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ORIGINAL ARTICLE

Stone products of the Roman municipium of Neviodunum, Pannonia (modern Drnovo, Slovenia)

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Abstract

The paper presents the lithologies used in the stone products of Neviodunum (modern Drnovo in Slovenia), a Roman municipium in south-western Pannonia. For this purpose, 95 stone monuments were assessed. Petrographic and biostratigraphic analyses were carried out on 56 archaeological and 57 geological samples. Our research shows that, besides some rare exceptions, most stone products refer to three lithostratigraphic units: the Middle Miocene 'Lithothamnium' Limestone Member of the Laško Formation, the Upper Cretaceous Krško Formation and the Early Jurassic Krka Limestone Member of the Podbukovje Formation.

KEYWORDS

biostratigraphic analysis, petrographic analysis, Roman period, Slovenia, stone monuments, stone provenience

INTRODUCTION

In the Roman Imperial period, the provenience of natural stone used in monuments and architecture often reflects the importance of a settlement, its connections and the wealth of its inhabitants (Djurić et al., 2006). For example, as much as 16 rock types were recorded from the Roman town of Sirmium (Sremska Mitrovica, modern Serbia), which was one of the four capitals of the Roman Empire during the tetrarchy, 14 of which were imported from neighbouring Roman regions. In contrast, recent analysis of the stone monuments from Emona (Ljubljana, modern Slovenia), a colony of moderate importance, shows a much more limited choice of natural stone (eight rock types) and a strong predominance of stone from local sources (six rock

types accounting for 80.2%) (Djurić et. al., 2022). Inhabitants of minor (and/or less important) settlements often had to make do with the building material available in the local area, finding sources of rock of desired (or at least satisfactory) physical properties, and which allowed cost-effective extraction and transport (Russell, 2013).

Such a minor settlement was also Neviodunum, a small Roman town in the province of Pannonia, dated between the end of the first and the fourth centuries CE. The site lies at the outskirts of present day Drnovo, in south-eastern Slovenia (Fig. 1). Our research was aimed at identifying the lithologies used for the production of its stone monuments. Lithostratigraphic units (formations) of origin of mainly used rocks were determined based on microfacies and fossils. Possible areas of origin of the natural stone were identified from the geological maps of the area, field surveys, sampling and microfacies analysis of the suitable lithologies. Rarely used rocks were assessed at lithofacies-type level and their provenience was not determined. Archaeological (spatial, functional, formal, typological, chronological) analysis was performed in order to provide information about the production of different stone products in different periods and areas of the ager of Neviodunum.

GEOLOGICAL CHARACTERISTICS OF THE AREA

The wider surroundings of Neviodunum include the eastern part of the Krško basin. Its periphery is formed by the Krško and Orlica Hills to the north and the Gorjanci Hills to the south. The main waterways in this area are the rivers Sava, Krka and Sotla. Along all these rivers there are vast floodplains filled with gravel and, to a lesser extent, sand, silt and clay (Poljak, 2017; Verbič, 2008). Successions of Mesozoic (Triassic–Lower Cretaceous) carbonate rocks are present on Mt Orlica and the Gorjanci Hills. These rocks are thick bedded, often massive and strongly lithified. The entire Krško Hills, the southern slope of Mt Orlica and the northern slope of the Gorjanci Hills consist of Cretaceous–Neogene carbonate and clastic rocks (Poljak, 2017). The Upper Cretaceous rocks are often thin bedded and strongly lithified, making them easy to format into platy masonry building stone. These mostly correspond to deeper marine Scaglia-type deposits and were formally described as the Krško Formation (Gerčar et al., 2022; Poljak, 2017). The Neogene succession largely consists of unlithified sediments. Only the Middle Miocene 'Lithothamnium' Limestone Member of the Laško Formation (Kuščer, 1967) is suitable for exploitation because it consists of lithified bedded limestone and (in its lower part) conglomerate. Additionally, Pliocene–Quaternary sediments of the Sava River (carbonate and siliciclastic gravel and sand), divided into several Alloformations (Verbič, 2004, 2008), are present in the area. They could be mostly used as masonry building material.

For a detailed description of the lithostratigraphic units, see Appendix S1 in the Supporting Information section.

ARCHAEOLOGICAL BACKGROUND

Neviodunum was a small town in Roman Pannonia (Fig. 1), excavated from the mid-19th century onwards. The area was originally part of the *civitas* of the Celtic tribe of the Latobici. At the very beginning of the Imperial period, when the main road Emona–Siscia–Sirmium was built (Lovenjak, 2006: 175), Roman military camps were built in the area. At Vihre, east of Drnovo, remains of two camps were excavated (Fig. 2); others were discovered in the surroundings (Mason, 2008: 194–96; Bavec, 2009: 52, 58; Guštin, 2015; Jovanović, 2022).

As documented by its name, the *municipium Flavium Latobicorum Neviodunum* was established under the Flavians. As for some other Pannonian towns, its founding is often

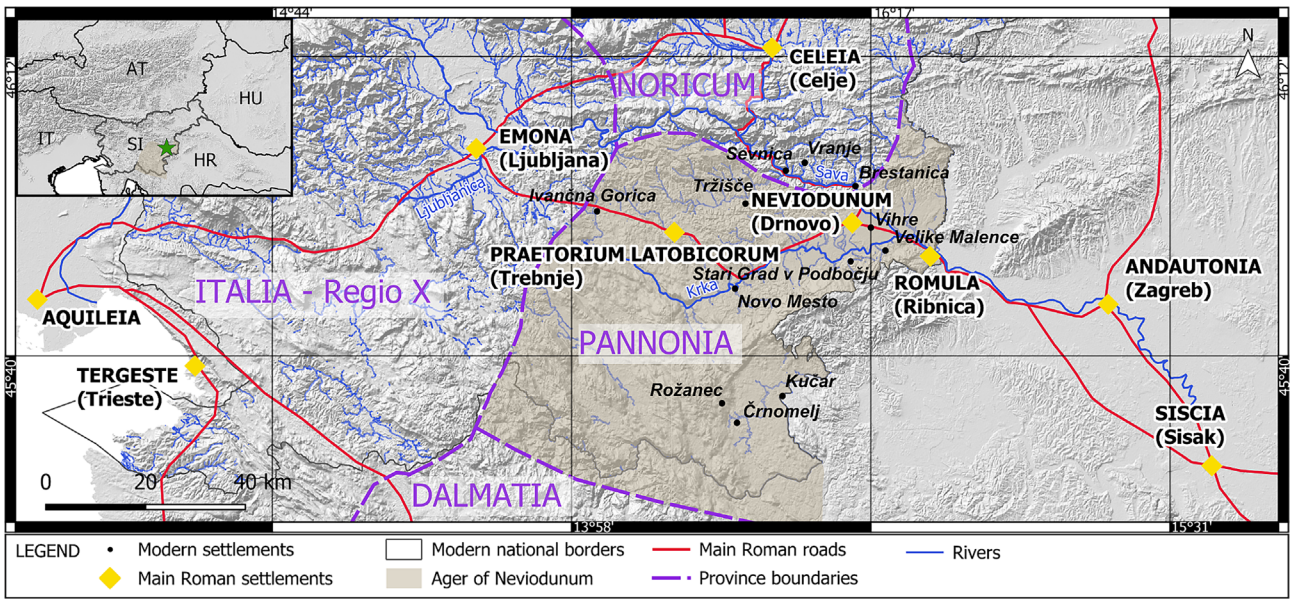

FIGURE 1 Geographical position of Neviodunum and the approximate extension of its ager with the province borders and main Roman roads (after Lovenjak, 2003; Gaspari, 2009; Šašel Kos, 2009; Istenič, 2014).

