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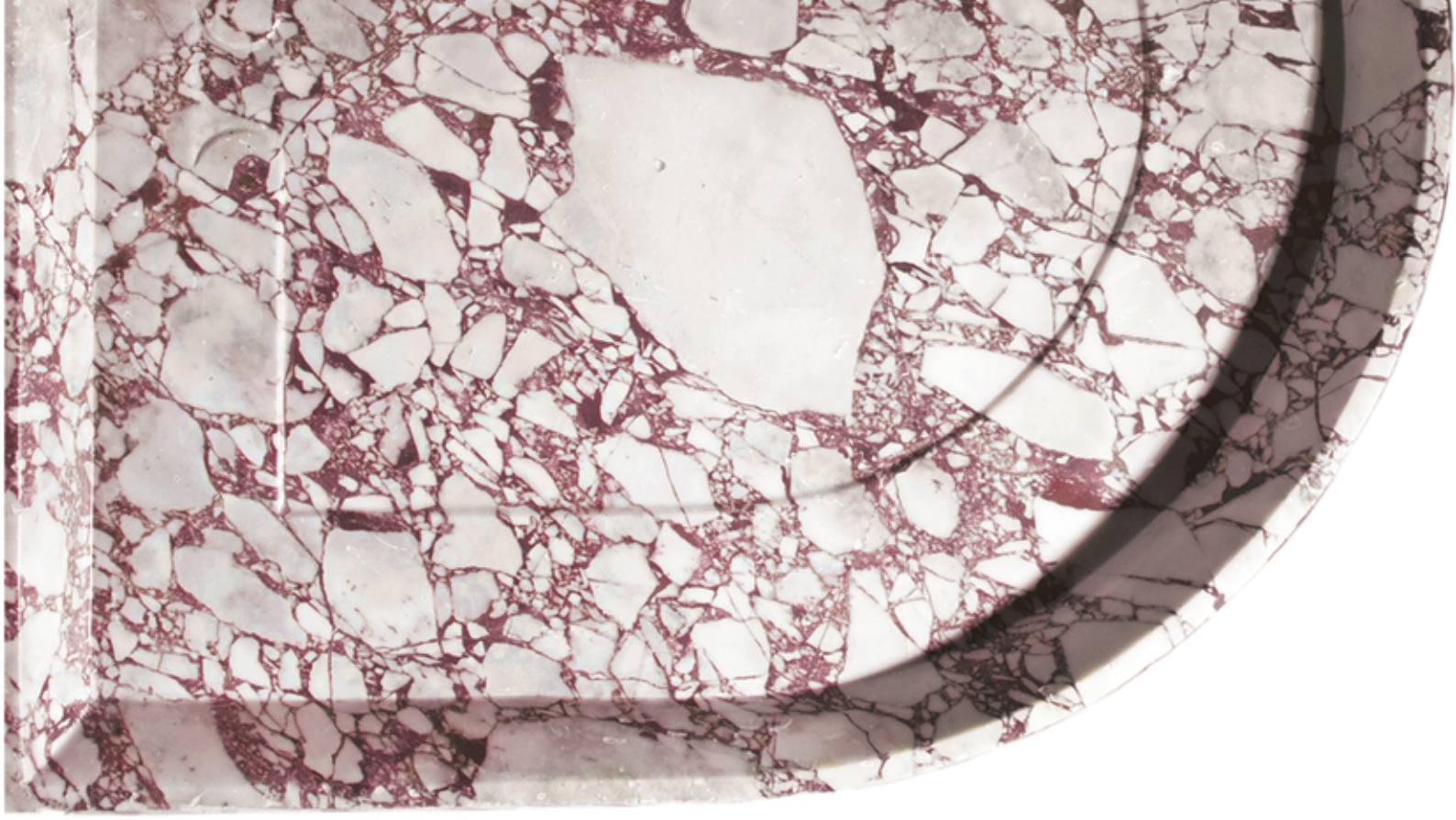

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CONTENT

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THE IMPACT OF THE LOCAL GEOMORPHOLOGICAL AND GEOLOGICAL FEATURES OF THE AREA FOR THE CONSTRUCTION OF THE BURNUM AMPHITHEATRE

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Abstract

In the middle of the 1st century intensive construction activities were conducted on the north-western boundary of the Roman military camp at Burnum. An amphitheatre, along with some additional military structures, was erected by the XI Legion CPF (*Legio XI CPF*) in that period. A natural doline was modified for the purposes of the amphitheatre construction, and therefore the physical and cultural landscape settings were permanently altered. The task of the interdisciplinary research team was to define the effect of the geomorphological and geological landscape settings on the formation of the Burnum agglomeration and to determine the physical and cultural landscape changes in the past.

