

# RESULTS OF LIDAR SCANNING AND ARCHAEOLOGICAL SURVEY OF THE SELECTED AREAS BETWEEN THE RIVERS KRKA AND CETINA FROM 2019 TO 2021

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## Izvešček

[Rezultati lidarskega skeniranja in arheološkega pregleda izbranih območij med rekama Krka in Cetino v letih od 2019 do 2021]

Hrvaška znanstvena fundacija od konca leta 2018 financira znanstvenoraziskovalni projekt "Razumevanje rimskih meja: primer vzhodnega Jadrana". Namen projekta je ugotoviti morebitne arheološke sledi rimskih vojaških utrd v zaledju rimskih kolonij Jader in Salona, to je na območju med rekama Krka in Cetino. Na 71,5 km dolgem in ozkem prostoru smo za identifikacijo morebitnih rimskih vojaških taborov in/ali objektov izbrali metodološki pristop, ki temelji na sedmih raziskovalnih fazah v štirih letih. V prispevku predstavljamo nepričakovane rezultate. Z lidarskim skeniranjem smo odkrili več doslej neznanih struktur, podobnih rimskim vojaškim taborom, in to na krajih, kjer jih nismo pričakovali. Nova najdišča in njihovo okolico smo sistematično pregledali, da bi ugotovili njihov arheološki potencial in pridobili osnovne podatke.

**Ključne besede:** Dalmacija, lidar, rimski vojaški tabori

## Abstract

Since the end of 2018, the Croatian Science Foundation has been funding the scientific research project "Understanding Roman Borders: the Case of the Eastern Adriatic". The project aims to determine possible archaeological traces of Roman military fortifications in the hinterland of the Roman colonies of Iader and Salona located between the rivers Krka and Cetina. To optimally identify possible Roman military camps and/or structures in an unusually elongated and narrow territory of 71.5 km air distance, a methodological approach was chosen based on seven consecutive phases of research that would be conducted over a period of four years. This paper presents the unexpected results. The data, obtained using LiDAR scanning, showed several hitherto completely unknown structures similar to Roman military camps in places where their existence had never been assumed. Following these findings, a systematic field survey was conducted in and around these sites to determine their archaeological potential and obtain basic information on the sites.

**Keywords:** Dalmatia, LiDAR scanning, Roman military camps



Fig. 1: Central Dalmatia: main settlements and legionary fortresses.

## 1. INTRODUCTION<sup>1</sup>

In the hinterland of the province of Dalmatia, between the cities *Iader* and *Salona*, the area first conquered by the Romans, the existence of a very early Roman line of defense is assumed (Fig. 1). The so-called *Delmataean limes* was established, according to Carl Patsch, who first wrote about it, to protect the conquered territory from the indigenous population (Patsch 1922, 57).<sup>2</sup> For this reason, the Romans raised two fortresses (*Burnum* and *Tilurium*) and several forts, along the Roman state road, connecting *Aquileia* with *Salona* and

*Dyrrachium* (Dziurdzik, Pisz, Rašić 2018).<sup>3</sup> This bold hypothesis was generally, with some remarks, accepted by the experts on the subject (Šašel 1974, 194–199; Wilkes 1977, 245–246; Zaninović 1996, 213–214; Šašel Kos 1997, 284; Sanader 2002, 713–718; Periša 2008, 507–517; Tončinić 2015, 335–345).

Thanks to the data from literary sources, it is known that the eastern Adriatic was also the stage for two great military conflicts between Rome and the indigenous people. The Octavian's Illyrian War (35–33 BCE) and the *Delmataean-Pannonian Rebellion* (6–9 CE). The experts, encouraged by these developments, did not put into question the existence of a *limes* but, rather, the date, as well as the reason, for its establishment. In

<sup>1</sup> This work has been fully supported by the Croatian Science Foundation under the project "Understanding Roman Borders. The Case of the Eastern Adriatic (*AdriaRom*)" (IP-2018-01-4934).

<sup>2</sup> .. eine Kette von größeren und kleineren Befestigungen an einer natürlichen Verkehrslinie, die von der Krka über die Cetina bis zur Narenta verlief. Sie durchzog das Gebiet der unterworfenen Delmaten der Länge nach und überwachte die Einbruchsstellen aus dem Binnenlande. Die Hauptpunkte des *Limes* waren *Burnum* an der Krka (westlich von Knin) und *Gardun* an der Cetina...