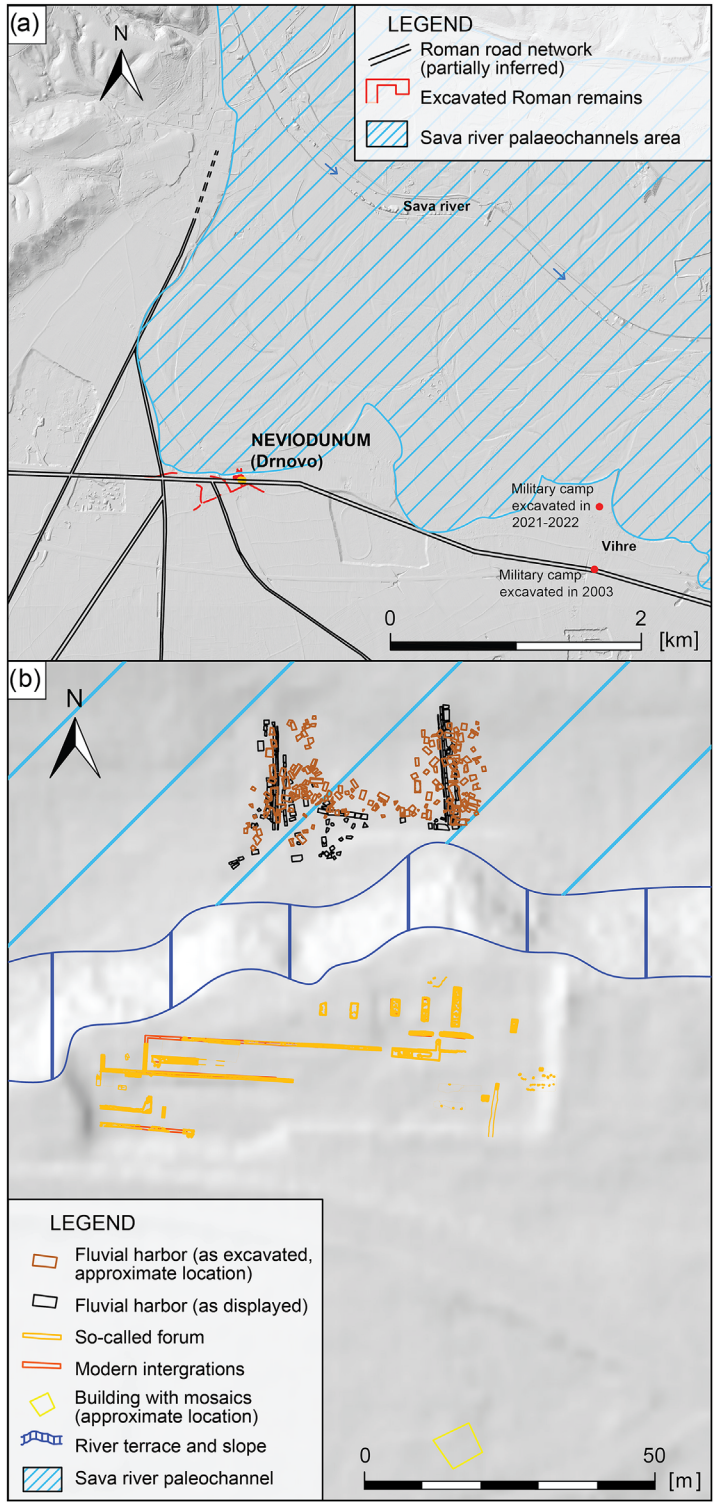

FIGURE 2 Topographic plan of Neviodunum and its surroundings on a LiDAR image (compilation of the drawings made by Arhos d.o.o. and the authors; LiDAR: ARSO): (a) general view with the Roman road network (after Vojaković & Novšak, 2022); and (b) area of the fluvial harbour and so-called forum.

referred to the time of Vespasian (most authors, following Petru & Petru, 1978: 30; Šašel, 1983: 79–91; or Šašel, 1989: 62–63), but a later date, under Domitian, could also be possible. Namely, the epigraphic material from Neviodunum can be mostly dated from the end of the first century CE onwards, with more copious material since the second century. The foundation in the later Flavian period would also be more consistent with the chronology of the main structures of the town and its tombs (cf. Tables S1–S4 in the Supporting Information section) (see also Vojaković & Novšak, 2022: 107, for the recently excavated tombs).

The ager of Neviodunum extended to the west (border with the ager of Emona, that is, with ancient Italy's Regio X) to Višnja gora, to the north (border with the ager of Celeia, that is, with the province of Noricum) almost to the Sava River. The eastern and southern borders are unclear, but could be somehow coherent with the current national borders of Slovenia (Lovenjak, 1998: 17). In line with this reconstruction, the town of Neviodunum is located in the north-eastern part of its ager, and other main Roman settlements and roads are all placed in its northern half (Fig. 1). The most important secondary settlement in the ager of Neviodunum is the *statio beneficiarii* of Praetorium Latobicorum, almost halfway on the road Emona-Neviodunum, in today's Trebnje. It is dated from the first century CE to the second half of the fourth century (Lovenjak, 1998: 223–24; Bavec, 2020). Another road station, Romula (today Ribnica) (Lazar, 2020), was located on the road segment connecting Neviodunum and Andautonia (today Ščitarjevo, near Zagreb in Croatia). Based on ancient sources (*Tabula Peutingeriana* segm. IV, 2; *Ravennatis Anonymi Cosmographia* 4.20), two other road stations were present in the ager of Neviodunum, but their location is uncertain : Acervo, in the surroundings of Ivančna gorica (Gabrovec, 1975; Lovenjak, 2006: 176), and Crucium, halfway between Praetorium Latobicorum and Neviodunum (Lovenjak, 2006: 176; Udovč, 2022: 8–9).

The most important terrestrial route passing through Neviodunum connected Emona, Siscia and Sirmium, hence it linked ancient north-eastern Italy to the Balkan area. Parts of the road were discovered in the excavations of Neviodunum (Petru & Petru, 1978: 23) and it probably represented the *decumanus maximus* of the town. Both nearby rivers, Sava and Krka, were likely used for the transportation of goods.

The most remarkable archaeological remains of Neviodunum pertain to the potential inland harbour (Figs 2 and 4, a), one of very rare examples in the Pannonian area. As can be deduced from the excavation's documentation from 1961 to 1962, the stone blocks of the harbour were found scattered across the area (Petru & Petru, 1978: 11–25; Lovenjak, 2003; Puhar, 2013). Petru reconstructed the layout of the quayside and the piers based on the remains of masonry structures, which apparently represented their foundations. As attested by the original excavation plans,[1] these structures are 30 m apart, as are also the displayed piers, and this measure corresponds to 100 Roman feet. The piers (as they were reconstructed) are characterized by the presence of a lateral channel. Parts of pillars and simple architectural decoration were also found. On the basis of overall coin finds from the area, the construction of the harbour was dated at the latest to the time of Trajan and its abandonment in the late fourth century (Petru & Petru, 1978). Traces of a dry riverbed to the north in close proximity to the site of Neviodunum lead to the interpretation that a navigable branch of the Sava River reached the site; the Sava is today some 2.5 km more to the north. As shown by LiDAR imagery (Mlekuž, 2009: 13–16), in this area the river migrated from south to north and the riverbed at Drnovo seems to be the oldest one. It is possible that in Roman times the main riverbed was already located more to the north and that the Romans used this older riverbed to set up an artificial channel intended for the inland harbour. We hypothesize that the riverbed used was no longer naturally active in Roman times. This would also better fit the rectangular design of the fluvial harbour with projecting piers, as reconstructed by Petru (Figs 2 and 4, a), which would hardly be suitable if it related to the main riverbed of the Sava, which has a very strong flow. Future research is needed on the precise dating of the migrations of the Sava River channels north of Neviodunum

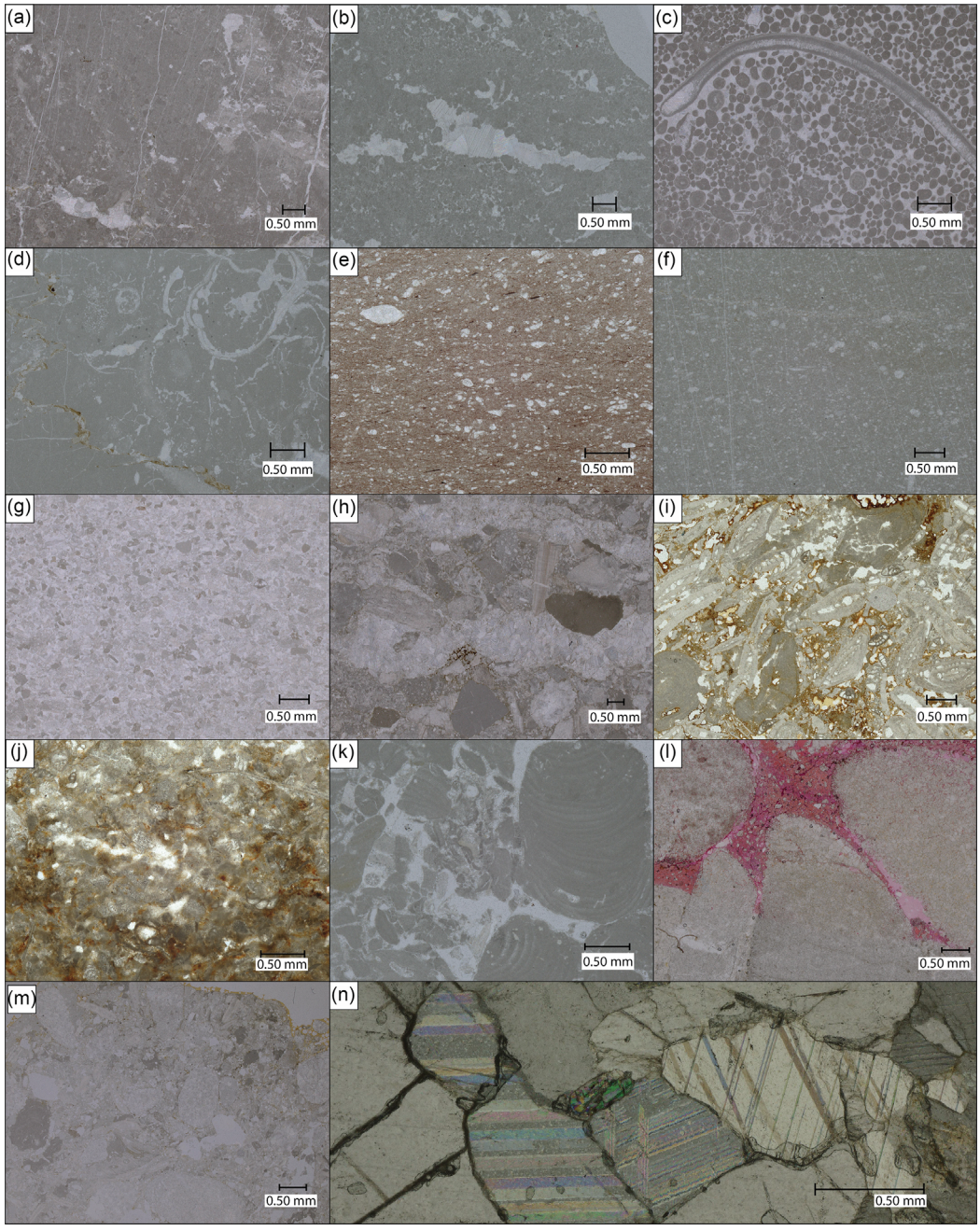

FIGURE 3 Characteristic microfacies types identified in Roman stone products from Neviodunum: (a–d) lithofacies grey shallow-marine limestone; (e–g) lithofacies deeper marine limestone; (i–k) lithofacies yellowish shallow marine limestone; (l, m) lithofacies conglomerate; (n) lithofacies marble. (a) MFT1.2: Fenestral microbial boundstone; (b) MFT1.3: Peloidal grainstone; (c) MFT1.4: Oolithic grainstone; (d) MFT1.5: Molluskan floatstone; (e, f) MFT2.1: Wackestone with planktic foraminifera; (g) MFT2.2: Fine-grained lithoclastic rudstone (calcarenite); (h) MFT2.3: Polymictic breccia (calcirudite); (i) MFT3.1: Foraminiferal grainstone; (j) MFT3.2: Bioclastic floatstone; (k) MFT3.3: Algal floatstone; (l) MFT3.5: Monomictic conglomerate; (m) MFT3.5: Polymictic conglomerate; and (n) MFT5: Coarse-grained schistose calcite marble. See Appendix S2 in the Supporting Information section for descriptions of the microfacies.

to elucidate our hypothesis, as current dating to the late Holocene glacial was presumed only based on pollen analysis (Verbič, 2004).