Keywords
Burnum, archaeology, geology, geomorphology, the Krka river

1. Introduction

At the end of Bato's rebellion in Illyricum (AD 6-9) the Romans built the Burnum legionary military camp (*castra*).[1] It is located on the right bank of the river Krka (*Titius flumen*), on the opposite side of the Liburnian hillfort (*oppidum*) of *Burnistae* on the Gradina near Puljani (Fig. 1). It had the function of the strategic-military control of the area and control of the Krka River Canyon as well as of river crossings.[2] In Burnum during the first century legions (*legiones*) were stationed, as well as various auxiliary units (*auxilia*) (CAMBI *et al.* 2007, 11-30; MILETIĆ 2010, 120-135), the soldiers of which built a number of objects intended for military requirements (*castellum, amphitheatrum, campus, aquaductus, viae*). In the vicinity of the camp a civilian settlement (*canabae*) was established when the *oppidum* of *Burnistae* still existed. They together formed the Burnum agglomeration, which became a *municipium*. That probably happened after the legions left Burnum, maybe in the period of the Emperor Hadrian.[3]

In the middle of the 1st century a military camp, amphitheatre (*amphitheatrum*) and military training ground (*campus*) were built on the NW outskirts. Prior to their construction the rocky karst surface was levelled and filled with material that is abundant in small archaeological finds (parts of military equipment and weapons and objects from everyday life).

In this article, we have used an interdisciplinary approach in the exploration of the archaeological site within case study of the Burnum amphitheatre and its surroundings. The main aim of the research was to determine the influence of the geomorphological and geological characteristics of the area on the formation of the Burnum agglomeration and to detect changes in the physical and cultural landscape throughout history.

2. Outline of archeological research within the study area

A systematic archaeological survey has been conducted in the area of the Burnum agglomeration since 2003. The research was carried out by the Department of

1 It is possible that in the area of Burnum there already existed a temporary military camp (*castra aestiva*). The end of the construction works of a permanent military camp (*castra stativa*), which was built of stone by soldiers of *Legio XI,* supported by soldiers of auxiliary units of *Ala I Hispanorum,* is dated between AD 14-17.

2 The garrison of Burnum controlled the passage across the Krka River by Puljane as well as passages several kilometres upstream by Bobodol and downstream in the area of Roški slap. A system of fortifications was erected within key locations (Strmica and Pađani on Mokropolje, Kapitul by Knin, Kadina glavica by Promona etc.) where *vexillationes* of legion and auxiliary units controlled the main communication lines of a wider area.

