj (Veranič, Repanšek 2016, 313–316, cat. no. 2, Fig. 7), the second (tombstone for Petto and his family), was discovered in 2014 in a Late Roman pit at Marof, the archaeological site at Ig (Ragolič 2016, Figs. 3–7). For the latter, the macroscopic description was supplemented by petrological and paleontological analysis of microscopic thin-sections, which were made of

rock fragments of the tombstone. Based on these studies, we attempted to give an assessment of the lithostratigraphic affiliation of rocks and thus restrict the possible location of the original quarry in the area along the southern outskirts of the Ljubljansko barje, where such rocks outcrop on the surface.

The two locations mentioned above and the potential sites of the ancient quarries along the southern outskirts of the Ljubljansko barje are presented in *Fig. 1*.

GEOLOGICAL SETTING
(*Fig. 1*)

The area of the Krim-Mokerc hills is formed of a thick sequence of Middle Triassic to Middle Jurassic carbonate rocks. In the east, older rocks also occur, specifically the Paleozoic clastites and Lower Triassic clastic-carbonate rock sequence. Northward, these rocks sink below the Quaternary alluvial, lacustrine and moor sediments of the Ljubljansko barje (the Ljubljana Moor). The area is intersected by several stronger faults, among which NW-SE (dinaric)-orientated faults dominate (Buser, Grad, Pleničar 1967; Buser 1968).

METHODS

Lithological analysis of tombstones was made on the basis of macro and microlithological description. The macroscopic analysis includes a description of the rock surface on the field. Reliable information about the rock gives a fresh surface, where the particular characteristics of rocks are more visible. For microscopic analysis, thin-sections were made from chips of the tombstone from Ig, which were examined under the optical microscope. In order to determine the carbonate minerals one thin-section was stained with Alizarin Red S.

The results of the macroscopic and microscopic analysis of rocks were compared with already known and described rocks from the southern outskirts of the Ljubljansko barje. On this basis, the possible locations of source-rocks from tombstones were determined.

RESULTS AND DISCUSSION

Tombstone for Quiemonis from Podkraj

Macroscopic description

The lithological description was carried out solely on the basis of the macroscopic examination (*Fig. 2*), since it was not possible to obtain a sample of the rock from the monument, which would allow for a more detailed analysis. This was facilitated by the inspection of a horizontal, narrow band of unweathered rock in the central part of the tombstone, clearly visible where the inscription field has suffered slight mechanical damage. The rock is dark grey or nearly black, and is interspersed with more or less regular white fields of calcite that could represent different sections of fossils. On the left side of the damaged zone, a 1 cm wide and a few cm long, vertically oriented patch of spar is observed (i.e. regarding the position of a monument); its central part displays a different crystal structure compared to the edges, which measure approximately 1 mm in width. According to its microstructure, this particular structure is assumed to represent a lithiotid shell, which is a reliable indicator that the tombstone is made of lithiotid limestone. The stone is intersected by a stronger system of calcitic veins. In addition, the thinner veins also appear in different directions and are partly filled with reddish material.

Decision

Based on the presence of the lithiotid bivalves in the dark coloured matrix, the stone is identified as Lower Jurassic lithiotid limestone. Such lithology occurs in several areas south of the Ljubljansko barje (Buser, Grad, Pleničar 1967; Buser 1968). It outcrops south of the town of Ig towards the Iška Canyon, on Mt Krim, from which it extends through Planinca to the village of Podpeč; it also composes the foothills of Mt Srebotnik. Two potential Roman quarries are mentioned in these areas (Šašel Kos 1997, 17–19): Podpeč and Staje near Ig. However, during the field overview of the Staje area, we did not detect lithiotid limestone and consequently, we can conclude that analysed tombstone from Podkraj was constructed from the limestone from Podpeč.

Tombstone for Petto from Ig

Macroscopic description

The surface of the tombstone is mostly weathered (*Fig. 3*). Freshly cut surfaces are seen solely at the lower part of the monument. The rock is dark grey ooidal limestone. The entire tombstone is cut by variously oriented systems of calcite veins. Some veins are partially filled with ocher-coloured material. The thickest veins run along the tombstone and reach several centimetres in thickness. On the surface a curved, more intensively weathered lines (cross-sections of planes) are visible. These morphological elements are most probably dissolution seams, which were also detected during a microscopic overview of the rock. On the weathered surface, a thin mesh-like texture is visible, which is typical for weathered ooidal limestone. Across the entire surface of the tombstone, small crinoid fragments stand out. Some are seen as large (up to 1 cm) five-pointed stars positioned in the upper portion of the tombstone (*Fig. 3*).