South of the harbour, an elongated edifice (interpreted as a warehouse) with a portico was discovered (Figs 2 and 4, b–c). Fragments of architectural decoration: a semi-finished composite capital with plain acanthus leaves (as well as chips of finished acanthus leaves of composite capitals) and other column parts (a base and a column shaft drum[2]) as well as small fragments of entablature, have been found in this area. After Petru, these fragments of architectural decoration referred to an older temple from the beginning of the first century CE, located in the same area. This would have been obliterated by the construction of the elongated building with the portico at the time of Hadrian[3] (Petru & Petru, 1978: 14, 17, 24; cf. also Horvat & Šašel Kos, 1999: 212–13). The photographs and drawings of the excavation have no elements for confirming this hypothesis. On the contrary, some pieces of architectural decoration have been

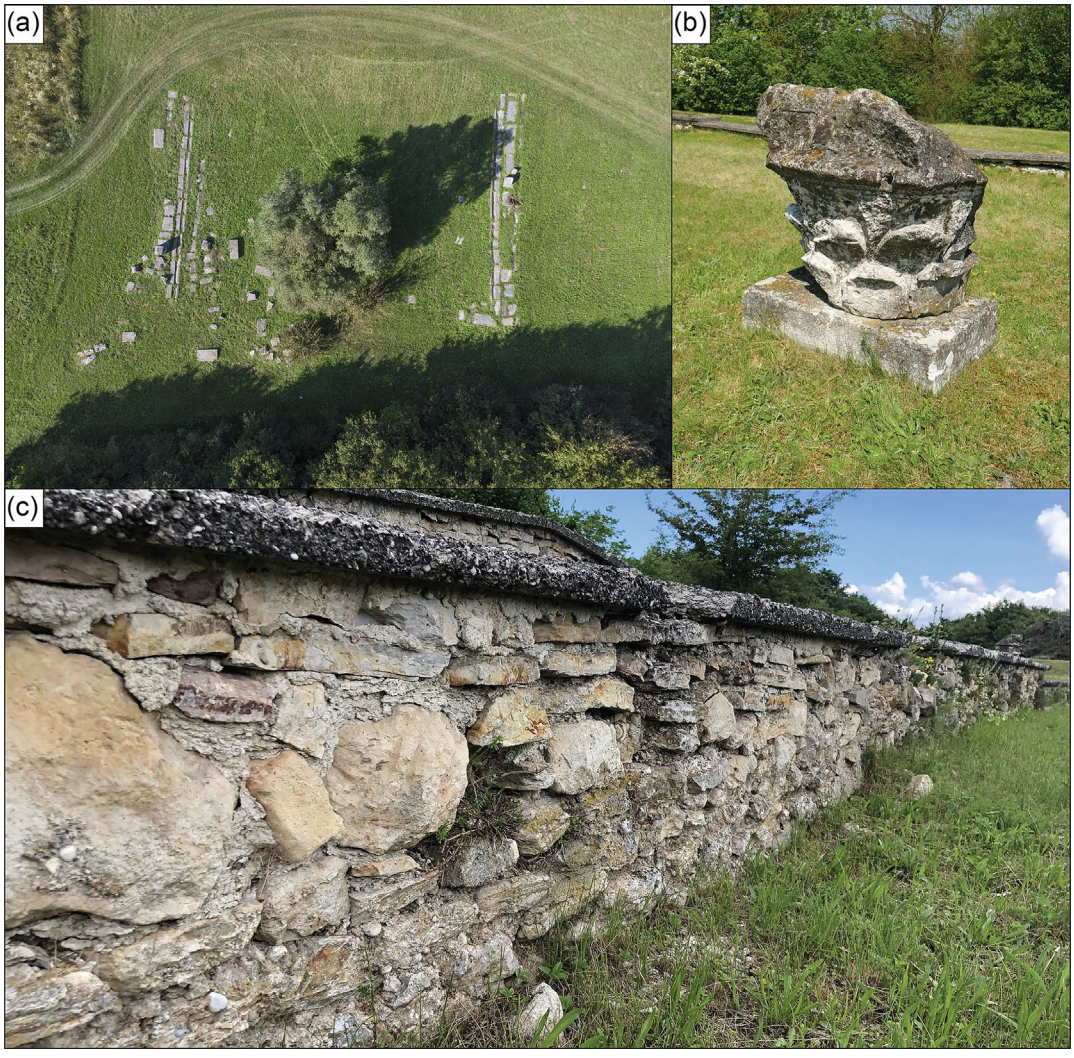

FIGURE 4 (a) Displayed remains of the fluvial harbour of Neviodunum (photo: Arhos d.o.o.); (b) unfinished composite capital (a.20) from the so-called forum of Neviodunum; and (c) wall (a.23) of the elongated building on the northern side of the so-called forum of Neviodunum.

found within more superficial layers. In addition, the composite capital cannot be plausibly dated to the beginning of the first century CE, as suggested by Petru, but from the Flavian period onwards (for the development and diffusion of the composite capital, cf., e.g., Gros, 2001: 499–502). At the same time, it is also very unlikely that a temple in Roman style would have been erected in the area above the establishment of the Flavian municipium. We therefore assume that the parts of architectural decoration pertain straight to the portico in front of the elongated building, not to an older (undocumented, hypothetical) edifice. The portico and the elongated building were probably built in a similar period as the harbour and could represent the northern part of the forum (hereinafter referred to as the 'so-called forum' as its identification is not yet confirmed). The elongated building was divided into several rooms, with wide door openings onto the portico, which could be interpreted as *tabernae*. South of the so-called forum a building with a mosaic, representing *opus sectile* panels made of different coloured marbles and breccias (Puhar, 2022), was discovered (Fig. 2).[4]

Coin finds suggest that the town was mostly abandoned after the end of the fourth century CE (Kos, 1986: 218–24; Horvat, 1999: 222). Stone material of the site was extensively looted for other constructions, being removed from its primary location. Several inscribed monuments from Neviodunum, also two mentioning the *municipium Flavium Neviodunum* or *municipium Latobicorum* (*CIL* III, 3925; Lovenjak, 1998, nos 11, 26), were reused in the walls of the Late Antique hilltop settlement of Gradišče at Velike Malence, 8 km south-east of Neviodunum (Lovenjak, 1998: 11). Also later, medieval and modern reuse provoked the dispersion of ancient stone products (cf. Tables S3–S6 in the Supporting Information section).

Parts of the archaeological, especially architectural, remains of Neviodunum are displayed *in situ* and *sub divo* in the form of a simple archaeological park (Figs 2 and 4), but several stone monuments from Neviodunum are dispersed in various locations and museums.

Lovenjak (1998) studied the epigraphic material of Neviodunum and its ager, that is, 200 inscribed monuments and some dispersed pieces. The material refers mostly to funerary monuments, with preponderant local names and non-sophisticated monument forms; there are also several votive, dedicatory and some honorary inscriptions. Overall, the majority of epigraphic material can be dated to between the end of the first and the third centuries CE.

RELEVANT PREVIOUS RESEARCH

Rocks used in the Roman stone products of the ager of Neviodunum were up to now identified only by a macroscopic approach and their potential provenience determined generically (Lovenjak, 1998; cf. also Petru, 1962–64, for the structures of the harbour and the elongated building). Identification of the lithologies used in the walls of the chamber tombs of the town's south-eastern necropolis was carried out recently (Verbič, 2022: 8–9).

The building material used in the area of the aforementioned site of Velike Malence was identified by Verbič and Bavec as 'Lithothamnium' Limestone Member, and its probable provenience was referred to the northern foothills of the Gorjanci area, possibly to the area of Velike Malence itself (Bavec, 2001: 11–12). Other possible sites of Roman quarries corresponding to the Laško Formation (*sensu* Kuščer, 1967), were suggested south of Čatež ob Savi (Petru, 1975; Gaspari, 2009: 123) and in Podgračeno, the last namely as a source for building material for the nearby Roman road station of Romula (Lazar, 2020: 398).

Verbič (quoted in Breščak & Lovenjak, 2010: 308) also identified the lithofacies used in some stone products reused in the church of St Peter at Jezero, east of Trebnje (some 32 km air distance to the west of Drnovo), as well as in a funerary precinct discovered in Draga near Bela Cerkev (19 km air distance west-south-west of Drnovo). He connected these monuments with a quarry of Lower Jurassic limestone at Brnek Hill in Dolnja Nemška vas east of Trebnje (Breščak & Lovenjak, 2010: 308; Bavec, 2020: 380; Udovč, 2022: 23–24). However, the

mentioned quarry was probably opened in recent times, during the construction of the main road Ljubljana–Zagreb in 1958 (B. Djurić, personal communication, 5 January 2024). Remains of a potential Roman, or later, quarry of Lower Jurassic limestone were excavated in the neighbouring Ponikve area (Ravnik & Tica, 2018: 24–25, 44, 54–55, 88–91; Rižnar, 2018). Another possible Roman quarry site was suggested at Pijavško near Brestanica close to the ager border between Neviodunum and Celeia (Leben, 1975; Gaspari, 2009: 123).