3 Inscription *CIL* III, 2828 = 9890, which was erected by *ordo decurionum* in honour of Hadrian, is dated AD 118.

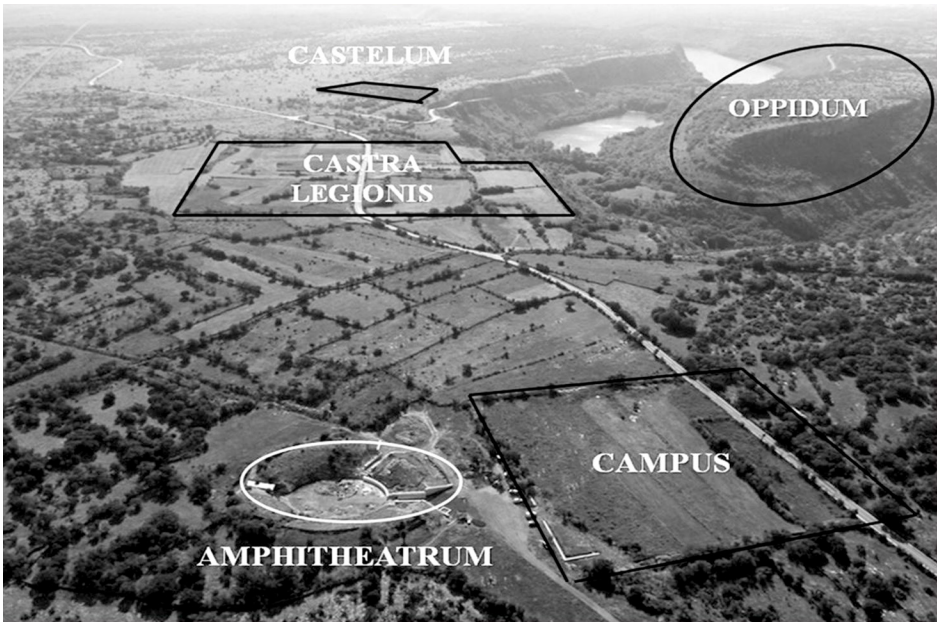

Fig. 1.
Position of the amphitheatre within the Burnum legionary camp

Fig. 2.
Aerial photograph of Burnum amphitheatre prior to archaeological works

Archaeology of the University of Zadar and the Municipal Museum of Drniš in cooperation with Laboratorio di Rilievo delle Strutture Archeologiche del Dipartimento di Archeologia dell'Università di Bologna supported by Krka National Park (e.g. CAMBI *et al.* 2006; CAMBI *et al.* 2007; CAMBI *et al.* 2008, 397-408; GLAVIČIĆ, MILETIĆ 2009, 75-84; GLAVIČIĆ 2011, 289-313; GLAVIČIĆ, MILETIĆ 2013, 157-172). The research revealed the construction of an amphitheatre (*amphitheatrum*) and some other military structures on the northwest margin of the Roman military camp (Fig. 1). It was also determined that the karst area was levelled, small depressions being filled by material consisting of small scale archaeological remains such as military equipment, arms fragments and everyday items. About the whole expanse of the amphitheatre was explored in detail. Constructional solutions that were adopted for the integration of objects within the natural configuration of the landscape were precisely documented since the amphitheatre was built within the perimeters of a doline (Fig. 2). The amphitheatre can be described as a four entrance amphitheatre type with two main entrances in the ellipse vertex and two side entrances. The asymmetrical arrangement of the entrances is interpreted as a consequence of the uneven terrain configuration within the doline. The funnel shaped walls of the side entrances were constructed for converging groups of the audience into the passages leading into auditorium. The south and north entrance extended to the arena. The side entrance walls were the foundation of an arch that was constructed in such a way that stripes of marly limestone and tufa interchanged (Fig. 3). The arena had a regular ellipsoid shape with a longer axis of 44 m and a shorter axis of 33 m. Its floor was of gravel and sand, which covered the levelled bedrock surface. Natural

Fig. 3. Use of local tufa and marly limestone as a construction materials in the amphitheatre

Fig. 4. Infill of grikes for the purpose of levelling the surface prior to construction works

widened cracks between grikes in the lower section of doline slopes were modified so as to function as drainage channels Although the auditorium was in very poorly preserved state, the construction method the the seating rows was documented. It is hypothesised that the capacity of the Burnum amphitheatre was suitable for six or more thousand spectators.

Two main construction phases were identified by means of archaeological explorations: the first phase from the period of Claudius and the second one from Vespasian. The first phase of construction was defined on basis of small-scale archaeological material discovered in the levelling layer that consisted of stone and soil below the substructures of the buildings. They were also identified within drainage channels, the east and west entrance and around the amphitheatre. An abundance of various artefacts of military provenance and other everyday life items was discovered within those strata (Fig. 4). The age of this material was typologically set to the late Augustan-early Tiberian period to the Claudian period. That age was also confirmed by about 300 coins that were discovered in the levelled layer. Bronze denominations prevailed among them, struck from the period of Augustus to the early period of Claudian rule. All the construction works related to terrain altering and levelling and the first phase of amphitheatre building were therefore carried out by the soldiers of the XI legion that was stationed in Burnum in that period. The results of archaeological excavations make it possible to relate the construction to historical context. Because in AD 42 the legionaries disobeyed imperial legate of the Dalmatian province, Lucius Aruntius Scribonianus, who had wanted to overthrow the newly installed emperor Claudius, legion XI was awarded the title *Claudia pia fidelis*. In the following years, the area of military camp in Burnum became the site of great construction works. Those building activities lasted a decade and incorporated the northwestern periphery where the *Legio XI CPF* soldiers built an amphitheatre and other military buildings.[4]