Microscopic analysis

The texture of the thin-sections is heterogeneous. It is marked by an alternation of the following textural limestone types: partly washed packstone, dense wackestone, and grainstone. The transitions between particular textural types are mostly gradual and irregular (*Fig. 4:* 1). Grains are well sorted, mostly rounded and isometric, whereas some bioclasts are elongated. Average grainsize varies between 0.2 and 1.5 mm, whereas the majority of grains falls between 0.4 and 0.8 mm. Grains are in point contacts.

The rock is pure limestone. The composition slightly varies according to its textural type, but ooids strongly prevail in all types. They can be up to 1.3 mm large and tend to be significantly micritized, but their primary radial and tangential structures are still recognized (*Fig. 4:* 2). Rare composite and superficial ooids also occur. Ooid cores are mostly micritic and rarely made of bioclasts, among which echinoderm (crinoid) fragments are most common. The cortex:nucleus ratio varies between 0.14 and 42.0 with an average of 7.53, and well-developed ooids show up to 25 laminae. Other grains are peloids, intraclasts, and bioclasts (*Fig. 4:* 3). Among the latter, echinoderms, gastropods, and bivalve shells dominate. Common are also benthic foraminifera; rather frequent are specimens of the family Vaginulinidae and genus *Everticyclammina* (species *E. praevirguliana* or *E. virguliana; Fig. 4:* 7,8). The specimens of the Cornuspiracea superfamily (*Ophthalmidium* sp. or *Vidalina* sp.), *Trocholina* sp., and encrusting foraminifera were also recognized (*Fig. 4:* 4). Some larger intraclasts have thin oncoidal cortexes. In dense wackestone, small (0.05 to 0.1 mm) biogenic spherical calcite fields occur.

The bioturbation is observed in thin-sections. Bioturbation burrows are filled with fine-grained bioclastic wackestone (*Fig. 4:* 5) which contains small sparitic bioclasts and pellets.

The matrix in packstone and wackestone is micrite recrystallized to microsparite. A corrosion void filled with mosaic cement was observed. The matrix in grainstone is drusy-mosaic cement (*Fig. 4:* 6). In the packstone, rare dissolution seams occur. The stone is cut by calcite veins.

Decision

On the Mt Krim-Mt Mokrec hills ooidal limestone appears in several formations (Buser, Grad, Pleničar 1967; Buser 1968; Miler, Pavšič 2008; Mušič, 1990; Gale 2015). The locations of potential Roman quarries assessed thus far are positioned within all such formations and consequently represent probable source-rock sites of the tombstone from Ig (in *Fig. 1* these formations are colored grey). Benthic foraminifera date ooidal limestone to the Jurassic (Velić 2007; BouDagher-Fadel 2008). Regarding the size (up to 1.3 mm) and good development of ooids (average cortex:nucleus ratio 7.53, up to 25 laminae), this rock is most probably of Toarcian (late Lower Jurassic) or Middle Jurassic in age.

Ooids of the Pliensbachian (middle Lower Jurassic) Podpeč limestone are, in contrast, up to 0.55 mm large and have poorly developed cortices (9–10 laminae, ratio of cortex:nucleus is 0.41–0.56) (Gale, 2015). Additionally, a constant component of the foraminiferal assemblage is *Meandrovoluta asiagoensis* (Gale 2014), which was not found in the thin-sections from the tombstone from Ig.

That the source-rock of the tombstone is Toarcian to Middle Jurassic ooidal limestone is also suggested by large five-pointed crinoid plates, as identical fossil forms were described from Toarcian limestone on the Mt Krim (Miler, Pavšič 2008). On the geological map (*Fig. 1*) these beds occur in

a lower (older) part of the lithostratigraphic unit that is indexed as upper Early and Middle Jurassic. They outcrop in the eastern cliffs of Iški vintgar (Iška Gorge), on the Mt Krim, near the Planinca, on the Sv. Ana hill above the Podpeč village, and on the Mt Srebotnik area (Buser, Grad, Pleničar 1967; Buser 1968). Thus far, from the listed areas in these formations potential Roman quarry was mentioned on the Sv. Ana hill at Podpeč (Šašel Šašel Kos 1997, 17–19), but this remains to be confirmed on the field and with a detailed geological survey of the area.

CONCLUSIONS

On the basis of the macroscopic overview of the tombstones from Podkraj and Ig and of the microscopic analysis of the latter, we conclude that:

– The tombstone for Quiemonis from the St. John the Baptist Church in Podkraj near Tomišelj is made from Lower Jurassic lithiotid limestone.

– The Petto tombstone from Ig is carved from ooidal limestone which is upper Lower and Middle Jurassic in age.

– Considering the spatial distribution of suitable formations, the stone was quarried on the southern outskirts of the Ljubljansko barje, most likely in the vicinity of the Podpeč village.

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