In the settlement of Črnomelj, in the southern part of the ager of Neviodunum, black (microfacies type recrystallized mudstone) and white (microfacies type mudstone with ostracods) limestone *tesserae* of an Early Christian mosaic have been archaeometrically investigated: a local stone supply has been suggested for them (Šmuc et al., 2017).

In summary, previous research assumed that there were several potential Roman quarries in the ager of Neviodunum and that the stone supply was arranged strictly locally. The aim of our research, therefore, was also to verify this hypothesis.

MATERIALS AND METHODS

For the purpose of this study, 95 Roman stone monuments were assessed from the geological (petrological and biostratigraphical) and archaeological (functional and formal) perspectives. The monuments to be assessed were selected in order to be representative of the town of Neviodunum and for the northern half of its ager, where the main Roman settlements and roads were located (cf. Fig. 1), and where the bulk of the stone products was discovered (cf. Lovenjak, 1998: 27).

Several of these stone monuments were displaced from their original location and reused in later buildings. In order to understand their original placement, context, function and chronology, we had to reconsider thoroughly the ancient topography of the site of Neviodunum and its ager. Numerous inscribed pieces, previously published by Lovenjak (1998) and included in the Epigraphic Database Heidelberg (https://edh.ub.uni-heidelberg.de/), were reassessed in consideration of their formal and functional aspects. We also included in our research several pieces that are almost or de facto unpublished, such as some architectural members found in Velike Malence and temporary stored there in the courtyard of a private house.

Archaeological samples were mostly collected in the archaeological park of Neviodunum at Drnovo, that is, from parts of the (almost) *in situ* displayed buildings pertaining to the harbour and the so-called forum (see Tables S1 and S2 in the Supporting Information section). Samples represent architectural members and architectural decoration, as well as building material from the walls.[5] Some monuments and milestones were also sampled in the Posavje Museum Brežice and at Velike Malence (see Tables S3, S5 and S6 in the Supporting Information section). Overall, 56 archaeological samples, corresponding to 37 monuments or structures, were analysed (for the structures of the harbour and some other monuments multiple samples were namely taken).

The structures of the displayed tombs of the south-eastern necropolis of Neviodunum were macroscopically assessed, as were also several stone monuments reused in numerous buildings in the surroundings of Drnovo. They pertain partially to Neviodunum itself (see Tables S3 and S4 in the Supporting Information section) or to its *ager* (see Tables S5 and S6 in the Supporting Information section). Several macroscopically assessed pieces concerning Neviodunum and its *ager* are stored in the National Museum of Slovenia in Ljubljana, in the Posavje Museum Brežice, in the Museum of Dolenjska in Novo mesto and in the Kunsthistorisches Museum Vienna (see Tables S3–S6 in the Supporting Information section). Some of these monuments belong to the sites of Praetorium Latobicorum and Romula (see Table S5 in the Supporting Information section).

Overall, 57 geological samples were taken on selected outcrops. The spatial distribution of the main rock units of the region is documented in geological maps by Poljak (2017) and Buser (2010). From all possible outcrops we selected some specific sites on the basis of proximity to the town of Neviodunum and of possibilities of river transport and road connections. These sites are: Mokrice/Čatež ob Savi, Šutna, Bela Cerkev and Jelovec. For additional information about the lithologies, lithofacies types and lithostratigraphic formations present on the locations of interest, see Appendix S1 of the Supporting Information section.

Petrographic and biostratigraphic analysis was done for primary geological samples (n = 57) and for selected stone monuments (n = 56). As already mentioned, the rest of the stone products were examined using a macroscopic approach (Zalasiewicz, 2017). For the determination of rock colour, a standard colour chart was used (Geological rock-color charts, 2011). Samples of the stone artefacts were taken with an 18 mm chisel and a hammer, after prior approval by the curators of the collection, exclusively from already damaged areas or, in exceptional cases, from the back sides of the stone artefacts. Thin sections of sizes 47 × 28 mm were made. They were stained with alizarin red S to determine the dolomite content and scanned with a high-resolution digital microscope Keyence VHX 7100-S750E, additionally equipped with a polarizing lens. Thin sections were subsequently examined with a polarizing optical microscope from Opton Zeiss. Limestone microfacies were named according to the classification of Dunham (1962) and recommendations by Wright (1992), while other sedimentary rocks were classified according to the classification proposed by Folk (1980). Metamorphic rock fragments were identified according to Fettes et al. (2008).

The age determinations of sedimentary rocks are based on the foraminifer assemblages, supplemented by indicative macrofossils (e.g., algae, bivalves). Samples of chert and pelagic limestones were additionally dissolved in diluted hydrofluoric acid for the determination of radiolarians. However, radiolarians were recrystallized to a degree that prevented further determination. The age range of each foraminiferal assemblages was determined according to relevant publications (BouDagher-Fadel, 2018; Fugagnoli, 2004; Fugagnoli & Loriga Broglio, 1998; Gale, 2014; Gale & Kelemen, 2017; Nagymarosy & Miller, 1988; Piller et al., 2007; Sevillano et al., 2020; Velić, 2007).

RESULTS AND DISCUSSION

Geological characterization

Among the studied archaeological material, eight different lithofacies types were recognized. Each lithofacies is further subdivided into one or several microfacies types (Table 1). Characteristic microfacies types are illustrated in Figure 3. For detailed descriptions of microfacies types, see Appendix S2; for assessed and sampled primary successions, see Appendix S1 (both in the Supporting Information section).

The petrographic analysis allowed defining the rock types constituting the sampled artefacts and their geographical provenience at various degrees of resolution. For all mainly used microfacies types we assessed a compatibility and provenience at the stage of lithostratigraphic units (formations), while rarely used rocks were only assessed at lithofacies type level.

The lithofacies grey shallow-marine limestone is represented by five microfacies types (MFT1.1–MFT1.5 in Table 1 and Fig. 3). The colour of this limestone is medium to light grey (N4–N6). Lighter shades of brown and green (10YR 5/1, 5YR 4/1, 5Y 6/1, 5Y 4/1) are less common. This limestone is compact and medium to thick bedded, as can be inferred from the backsides of the studied stone products, which in several cases were recognized as bedding planes. The weathered surface of some stone products shows a dense network of thin calcite veins, while a secondary infill of reddish and green clay can be found in some. The presence of

TABLE 1 Identified lithofacies and corresponding microfacies types with the identification of their lithostratigraphic provenience.

Lithofacies type	Microfacies type	Confirmed lithostratigraphic unit of provenience (see Appendix 1 in the Supporting Information section)	Type of use
Grey shallow marine limestone	MFT1.1: Carbonate mudstone with individual fossils MFT1.2: Fenestral microbial boundstone (Fig. 3, a) MFT1.3: Peloidal grainstone (Fig. 3, b) MFT1.4: Oolithic grainstone (Fig. 3, c) MFT1.5: Molluscan floatstone (Fig. 3, d)	Krka Limestone Member, Podbukovje Formation	Milestones (very frequent), votive/sacral and funerary monuments, architectural decoration, large blocks used in the fluvial harbour and building material in the walls of the chamber tombs
Deeper marine limestone	MFT2.1: Wackestone with planktic foraminifera (Fig. 3, e–f) MFT2.2: Fine-grained lithoclastic rudstone (Fig. 3, g)	Krško Formation	Rare: funerary monuments, architectural elements, building material (wall of the elongated building and chamber tombs)
Deeper marine breccia	MFT2.3: Polymictic breccia (Fig. 3, h)		
Chert	MFT2.4: Chert		
Yellowish shallow marine limestone	MFT3.1: Foraminiferal grainstone (Fig. 3, i) MFT3.2: Bioclastic floatstone (Fig. 3, j) MFT3.3: Algal floatstone (Fig. 3, k)	'Lithothamnium' Limestone Member, Laško Formation	Milestones, honorary and especially votive and funerary monuments, architectural decoration, building material (wall of the elongated building and chamber tombs)
Conglomerate	MFT3.4: Monomictic conglomerate (Fig. 3, l) MFT3.5: Polymictic conglomerate (Fig. 3, m)		

TABLE 1 (Continued)

Lithofacies type	Microfacies type	Confirmed lithostratigraphic unit of provenience (see Appendix 1 in the Supporting Information section)	Type of use
River pebbles	–	Not confirmed	Building material (wall of the elongated building and chamber tombs)
Marble	MFT5: Coarse-grained schistose calcite marble (Fig. 3, n)	Not confirmed	Funerary (4), votive (1) and honorary (1) monuments
Calcite tufa	–	Not confirmed	Funerary monument (1 example)

fenestra, peleoids and pellets, ooids, mollusc shells and benthic foraminifera suggests a shallow-marine (inner platform: intra-tidal to restricted lagoonal setting) environment of deposition (after Flügel, 2004). The foraminiferal assemblage includes *Duotaxis metula* (Kristan), *Erlandia tintinniformis* (Mišik), *Reophax* sp., *Erlandia* sp. and *Ammobaculites* sp. In MFT1.5, calcareous sponges, *Thaumatoporella* sp. and faecal pellets of the *Favreina* type were additionally identified. The identified foraminiferal assemblage corresponds to the Hettangian–early Pliensbachian. The corresponding litho- and microfacies types were identified at Šutna based on 20 geological samples (see Appendix S1 in the Supporting Information) within the Krka Limestone Member of the Podbukovje Formation. Other known outcrops are shown in Figure 5.

The next group of lithofacies types identified in the stone products of Neviodunum are deeper marine limestone (represented by two microfacies types: MFT2.1–MFT2.2), deeper marine breccia (with one microfacies type: MFT2.3) and chert (MFT2.4). The limestone is moderately red (5R 4/6) or pale olive (10Y 6/2) in colour. The chert is greenish grey (10GY 5/2), dark red (5R 2/6) or yellowish grey (5Y 8/4). All lithologies are compact. The presence of lamination (limestones and cherts), planktonic foraminifera and radiolarians indicate pelagic sedimentation. Gradation, visible in the breccia is typical of turbidite sedimentation (Tucker, 2001). The identified foraminifera *Rotalipora* sp. and *Marginotruncana* sp., found in all three lithofacies types, indicate a late Cenomanian–Turonian (Late Cretaceous) age. Limestones and cherts are from thin-bedded (less than 20 cm thick beds), while breccia outcrops in thick to massive beds (up to 3 m thick).