The second building phase was dated by the monumental Vespasian inscription that was put on the south facade of the amphitheatre entrance in the year 76/77 AD.[5] This was the final act of the reconstruction and rebuilding of the amphitheatre, financed by the Emperor as confirmed by his name, written in the nominative. At

4 Remains of the foundations of parallel walls were discovered on the south side of the amphitheatre. The space between those wall remains is approximately 9m and they were a part of a monumental building with dimensions about 150 x 150m. It is assumed that these are the modest architectural building remains of a military training ground (*campus*). The *campus* had series of chambers that were situated in a processional part that surrounded a central open area (*palestra*). In the middle of the structuret on the eastern side, a monumental three-piece entrance with a barrel vault made of tuff blocks was discovered. The exterior wall on the north side was strengthened by a counterfort. During the archaeological excavations that were conducted along the northern perimeter of the military training ground, it was proven that this area was also levelled. The levelling of karstic terrain was done by pruning the bedrock and filling the grikes with a layer consisting of stone and soil in the same way as was defined in the area of the nearby amphitheatre. Discovered within the levelling layer was the same amount and type of archaeological military provenance material and items used in everyday life as in the amphitheatre substructions and around it.

5 The inscription inscribed onto a big block of quality fine-grained limestone (294 x 100 x 32cm): *Imp*(*erator*) *Caesar Ve*[*s*]*pasianus Aug*(*ustus*) *pont*(i*fex*) *max*(*imus*) / *trib*(*unicia*) *pot*(*estate*) *VIII imp*(*erator*) *XVIII p*(*ater*) *p*(*atriae*).

Fig. 5.
The large tufa dams of the Manojlovac waterfall within the Krka River canyon

that time, the construction of side entrance walls, covered passages, auditorium and arena walls took place. As a result of the extensive construction works, the Burnum amphitheatre took on monumental proportions. The works were conducted by the soldiers of *Legio IIII Flavia felix*, stationed in Burnum during that period.

After the IV legion left Burnum in 86 AD, the amphitheatre maintained its primary function. The amphitheatre remained a strong medium for promotion of Imperial policy as well as for the Romanisation of the local population, since it was a place for spectacles that attracted a great number of visitors. It is not known when the amphitheatre ceased to operate. It gradually collapsed most likely in late antiquity due to weathering of construction materials. This was confirmed by means of an archaeological survey that revealed collapsed arches and building material within passages.

3. Materials and methods

The geomorphological and geological survey of the area was conducted during campaigns in 2014. It was supported by analysis of a digital terrain model (DTM field), topographical maps and geological maps. The aim of the field survey was to acquire data on general geomorphological settings of the area and the bedrock variety along with data of possible exploitation of natural resources in the past. Geomorphologic analysis of the study area was conducted by applying basic analytic geomorphological methods (PAVLOPOULOS, EVELPIDOU, VASSILOPOULOS 2009). Morphographic analyses included identification and spatial documentation of geomorphological features and the surrounding plateau using topographic maps and detailed morphographic mapping in the field. The morphographic field mapping that was carried out was accompanied by morphometric analysis of landforms such as dolines and other elongated depressions along the plateau. Morphometric data regarding landforms were obtained in the field using barometric altimeters and GPS. Furthermore, the morphometric analyses were supported by analysis of topographic maps. Morphostructural analyses of bedrock and sediments were conducted in exposed bedrock areas and within excavated profiles.

4. Geological and geomorphological settings of the area and their impact on construction of the Burnum amphitheatre

The whole area of the Burnum campus is located in the central part of an extensive North Dalmatian corrosion plain (Sjevernodalmatinska zaravan) close to the Krka River. It is an area of levelled lowland at elevations between 220 and 320 m dissected by the deep canyons of the Zrmanja, Krka and Čikola Rivers (ROGLIĆ 1957, 107). It is built mostly of carbonate bedrock that hosts a karst landscape. As a result, there is almost complete vertical drainage of precipitation. With exception of the three bigger rivers intersecting the area, there is an almost complete absence of surface drainage (PERICA, OREŠIĆ, TRAJBAR 2005, 143). Therefore the surface is dissected only by typical karst features such as grikes, dolines, isolated cone hills and other non-typical middle sized karst depressions (MIHEVC 2010, 33).