<sup>3</sup> C. Patsch extended this defensive line to the hinterland of the Roman colony of *Narona*, located on the Neretva River. Near Ljubuški, at the site *Gračine*, he proposed that the remains of the site were a former Roman military fort. He named this fort *Bigeste* inspired by its proximity to *Bigeste*, a road station marked on the *Tabula Peutingeriana*. Recent research has established that there was indeed a 1.5-hectare military fort in *Gračine*. It does not appear, however, to be in any way related to the mentioned road station *Bigeste*. For now, the former name of the military fort in *Gračine* remains unknown.

both cases scholars, mostly historians, have made their conclusions through the study of ancient literary sources and epigraphic evidence (Wilkes 1969; Alföldy 1987; Miletic 2010, 113–176).<sup>4</sup>

If the assumption that a defensive line of forts was formed to protect the hitherto conquered territory in the eastern Adriatic turns out to be true, it would be one of the earliest such defense systems in this part of the Roman world. The issue with confirming the existence of the Delmataean limes lies in the fact that only two legionary fortresses are undeniably confirmed by systematic archaeological excavations (Cambi et al. 2007; Sanader 2003; Šimić-Kanaet 2010; Sanader et al. 2014; Sanader et al. 2017; Sanader et al. 2021), but the existence of smaller forts is still known only from literary sources (Πρωμόνα: App, *Illyr.* 2528; Πριάμωνα: Strab. 7, 5, 5; Promona: Tab. Peut. 6,1; Geograf. Rav. 211. Magnum: Geograf. Rav. 4, 16; Tab. Peut. 5; Andetrium: Pliny NH III, 142; Dion 56, 1214) and their location is assumed based on a respectable number of epigraphic monuments found in the area.<sup>5</sup> Previous research at-

<sup>4</sup> Pliny's words were a strong support for this assumption (NH III, 142): *in hoc tractu sunt Burnum, Andetrium, Tribulium, nobilitata proeliis castella.*

[https://www.loebclassics.com/view/pliny\\_elder-natural\\_history/1938/pb\\_LCL352.105.xml?readMode=reader](https://www.loebclassics.com/view/pliny_elder-natural_history/1938/pb_LCL352.105.xml?readMode=reader)

<sup>5</sup> Promona: EDCS-30200178; EDCS-30200179; EDCS-30200180; EDCS-30301341; EDCS-29500345; EDCS-30301342; EDCS-30301343; EDCS-30301344; EDCS-30301345; EDCS-30301346; EDCS-30301347; EDCS-30301348; EDCS-30301349; EDCS-30301351; EDCS-30301352; EDCS-30301353; EDCS-30301354; EDCS-31300525; EDCS-31400315; EDCS-32300020; EDCS-32300021; EDCS-32300022; EDCS-32300023; EDCS-32700977; EDCS-32700978; EDCS-10101828; EDCS-10101829; EDCS-10101830; EDCS-10101831; EDCS-10101832; EDCS-10101833; EDCS-10101834. The inscription EDCS-30200387 reads: *aquae Promo[nensis], pagani Prom[onenses]*. Magnum: EDCS-31300571; EDCS-32300019; EDCS-30200154; EDCS-10102004; EDCS-30200144; EDCS-30200145; EDCS-30700729; EDCS-30200146; EDCS-30200147; EDCS-30200148; EDCS-30200149; EDCS-30200150; EDCS-30200151; EDCS-30200152; EDCS-30200153; EDCS-31400284; EDCS-31400285; EDCS-32700508; EDCS-32700509; EDCS-32700510; EDCS-32700511; EDCS-32700512; EDCS-32700513; EDCS-32700514; EDCS-32700515; EDCS-32700516; EDCS-32700517; EDCS-32700518; EDCS-32700519; EDCS-32700520; EDCS-32700521; EDCS-10000768; EDCS-67400472; EDCS-57300167. Thiel suggests that the *municipio* Magar from the inscription CIL 13, 6538 refers to Maccarum/Makarska (Thiel 2020, 432). Andetrium: EDCS-28300068; EDCS-28300069; EDCS-28300070; EDCS-28300071; EDCS-28300072; EDCS-30200136; EDCS-57200190; EDCS-30200137; EDCS-30200138; EDCS-30200139; EDCS-30200140; EDCS-30200141; EDCS-30200142; EDCS-31400695; EDCS-31400696; EDCS-31400697; EDCS-31300588; EDCS-32700504;

tempts to find mentioned military infrastructure were focused on the problematic interpretations of satellite and aerial photography which is why they brought only theoretical discussions without material evidence (Glavaš 2011, 63–64; Bekić 2011, 317–318; Bekavac, Miletic 2021, 37–40).

However, all of the sites have findings, mostly numismatic, which are dated before the Delmataean-Pannonian Rebellion, predominantly from the time of the late Republic, but also the very early Principate (Šeparović 2003; id. 2008, 269–274; Bonačić Mandinić 2009–2011, 41–43; Šeparović 2020; Šeparović, Uroda, 1999; Tončinić, Ivčević 2022). But the truth is that the exact locations of these forts remain unknown as they have never been archaeologically verified so their positions are yet to be determined.