The corresponding litho- and microfacies types were identified at two investigated sites: Šutna and Jelovec/Mirna area (14 geological samples were analysed for the first site and seven for the second; see Appendix S1 in the Supporting Information). Other known outcrops are mentioned below. The lithostratigraphic unit of origin is the Krško Formation.

Soft yellowish shallow marine limestone and conglomerate lithofacies types were also identified. The limestone is represented by three microfacies types (MFT3.1–MFT3.3). The characteristic colour of the limestone is yellow to pale yellow (10Y 8/2, 2.5Y 8/2). Red coralline algae, fragments of oysters and scaphopods of the genus *Dentalium*, along with other common pectinid and cardioid bivalves, were identified in addition to benthic foraminifera. Grains are commonly abraded. Foraminifera are mainly represented by *Bolivina* sp., *Cibicides* sp., *Ammonia* sp. and *Elphidium* sp. The sedimentary environment of this lithofacies is identified as a higher energy marine environment of the inner to middle ramp (after Flügel, 2004). The relative proximity of terrigenous input into the sedimentary environment is evident from the presence of terrigenous lithic grains. Foraminifera indicate the Middle Miocene age of the studied samples.

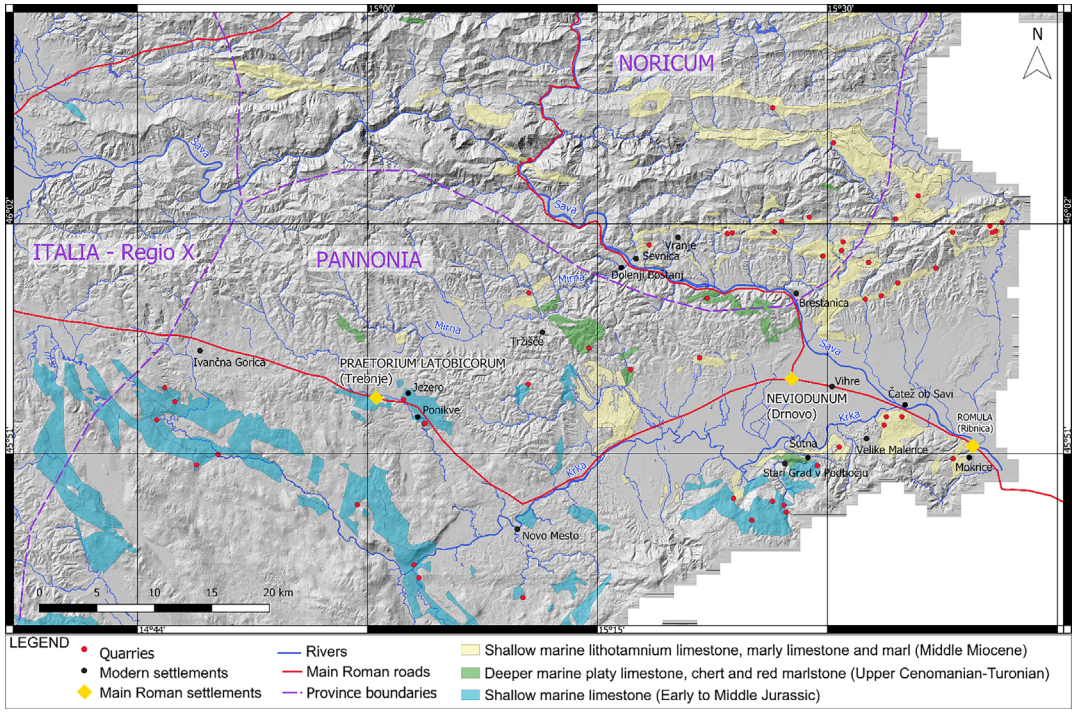

FIGURE 5 Spatial distribution of the primary outcrops of the main lithostratigraphic units (after Buser, 2010) used in the stone products of Neviodunum and its ager, with the indication of quarries (after a mining registry book, 2024) and main Roman roads (after Gaspari, 2009; Istenič, 2014) .

The conglomerate lithofacies is strongly lithified and exhibits poor sorting of grains. Two microfacies types of conglomerates, MFT3.4 and MFT3.5, are present in the studied stone products and in the geological samples: MFT3.4 consists of monomictic sparitic limestone clasts (characteristic colour: 10Y 8/2), MFT3.5 is polymictic and consists of several different siliclastic and carbonate clasts. Clasts (pebbles) represent eroded rocks from the basal surface, on which the conglomerate was deposited. Thus, the difference in the composition of the eroded clasts indicates that the two types of conglomerate originate from different localities. Coralline red algae and molluscs are present in the matrix of both microfacies types, pointing at Middle Miocene age of the conglomerates.

Both, the yellowish shallow-marine limestone and the conglomerate lithofacies types are indicative of the 'Lithothamnium' Limestone Member of the Laško Formation. At three investigated sites the corresponding litho- and microfacies types were identified: the Šutna area (six geological samples of limestone and polimictic conglomerate; see Appendix S1 in the Supporting Information), Mokrice/Čatež ob Savi area (six geological samples of limestone and polimictic conglomerate) and Bela Cerkev area (four geological samples of monomictic conglomerate).

The lithofacies type river pebbles of carbonate and siliciclastic rocks was macroscopically identified. As we could not get a sufficient sample size for archeometric analysis (according to the standard for gravel and pebbles analysis, at least 300 pebbles are required; cf. Bridgland, 1986; Mange & Maurer, 1992), their provenience was not studied in detail. However, carbonate and siliciclastic pebbles are present in the Drnovo Alloformation (Poljak, 2017), which forms the river terrace on which Neviodunum stands. An on-site origin is thus most likely.

Coarse-grained schistose calcite marble (white marble) was also recognized among the studied material and is represented by one microfacies type (MFT5). It was used in four funerary, one votive and one honorary monument. It is characterized by coarse crystal size, foliated structure and low amount of non-carbonate inclusions. Additional geochemical analysis would be needed to pinpoint the quarry of origin.

Calcite tufa is only used in one funerary monument. It is thinly laminated (laminae up to 3 mm thick) and has the calcite crystal oriented perpendicular to lamina. Its colour is light grey to pale yellow (N8, 2.5Y 8/2). Calcite tufa can form on various different carbonate lithologies and can not be directly connected to any lithostratigraphic unit as it is formed by secondary karstic processes. Its provenience determination therefore currently surpassed the aims of our research.

Spatial, chronological and functional distribution of the stone products

The assessed archaeological material includes inscribed honorary, votive and especially sepulchral monuments, architectural decoration and elements, as well as walls and milestones. The artefacts date mostly to the second and third centuries CE. Only a few pieces could still be dated to within the first century CE, and almost no monument could be clearly dated to the fourth century.[6] Tables S1–S7 in the Supporting Information section present gathered information about all assessed pieces. We refer to these tables also for the letter–number coding used to identify assessed artefacts (e.g., A.1).

Most archaeological samples pertain to public architecture displayed *in situ* in the archaeological park of Neviodunum: the fluvial harbour and the elongated building on the so-called forum, dated *c*.100 CE (Table 2; see also Table S1 in the Supporting Information section). As expected for public architecture, parts of architectural decoration are preserved at both locations. Almost all lithologies are attested here, with exception of marble. Huge amounts (at least 110 in number) of large blocks made of limestone of Krka Limestone Member of the Podbukovje Formation are used in the fluvial harbour (A.1–A.12 in Table S1 in the Supporting Information section).

Among the assessed material, funerary monuments which were found *in situ* in the necropolises of Neviodunum are quite rare (Table 2; see also Table S2 in the Supporting Information section), as most of the material was later reused, but three small chamber tombs (B.1) of the south-eastern necropolis (dated to the second–third centuries CE) stand out here. One stele (B.3) of the second century CE, found *in situ* together with its base in the centre of modern Drnovo, is made of marble.

As already mentioned, several monuments were reused in the surroundings of Neviodunum, but are originally most likely from the town itself. These are on the one side votive and honorary monuments, as well as elements of architectural decoration (Table 2; see also Table S3 in the Supporting Information section), which have similar counterparts in the *in situ* material and cannot be expected in other minor sites of the area. On the other side also several funerary monuments deriving from the necropolises of Neviodunum were secondarily reused in its surroundings (Table 2; see also Table S4 in the Supporting Information section). Almost all lithologies are documented in these monuments, also marble. The artefacts date mostly between the late first and fourth centuries CE.

Our research included also several monuments from the ager of Neviodunum, that is, from its northern half (Table 3; see also Table S5 in the Supporting Information section). Some products are from the important sites of Praetorium Latobicorum (E.4–E.8) and Romula (E.22–E.23), some from burial grounds of other secondary settlements and villas. Mostly funerary monuments namely stand out here, together with a few pieces of votive/sacral character, but no honorary monuments or architectural decoration. The chronology is similar to the previous

TABLE 2 Synthetical overview of the assessed products from Neviodunum with an indication of the lithologies and/or lithostratigraphic units of provenience (cf. also Tables S1–S4 in the Supporting Information section).