Fig. 6.
Location where there were quarries of bedded marly limestone in antiquity

The surrounding plain in the wider area of the Burnum amphitheatre is built of Paleogene age carbonates. North of the site is an axis of an anticline in the northwest-southeast direction. A limited area around the amphitheatre consists of Eocene and Oligocene carbonate conglomerate with thin beds of limestone. It is surrounded by Eocene and Oligocene bedrock, which comprise limestone conglomerate, breccia and layers of marl (GRIMANI *et al.*, 1966, 36). Throughout our survey relatively thick layers of marly limestone were identified only in a few isolated strata.

The area of the amphitheatre and its surrounding is almost completely flattened at lan elevation of 250m. Surface karst features as dolines and grikes are positioned westwards where the surface is barren and predominantly rocky. The karst surface east of the amphitheatre has been completely altered by human activity. It is densely covered by dry stone walls, larger piles of rock, ruins and soil layers. Almost no karst features are exposed on the surface except sporadic outcrops of the carbonate bedrock. The extent of the modified karst area illustrates the approximate extent of the Burnum *campus* that was clearly located eastwards of the amphitheatre.

The canyon of the Krka River is located a few hundred meters southeast of the amphitheatre. It is entrenched more than a hundred metres deep into the surrounding plain forming a vast, almost half a kilometre wide canyon. In the close proximity of the Burnum campus in the canyon, there are extensive tufa dams with a number of waterfalls (Fig. 5). Two types of tufa are formed within the riverbed. Fine grained silty tufa deposits are accumulated within lakes in the hinterland of the dams. Great quantities of compact and porous tufa are positioned within the dams (PERICA, ORešIĆ, TRAJBAR 2005, 135).

For construction of the amphitheatre, a natural dissolution doline was utilized. The dimensions of the amphitheatre were strongly influenced by the initial doline. Through detailed morphometric analysis of surrounding dolines towards the northwest we establish that the dimensions and orientation of their longer axis strongly correspond to those of the amphitheatre. Prior to the beginning of construction works the karren surface of the area was levelled by cutting and hewing. Numerous cavities between the karren were filled by stone debris and soil. Those cavities provided abundance of archaeological remains. The majority of the finds can be easily dated to the early Imperial period along with numerous coins.

Analysis of the construction material of the amphitheatre exhibits that limestone conglomerate and breccia are the prevailing materials. External walls are constructed of blocks of marly limestone and travertine. Limestone conglomerate and breccia are common local materials, available in large quantities.

Within our field investigations we identified small quarries where bedded marly limestone was excavated (Fig. 6). They are positioned more than a kilometre towards the southwest where the bedrock alters to Lower Oligocene marly limestone along with fine-grained conglomerates (GRIMANI *et al.* 1966, 36). Those quarries that provided construction material for the amphitheatre were opened here in antiquity. Large amounts of tufa, which is present as a construction material in the amphitheatre and also plenty of other structures in the campus, were obtained from nearby tufa dams within the canyon.

Both marly limestone and tufa are porous and prone to intense mechanical weathering when exposed on the surface. Local climatic conditions that also favour

intense frost action add to the dynamics of the process. This eventually led to the gradual decay of the amphitheatre and the final collapse of vaults and side walls.

5. Summary

Constructions over the wider area of the Burnum military camp permanently changed the physical and cultural landscape. An interdisciplinary approach, involving archaeologists and geologists, is aimed at determining how the formation of the Burnum agglomeration was influenced by the geomorphological and geological characteristics of the area and at detecting the changes in the physical and cultural landscape during the course of history.

The utilization of the local resources and construction materials significantly influenced the spatial position, morphology and structure of the amphitheatre. The lack of any local material more resistant to mechanical weathering eventually led to the significant decay of the majority of the structures within the Burnum legionary military camp along with the amphitheatre.

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