## 2. PROJECT AdriaRom

The successful application of remote sensing and non-destructive methods in archaeology has been proven in numerous examples, and the same is true when it comes to defining remnants of Roman military infrastructure. Recent applications of multiple remote sensing methods yielded spectacular finds concerning the Roman military in Spain and Portugal, where more than 60 new Roman military camps were identified (Costa-Garcia, Fonte, Gago 2019; Menéndez Blanco et al. 2020). New Roman military sites have been reported in Italy and Slovenia (Bernardini et al. 2015), and it seemed very likely that it could be shown in Croatia as well. Following this assumption, a scientific research project *Understanding Roman Borders: The Case of the Eastern Adriatic* (AdriaRom) has been designed and funded by Croatian Science Foundation since 2018.<sup>6</sup>

This project investigated the topographic and strategic circumstances between the rivers Krka and Cetina to determine the very early roots of the border zones concept with special attention directed towards so-called *Delmataean limes* (Tončinić et al. 2022). The idea of project AdriaRom is that the defense line was established already in the time of Octavian's Illyrian War (35–33 BCE). That should be corroborated by analysing old and new archaeological findings as well as the research results obtained by applying contemporary archaeological methods. A combination of all these approaches should significantly contribute to solving these complex issues and determine possible archaeological traces of Roman military fortifications in the hinterland of the Roman colonies of Iader and Salona, located in

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<sup>6</sup> <https://adriarom.ffzg.unizg.hr>



Fig. 2: Map of seven ALS target areas in the Dalmatian hinterlands; two legionary fortresses marked by red squares. (Map source: Google earth V 7.3.4.8248 (July 16, 2021) Croatia 43° 46' 08" N, 16° 22' 23" E, camera 83 km, altitude 655 m, Maxar Technologies CNES / Airbus Data SIO, NOAA, U.S. Navy, NGA, GEBCO. Data source: AdriaRom project database.)

the area between the rivers Krka and Cetina (Sanader 2021, 35–42).<sup>7</sup>

The hinterland area of Dalmatia lying between these two major rivers is bordered by the Adriatic Sea to the west and it encompasses roughly 1400 km<sup>2</sup>. The terrain and the sea also dictate the shape of our research area forming a long and relatively narrow area approximately 70 km long, a distance corresponding to the air-line distance between two legionary fortresses Burnum and Tilurium. The two fortresses and their surroundings were selected as focus areas, as well as the locations where the proposed sites of Promona, Magnum, and Andetrium are situated (Čače 1979, 43–125).<sup>8</sup> These latter sites are agglomerations of indigenous settlements, Roman military infrastructure, and Roman civilian settlements which makes potential archaeological clues harder to recognize and differentiate in the field.

We selected seven separate areas covering 239 km<sup>2</sup> (Fig. 2), and during the selection process, we tried to fol-

low the natural landscape boundaries as well as adhere to the existing archaeological clues from the field, namely the epigraphic monuments and past random finds.

We emphasize that our research took place in karst landscape, where the stone is the predominant material. To obtain a cultivated soil, stone is often removed and deposited at the borders of land plots where over time it forms into demarcation drywall. Sometimes these agricultural/ethnological structures can form regular shapes reminiscent of Roman military camps and when they coincide with surface material dated to antiquity or are proximal to an inscription connected to the Roman military, it usually ends with a conclusion that the drywalls represent the remains of a camp. This type of reasoning presented us with a problem. Although in some cases agricultural drywalls can cover walls or even smaller structures, without confirmation in the form of datable material there is no definitive proof of the origin of the walls, if they do exist under the surface drywalls.

To optimally identify possible Roman military fortifications and/or structures a methodological approach was chosen based on several important and consecutive steps of research that would be conducted over four years. The head of the research and his team of experienced researchers, who have successfully

<sup>7</sup> At the *Corpus Limitum Imperii Romani* Online conference held in May 2021, we presented the first insights in the results from the LiDAR scanning.

<sup>8</sup> Some researchers believe that Magnum is the Delmestan Sinotium (old and new) mentioned by Strabo (7,5,5) and Sunodium mentioned by Appian (*III*, 5,27).