		Lithology and/or lithostratigraphic unit of provenience					
Original context and find spot	**Type of use and chronology**	**Limestone of Krka Limestone Member, Podbukovje Formation**	**Limestone, breccia and chert, Krško Formation**	**Limestone and conglomerate of 'Lithothamnium' Limestone Member, Laško Formation**	**Carbonate and siliciclastic pebbles**	**Marble**	**Calcite tufa**
Town's public buildings, found *in situ* (cf. Table S1)	Building material, *c*.100 CE		1 structure (elongated building)	1 structure (elongated building)	1 structure (elongated building)		
	Architectural elements (blocks), *c*.100 CE	110 blocks (fluvial harbour)	1 block	3 blocks			
	Architectural decoration, *c*.100 CE	4 (fluvial harbour)		3 (elongated building)			
Reused in the surroundings of Neviodunum, originally most likely from the town's public buildings (cf. Table S3)	Honorary monuments, 98–130 CE	1		1		1	
	Votive monuments, second half of the second century CE	1					
	Votive monuments, second century–first half of third century CE	1		8			
	Votive monuments, late first–fourth centuries CE			1			
	Architectural elements, late first–fourth centuries CE	3	1	6 (of which 5 consoles)			
	Architectural decoration, late first–fourth centuries CE	1		2			
Funerary monuments of the town's necropolises, found *in situ* (cf. Table S2)	Building material, second–third centuries CE	3 structures (chamber tombs)	3 structures (chamber tombs)	3 structures (chamber tombs)			
	Funerary monuments, 1nd century CE			2			

TABLE 2 (Continued)

Original context and find spot	Type of use and chronology	Lithology and/or lithostratigraphic unit of provenience					
		Limestone of Krka Limestone Member, Podbukovje Formation	Limestone, breccia and chert, Krško Formation	Limestone and conglomerate of 'Lithothamnium' Limestone Member, Laško Formation	Carbonate and siliciclastic pebbles	Marble	Calcite tufa
	Funerary monuments, second century CE			1		1	
	Funerary monuments, late first–fourth centuries CE	1					
Reused in the surroundings of Neviodunum, originally most likely from the town's necropolises (cf. Table S4)	Funerary monuments, second half of the first century–first half of the second centuries CE	1	1				
	Funerary monuments, second–third centuries CE	1	1	2		1	
	Funerary monuments, third–fourth centuries CE	1					

group, as well as the variety of the attested lithologies, which are however not equally distributed. In the ager most products are made of limestone of Krka Limestone Member of the Podbukovje Formation, especially in its western and central part: clusters of these products can namely be recognized around Ivančna Gorica, Praetorium Latobicorum and Novo mesto. In the central and eastern part of the ager three monuments made of limestone and monomictic conglomerate of 'Lithothamnium' Limestone Member of the Laško Formation are attested. Three marble monuments are documented in the ager (E.9, E.21, E.23), as well as one monument made of calcite tufa (E.10) and one made of limestone of the Krško Formation (E.20).

From the ager of Neviodunum also eight milestones were assessed; one additional item (F.7) could be identified as an uninscribed milestone or as a column shaft (Table 4; see also Table S6 in the Supporting Information section). Here we have three main groups of milestones, dating to 139–141 (F.1, F.5, F.10), to 161 (F.2, F.4) and to 201 CE (F.3, F.6, F.8, F.9, F.11). Milestones appear to be produced from two lithologies corresponding to the lithostratigraphic units of the Podbukovje and Laško Formation, also in one and the same period.

Information about assessed pieces from the town of Neviodunum is gathered in Table 2, while Table 3 shows an overview for the material from its ager, namely from its westernmost to its easternmost part. Main data about milestones (again sorted from the western to the eastern parts of the ager) are presented in Table 4.

Mainly used rocks

The geological assessment of the material from Neviodunum shows a low diversity of the lithologies used, not only for Neviodunum and its immediate surroundings, but also for other parts of the ager, around the stations of Romula and Praetorium Latobicorum, of which, however, only few pieces were assessed. As mentioned above, we included in our research only monuments from the northern half of the ager of Neviodunum, where main Roman settlements and roads were located (cf. Fig. 1). Besides some very rare examples of marble and calcite tufa products, as well as river pebbles that were used exclusively as building material, three main lithostratigraphic units were the source of the natural stone: the Lower Jurassic limestone of Krka Limestone Member of the Podbukovje Formation, the Upper Cretaceous limestone of the Krško Formation, and the Middle Miocene limestone and conglomerate of 'Lithothamnium' Limestone Member of the Laško Formation. From the chronological point of view, there are no evident differences in the use of different rocks: most of them are used from the first century CE onwards until at least the third century.

Krka Limestone Member of the Podbukovje Formation

The Krka Limestone Member is used for a large number of stone monuments, mainly in the town of Neviodunum itself (and in its immediate surroundings) and west of it (cf. Tables 2–4). The entire harbour (see A.1–A.16 in Table S1 in the Supporting Information section; cf. Fig. 4, a) is exclusively made of Lower Jurassic limestone blocks, which represent a huge amount of material of considerable size and weight (singular blocks weigh up to 2 tons: cf. Petru, 1962–64). Very dense limestone of Krka Limestone Member seemed probably the most appropriate material in this watery context, being less susceptible to erosion processes. The complex was also equipped with simple architectural decorations made of the same material. This limestone was also used for several milestones (see F.1–F.6 and F.9 in Table S6 in the Supporting Information section). All the mentioned items require thick to massive beds to produce large enough and durable stone blocks. The use of Lower Jurassic Krka Limestone Member as masonry

TABLE 3 Synthetical overview of the assessed products from the ager of Neviodunum with an indication of the lithologies and/or lithostratigraphic units of provenience (cf. also Table S5 in the Supporting Information section).

		Lithology and/or lithostratigraphic unit of provenience					
Area of the ager	**Type of use and chronology**	**Limestone of Krka Limestone Member, Podbukovje Formation**	**Limestone, breccia and chert of Krško Formation**	**Limestone and conglomerate of 'Lithothamnium' Limestone Member, Laško Formation**	**Carbonate and siliciclastic pebbles**	**Marble**	**Calcite tufa**
Westernmost part of the ager	Funerary monuments, second half of the first century–third centuries CE	3					
Praetorium Latobicorum area, in the western part of the ager	Sacral in votive monuments, end of the second–third centuries CE	3					
	Funerary monuments, first century–first half of the second centuries CE	2				1	1
	Funerary monuments, third century CE	1					
Central part of the ager, around Novo Mesto	Funerary monuments, mostly second–third centuries CE	6	1	2			
South of Neviodunum and the Krka river	Funerary monuments, late first–third centuries CE					1	
Necropolis of Romula, east of Neviodunum	Funerary monuments, second half of the first century–early third centuries CE			1		1	

TABLE 4 Synthetical overview of the assessed milestones from the ager of Neviodunum with an indication of the lithologies and lithostratigraphic units of provenience (cf. also Table S6 in the supporting information section).

Area of the ager	Type of use and chronology	Lithology and lithostratigraphic unit of provenience	
		Limestone of Krka Limestone Member, Podbukovje Formation	Limestone and conglomerate of 'Lithothamnium' Limestone Member, Laško Formation
Westernmost part	Milestone, 139 CE	1	
Central part	Milestone, 161 CE	1	
Central part	Milestone, 201 CE	1	
Central or eastern part (findspot unknown)	Milestone or column shaft, first–fourth centuries CE		1
Eastern part, surroundings of Neviodunum	Milestones, 139–41 CE	1	1
Eastern part, surroundings of Neviodunum	Milestone, 161 CE	1	
Eastern part, surroundings of Neviodunum	Milestones, 201 CE	2	2

building material is rare, but is attested in the walls of the chamber tombs (see B.1 in Table S2 in the Supporting Information section) of the south-eastern necropolis of Neviodunum.

This limestone is used in the funerary enclosure E.18 from Draga near Bela Cerkev, north-east of Novo mesto (Udovč, 2022: 23–24) and in several other monuments from the central part of the ager (E.12–E.15, E.17). This material is very frequent in Praetorium Latobicorum/Trebnje and its surroundings (E.4–E.8 and E.11). It appears also in the above-mentioned elements reused in the church of St. Peter at Jezero east of Trebnje (Breščak & Lovenjak, 2010: 308). The westernmost cluster of assessed monuments made of this lithostratigraphic unit is around Ivančna Gorica (E.1–E.3).

Limestones of the Krka Limestone Member outcrop in the radii of local origin (10 Roman miles; *sensu* Djurić & Rižnar, 2017; Flügel, 1999, 2004) only on the southern side of Neviodunum, in the Šutna area. Other, possible sources in the regional radii of origin are around Novo mesto, Trebnje (Pleničar & Premru, 1970) and Ivančna Gorica (Buser, 1965). Historical quarries of this lithostratigraphic unit are not known in the area near Neviodunum, although several places of extraction of unknown date (Fig. 5) are listed in the database of the *Mining Registry Book* (Geological survey of Slovenia, 2024). The geographical distribution of the assessed archaeological material made of Lower Jurassic Krka Limestone Member (cf. Tables 2–4 and Tables S1–S6 in the Supporting Information section) is coherent with the location of mentioned outcrops. It is possible, that different quarries of this limestone were active at the same time, supplying stone material for different areas of the western and central part of the ager, cutting in this way on transportation costs. This hypothesis cannot be proven based on existing data, as the same litho- and microfacies with the very same characteristics outcrops in different parts of the ager. But, from an archaeological (formal and stylistic) point of view there are some considerations to make. We already mentioned that clusters of monuments made of Krka Limestone Member are present in the town of Neviodunum, around Novo mesto, Trebnje (i.e., Praetorium Latobicorum) and Ivančna gorica. These clusters are clearly pertinent to different production groups, that is, the monuments were produced within different workshops. Each production group could be supplied by its own local quarries, as all four areas

also correspond to the main outcrops of Krka Limestone Member mentioned above (cf. Fig. 5 and Table 3). Even if this argument is not compelling, as different production groups can be supplied by one quarry or, vice versa, one production group by different quarries (cf. Russell, 2013: 267–68; Brajković et al., 2019), it seems at least a plausible hypothesis to be further verified in future research.

'Lithothamnium' Limestone Member of the Laško Formation

'Lithothamnium' Limestone Member (MFT3.1–MFT3.5) is used predominantly in the eastern part of the ager of Neviodunum, namely for a large share of stone monuments, architectural decoration, milestones and also as masonry building material (cf. Tables 2–4). As such, 'Lithothamnium' Limestone Member was used in the walls of the chamber tombs (see B.1 in Table S2 in the Supporting Information section) of the south-eastern necropolis of Neviodunum (cf. also Verbič, 2022), but also in the wall of the elongated building on the so-called forum (see A.23 in Table S1 in the Supporting Information section; cf. Fig. 4, c). It was also used in the architectural decoration (see A.19–A.21 in Table S1 in the Supporting Information section; cf. Fig. 4, b) of the portico in front of it. 'Lithothamnium' Limestone Member is not a very resistant material but was probably preferred because of its easy to work softness.

Sporadic, very specific examples of its use are attested east of Novo mesto. One is a sarcophagus composed of two reused cinerary urns of the third century (E.16 in Table S5 in the Supporting Information section), found in a tomb south of the Paleochristian church of the fifth to sixth centuries at Zidani Gaber above Mihovo (Breščak et al., 2002). The second example pertains to the funerary enclosure E.19, composed of rectangular blocks and half-cylindrical *lorica* elements discovered in Bela Cerkev (Šribar, 1958–59: 251–53; Udovč, 2022: 25); specifically, these consist of monomictic conglomerate (MFT3.4). Interestingly, the afore-mentioned funerary enclosure of similar chronology found nearby in Draga (E.18) was made of limestone of Krka Limestone Member.

Most of the assessed products made of limestone and conglomerate of 'Lithothamnium' Limestone Member—honorary, votive and funerary monuments—are from Neviodunum itself (see Tables S1 and S3 in the Supporting Information section), its necropolises (see Tables S2 and S4 in the Supporting Information section). One stele made of 'Lithothamnium' Limestone Member (E.22), with similar formal characteristics as the town's monuments, and therefore probably pertinent to the same workshops, was also found in Romula/Ribnica. Most milestones made of this material (see F.7, F.8, F.10 and F.11 in Table S6 in the Supporting Information section) are from the immediate surroundings of Neviodunum or east of it. Since the conglomerates in this formation can be considered as a clue for a site-specific (or at least area-specific) provenience determination, it should be noted, that one milestone (F.11) made of polymictic conglomerate (MFT3.5) was found at Obrežje, while one uninscribed milestone (or column shaft) of uncertain provenience (F.7) made of monomictic conglomerate (MFT3.4) is displayed at Bela Cerkev.

Middle Miocene 'Lithothamnium' Limestone Member occurs at suitable sites to the north, west and south of Neviodunum in the local radii of origin. These sites correspond in facies and age to those of the Neviodunum stone products. Historical places of extraction are known from Šutna, the area south of Čatež ob Savi,[7] at Podgračeno[8] and Mokrice/Čatež ob Savi (Fig. 5), where there are outcrops of polymictic conglomerates (cf. Appendix S1 in the Supporting Information section), which are present in some products of Neviodunum itself (A.23, C.5 and C.21) and in the milestone F.11 from Obrežje (east of Neviodunum). As mentioned above, the area of Šutna disposes also of Krka Limestone Member outcrops and this could represent an advantage for locating the ancient quarries of 'Lithothamnium' Limestone Member of the town of Neviodunum in the same area, making use of the same transportation routes.

Based on geological samples monomictic conglomerates are present at primary outcrops at Bela Cerkev (cf. Appendix S1 in the Supporting Information section), where also the only two products made of this material (E.19 and F.7) are located.

It is important to note that the two different microfacies types of conglomerates, monomictic (MFT3.4) and polymictic (MFT3.5), reported from archaeological and geological samples, indicate (at least) two quarry sites of the Middle Miocene 'Lithothamnium' Limestone Member. The different composition of the conglomerate clasts namely reflects the pre-Middle Miocene paleosurface in the studied area (Poljak, 2017) and therefore rules out the possibility of a single quarry of the Middle Miocene 'Lithothamnium' Limestone Member in the ager of Neviodunum.

On the contrary, the lithofacies type yellowish shallow marine limestone, which occurs in the higher parts of the 'Lithothamnium' Limestone Member succession is composed of identical microfacies types at all the sites investigated. Therefore, its origin cannot be pinpointed based solely on the basis of petrographic and paleontological analysis.

Krško Formation

The limestone of the Krško Formation appears almost only in Neviodunum and is less common among the studied products (cf. Tables 2 and 3). Due to its occurrence in thin beds, the lithofacies types of Krško Formation (limestone, chert and breccia) were used primarily as masonry building material; see the wall A.23 of the elongated building on the northern side of the so-called forum (Fig. 4, c) and the tomb walls B.1 in the south-eastern necropolis of Neviodunum (cf. Verbič, 2022). Singular blocks of this lithostratigraphic unit were also used as architectural elements (A.22 and C.8) and as funerary monuments (D.5, D.8 and E.20).

The Upper Cretaceous Krško Formation outcrops only 3 km air distance to the north of Neviodunum (Fig. 5). Geomorphological or archaeological traces of quarry activity are here likely destroyed by modern regulation of the Sava River (Verbič & Berič, 1994). Suitable facies occur also to the north and west, but only the area south-west of Dolenji Boštanj (Rožič et al., 2010) (north-west of Neviodunum) is directly connected to Neviodunum by the Mirna and Sava rivers, at a distance of almost 20 km. A small amount of suitable outcrops occur south of Neviodunum, at 7 km air distance: historical sites of extraction are again known from Šutna (northern slope of Gorjanci) (Geological survey of Slovenia, 2024).

As already mentioned, this lithology is used almost only in the town of Neviodunum (Table 2 and see Tables S1–S4 in the Supporting Information section). One exception is the stele E.20 (see Table S5 in the Supporting Information section), reused as lid of a tomb near Šmarjeta, north-east of Novo mesto: for its rudimentary, only engraved decoration and irregular inscription it is definitely pertinent to another production group than the examples from Neviodunum itself and seems to be the result of a somehow extemporary, strictly local craftsmanship. This could point to the fact that also the stone was sourced elsewhere than the material intended for the town. Some outcrops of the Krško Formation are in fact also known in areas not far from Šmarjeta north-east of Novo mesto (Fig. 5), but it is also possible that the stone was transported there from another quarrying site within the ager.

Inferences about the provenience of mainly used rocks

For the identification of the quarries of the town, the coeval use of all three main lithostratigraphic units, as it appears in Neviodunum itself (cf. Table 2), seems very significant. At least hypothetically, the provenience should be searched in an area where all three

formations are present. In the study area this applies only to the area south of Neviodunum to the village of Šutna, where all three units occur in primary outcrops (Fig. 5). The location would probably require a combination of river (Sušica and Krka) and land transport of the stones to Neviodunum, which was very well connected to the south by at least three roads (Fig. 2). In consideration of different possibilities of reconstruction of the ancient hydrography of the area between the Krka and Sava rivers, it is premature to suggest the specific route of supply. Certainly, the banks of the Krka River seem in this area to be particularly rich in archaeological sites. Some iron age hillforts (Mason & Kramberger, 2022: 9–14) could indicate that the quarries were already in use in prehistoric times. Especially the hillfort of Stari Grad v Podbočju stands out here for its vicinity to the Šutna area. The site was frequented also in Roman and then in Medieval times, when a fort was built there, showing off also with Romanesque architectural stone decoration (Guštin et al., 1993; cf. also the funerary lion statue E.21 in Table S5 in the Supporting Information section, which was perhaps reused in the fort). Several Roman sites with settlement and burial remains clearly show the importance of the area in Roman times (Saria, 1937–40: 254–55; Škaler et al., 1958–59; Petru, 1960–61b; Škaler, 1968–69; Breščak, 1989; Grosman, 1996: 65, 68; Bavec, 2006; Bavec & Olić, 2007; Bavec & Murko, 2008; Pergar, 2009; Pavlovič et al., 2021; Vojaković & Novšak, 2022: 74, 105, 108). Especially the archaeological site of Gazice seems to be interesting in relation to our hypothesis about the location of the town's quarries, as the traditional name of the site is Rimski breg, meaning in Slovenian 'Roman river bank', and Roman worked stone has been copiously found on the site (Škaler, 1962–64), possibly indicating that the site was related to the transport of quarried stone.

The situation of the ager seems to be different. Based on the spatial distribution of artefacts of the very same chronology and type made of different rocks it seems plausible, that the ager was supplied by different quarries. The use of different lithologies differs namely in different parts of the ager. As described above and as shown in Tables 3 and 4, in the western and central parts of the ager, almost only limestone of the Krka Limestone Member is used, which could be quarried in different local quarries, connected to different production groups. At the same time, the central and eastern part of the ager was supplied with limestone and conglomerates of 'Lithothamnium' Limestone Member products, the use of which becomes exclusive east of Neviodunum. As mentioned above, based on petrography (at least) two different quarries of 'Lithothamnium' Limestone Member are attested, one with polymictic (cf. artefacts A.23, C.15, C.21 and F.11 from the town of Neviodunum and east of it, as well as geological samples from the Šutna and Mokrice/Čatež ob Savi area) and the other with monomictic conglomerates (cf. artefacts E.19 and F.7 from Bela Cerkev, as well as geological samples from the same area).

In the ager, the spatial distribution of products made of different rocks is mostly in line with the location of the main outcrops of the respective lithostratigraphic units (Fig. 5). A vivid example of this is the use of both, Krka Limestone Member and 'Lithothamnium' Limestone Member for the production of three milestones of Antoninus Pius dated to 139–40 CE and five milestones of Septimius Severus and his sons, set up under the supervision of the same imperial *legatus* Lucius Fabius Cilo in 200–01 CE.[9] Coeval milestones in the western and central area of the ager are made of limestone of the Krka Limestone Member, while in the eastern strip of the ager they are made of 'Lithothamnium' Limestone Member (cf. Table 4). The preference for one material or another can here be only explained by considering the proximity of one or another quarry to the sites, where the milestones had to be set up. We therefore think that different local quarries were active in the ager of Neviodunum.

Rarely used rocks

Besides mentioned main lithologies, some others were identified, but within the assessed material they appear to be used for few or singular artefacts. These are pebbles, most likely of the Drnovo Alloformation, white marble and calcite tufa.

Pebbles

Siliciclastic and carbonate pebbles, largely used for the walls of the elongated building A.23 on the so-called forum and of the chamber tombs B.1, were probably extracted on site, as the lithological composition of the pebbles strongly resembles the composition of the Drnovo Alloformation (Poljak, 2017).

White marble

White marble was identified in only six products (three from the town: B.3, C.20 and D.3; three from the ager: E.9, E.21 and E.23): four funerary, one votive and one honorary monument. Its predominant use in funerary and votive monuments is at least unexpected (if we consider that the use of marble would be much more likely within public monuments). Still more unexpected is the overall small number of marble products attested in the area. This shows that marble trade was not very well established in Neviodunum and was connected only to singular commissions. The scarcity of its use shows its high price, that in minor Roman towns only a few could afford, especially in consideration of the transportation costs. But also the local public administration of Neviodunum could apparently not afford much of marble items. One exception is the marble honorary monument (C.20), dedicated from the municipal council to T. Eppius Latinus, which was duumvir in Neviodunum and procurator of an imperial province under Trajan as well as procurator of a special tax in Africa (Lovenjak, 1998, no. 26). Other marble artefacts in the study area are private monuments. One of the marble funerary monuments comes from the area north of Praetorium Latobicorum (E.9) and consists of a slab with inscription, mentioning the typical Celtic name Togivepus, showing that the local population was however interested in the use of marble as a special status symbol. The marble provenience will have to be confirmed in future research, but based on proximity to the source we assume its connection with the nearest marble outcrops in the Eastern Alpine Pohorje region (for which we refer to Djurić & Müller, 2009).

Calcite tufa

One funerary monument (E.10) is made of calcite tufa, which might be used as a surrogate for marble for its translucent characteristics: it consists of a fragmentary slab from Tržišče near Mokronog north-east of Praetorium Latobicorum, with an irregular, rustical inscription mentioning Vepo, son of Caio, which was son of Boudio and husband of Suadella. All mentioned names are Celtic and are typical for the Noricum area. The name Vepo is similar to the aforementioned, very characteristic name of Togivepus of the marble funerary monument E.9, which pertains to the same area and chronology (Lovenjak, 1998, no. 93). This could indicate that they were somehow linked and, more generally, that especially members of the Celtic elites were interested to auto-represent themselves by using marble or marble surrogates in their funerary monuments. As for the provenience of the calcite tufa, it could probably occur in the same area as the shallow marine limestone of the Lower Jurassic age, as this is one of the lithologies that

is most susceptible to karst weathering and the formation of calcite tufa. Therefore, it is likely that the material originates from the same areas as the Krka Limestone Member, which is also most likely, considering the area of discovery, characterized by the predominance of Lower Jurassic limestone products. However, this does not completely exclude the possibility that it has a separate origin or even that it originates from the 'Lithothamnium' Limestone Member. Thus, its provenience cannot be defined with existing data.

CONCLUSIONS

The analysis of 95 selected stone monuments leads us to the following conclusions. These are not definitive, as we assessed only a part of the discovered stone products of Neviodunum and its ager, but the analysed selection seems to be quite representative. As usual, additional stone products will probably be found also in the future, possibly changing our outcomes.

The town of Neviodunum was mainly supplied with lithologies belonging to three lithostratigraphic units of local provenience: the Lower Jurassic Krka Limestone Member of the Podbukovje Formation, the 'Lithothamnium' Limestone Member of the Laško Formation and the Upper Cretaceous limestone, chert and breccia from the Krško Formation. Additionally, pebbles (mostly likely of the Drnovo Alloformation) and some marble monuments are also attested. Functional characteristics of the rocks influenced probably the choice for the use of one material over another. Very dense Lower Jurassic Krka Limestone Member of the Podbukovje Formation is used in the area of the fluvial harbour, representing the most challenging construction site of the town in terms of quantity and dimensions of the blocks employed. In the nearby (at least nearly coeval) so-called forum, very soft 'Lithothamnium' Limestone Member is used for the architectural decoration and limestone of the Krško Formation (together with other lithologies) for its wall structures. Considering their coeval use, the most likely place of provenience of all three lithologies is the area of Šutna, at about 7 km air distance from Neviodunum, as this is the only location in the whole area of the ager where all three lithostratigraphic units outcrop in close proximity to each other.

In the assessed monuments of the northern half of the ager of Neviodunum mostly two lithostratigraphic units are attested and their use differs in different parts of the ager. The Krka Limestone Member is used in its western in central part up to the town of Neviodunum, 'Lithothamnium' Limestone Member in its central and eastern parts. These two lithologies appear to be used at the same time and indiscriminately for the same types of products, but respectively in different parts of the ager. This shows that the stone material was not centrally supplied for the whole ager and, probably, that different quarries were in use at the same time in different parts of the ager. This hypothesis has still to be fully proved, but is at least demonstrated for the conglomerates of Middle Miocene 'Lithothamnium' Limestone Member, for which two different microfacies types have been detected in the assessed stone products, excluding the possibility of a single quarry of the Middle Miocene 'Lithothamnium' Limestone Member in the ager of Neviodunum. Especially significant in this regard is also the evidence offered by milestones: some are produced in the same year and for the same road either from 'Lithothamnium' Limestone or from Krka Limestone Member, depending on the area where they were set up. The selection of one material or another seems here dictated by the proximity of one or another quarry, as the spatial distribution of milestones made from one or another limestone is coherent with the location of the main outcrops of both lithologies. In the ager, different rock types are used in a quite indiscriminate way, with no special concern to bed thickness and softness of the rocks. Most lithologies appear to be used as multifunctional stones, from building material to monuments of considerable dimensions. And this could also be the reason for the existence of more quarries over the territory of the ager, as they probably supplied at the same time building material and different types of stone monuments.

Extremely rare appears the use of marble. The town and the ager are in this regard similarly poor. Numbers could change in the future, if, for example, some other public building of the town would be discovered, but in consideration of the current data, marble seems to be used only exceptionally and mostly only in private context, as shown by the fact that four funerary and one votive (= private) monuments and only one honorary (= public) monument are made of marble. This is consistent with the minor relevance of the town of Neviodunum and the absence of exigent elites/colonists of Italic origin in the town and its ager—the latter is coherent with the fact that local names and non-sophisticated monument forms are preponderant in the *corpus* of funerary monuments. The use of a marble surrogate (calcite tufa) in the funerary monument of a Celtic family from Tržišče near Mokronog has also to be pointed out here, attesting to the fact that marble was anyhow seen as a status symbol and was therefore replaced or imitated in different ways. This is shown also by the aforementioned mosaic found south of the so-called forum, imitating *opus sectile* panels made of different coloured marbles (Puhar, 2022). Considering the lithological repertoire of the stone products of Neviodunum, this mosaic represented apparently some kind of fanciful desideratum in the town.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available in the Supporting Information section.

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ENDNOTES

[1] Most of Petru's excavation plans represent singular buildings and contexts. It is therefore difficult to georeference them exactly, when the remains are not displayed *in situ*. A schematic plan showing the position of the fluvial harbour and the nearby elongated building with the portico was published by Nataša Štupar-Šumi (1968–69: 55). Figure 2 presents the ground plan of the elongated building with the portico, which is displayed *in situ*, and its excavation plans could therefore be georeferenced exactly. We also georeferenced exactly the displayed remains of the fluvial harbour, which have though been repositioned by Petru for their presentation. The excavation plans of the discovered remains of the harbour were vectorized and located in accordance with the aforementioned general plan (Štupar-Šumi, 1968–69: 55), considering also the overlapping of the walled foundation structures and the reconstructed piers.

[2] The column drum is nowadays located in the lower terrace, pertaining to the harbour. Similarly also pieces from the harbour are today placed on the higher terrace, where some materials from other locations are also exposed for the public.

[3] This datation was suggested by the presence of a coin of Hadrian on the floor of the elongated building. Of course, this coin attests to the time of use of the building, not necessarily exactly to its construction period.

[4] As mentioned above, the retrieved graphic documentation of Petru's excavations is incomplete; the location of this building was therefore defined by interviewing an eyewitness involved in the excavation of the building as a child.

[5] The crown of the walls of the elongated building and of the portico was reconstructed for presentation purposes. We therefore considered and sampled only the lower part of the structure, which can be regarded as original, considering the documentation about the consolidation and restoration work completed after the excavation of the site.

[6] The dating of the epigraphic material is resumed from Lovenjak (1998) and the Epigraphic Database Heidelberg. The chronology of the architectural remains is based on excavation data and/or stylistic elements. Pieces that are not clearly datable are attributed to the period of existence of Neviodunum between the end of the first and the fourth centuries CE.

[7] The site was identified as potential Roman quarry (cf. Petru, 1975), but without solid evidence.

[8] The site is suggested as the area of provenience of building material of a funerary enclosure in the western necropolis of Romula/Ribnica (Lazar, 2020: 398).

[9] The same Fabius Cilo is also mentioned in the consular date of the votive altar E.6 (see Table S5 in the Supporting Information section), from Trbinc in the area north of Praetorium Latobicorum (Šašel Kos, 1997, no. 137; Lovenjak, 1998, no. 61). As attested by several milestones, in 200/201 CE governor Lucius Fabius Cilo intensively cared for the renewal of the road network of his province Pannonia Superior (Kiss, 2007) and was in general a notable figure in the entourage of Septimius Severus, covering several important positions (Mennen, 2011).

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