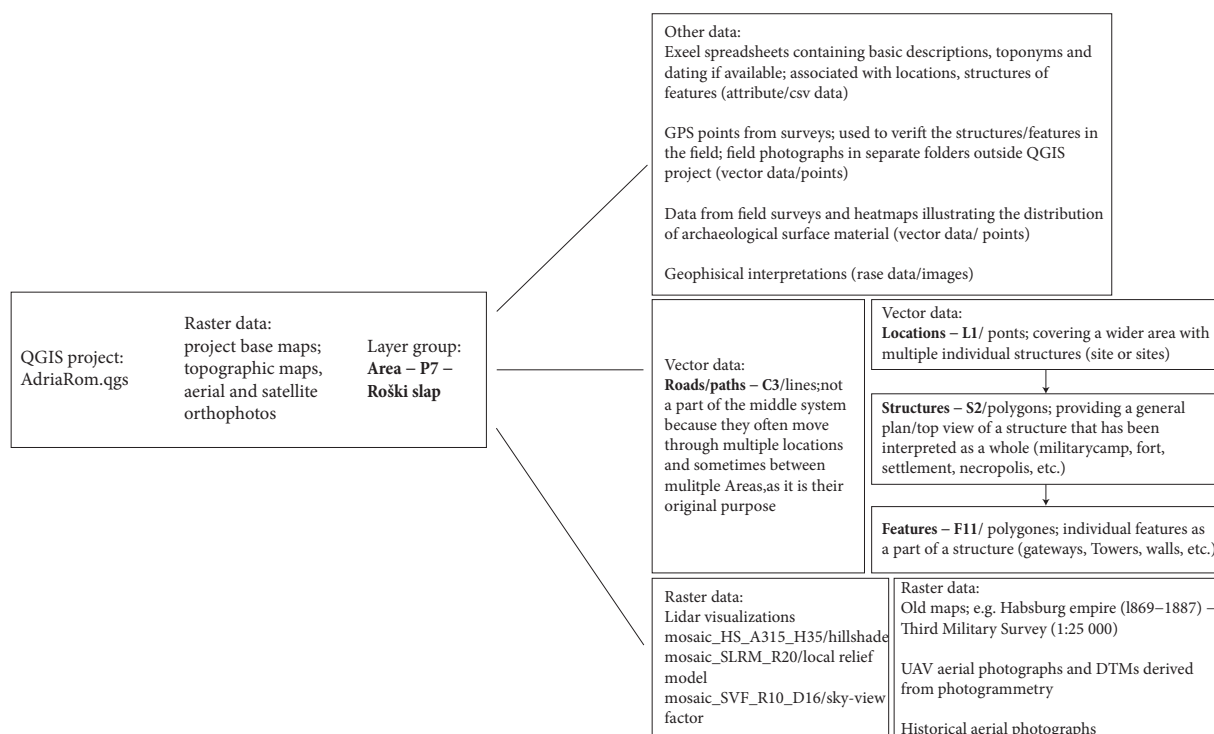


Fig. 3: Schematic of the AdriaRom project database in QGIS.

conducted complex archeological projects related to Roman conquests and Roman military infrastructure completed three project phases in 2019 and 2020, following the established methodology.<sup>9</sup> The goal of this paper is a report of our recent work dealing with the problems of the development of Roman borders and to present the results that emerged from the archaeological research that included the analysis of aerial and satellite photographs, maps, and airborne laser scanning (ALS/LiDAR) data.

### 3. LiDAR/ALS DATA

The ALS scanning was done by a Slovenian company Flycom d.o.o, using a private helicopter mounted

<sup>9</sup> The methodological approach was based on seven steps with the assumption that the positive or negative results of the research through each step will determine the most promising areas for the following methodological step. This seven steps were: Study of ancient literary sources, Roman epigraphic monuments and analysis of archaeological findings; Analysis of aerial and satellite photographs, maps and LiDAR scanning for the identification of possible Roman military forts and/or structures in the proposed research area; Systematic field survey on selected areas; Geophysical research of selected areas; Archaeological excavations of selected areas; Analysis of archaeological excavations results and Analysis and interpretation of all selected data.

with a Riegel LiDAR system. The resulting dataset has a density of 20points/m<sup>2</sup>, and after classification and filtering a DTM was produced with a 0.5 m grid size.<sup>10</sup> During the flight, two onboard cameras were used to acquire photographs and produce a digital orthophoto of the scanned areas. The resulting DTM was used to produce visualizations of the data using the RVT software developed by ZRC SAZU (Zakšek, Oštir, Kokalj 2011; Kokalj, Somrak 2019). The first step was to produce hill shade visualizations for all the areas which formed our basic data structure in QGIS. The areas were numbered P1-7, and each area was assigned with a group in QGIS layers. The base layers are the same for the entire project and they include the standard topographical base maps along with satellite and aerial photography available for the area. The individual groups concerning a particular area contain ALS visualizations<sup>11</sup> and layers of points, vectors, and polygons used to interpret the data. The schematic (Fig. 3) shows an example of our database organization in QGIS. The data in GIS is accompanied by

<sup>10</sup> We would like to thank prof. dr. sc. Michael Doneus from the Department of archaeology at the University of Vienna for his guidance and help with ALS data interpretation.

<sup>11</sup> Besides the basic hill shade visualization, we mostly used a combination of local relief model with other layers such as sky-view factor, slope, or openness to enhance the relief and gain a better view of the features present on the ground.

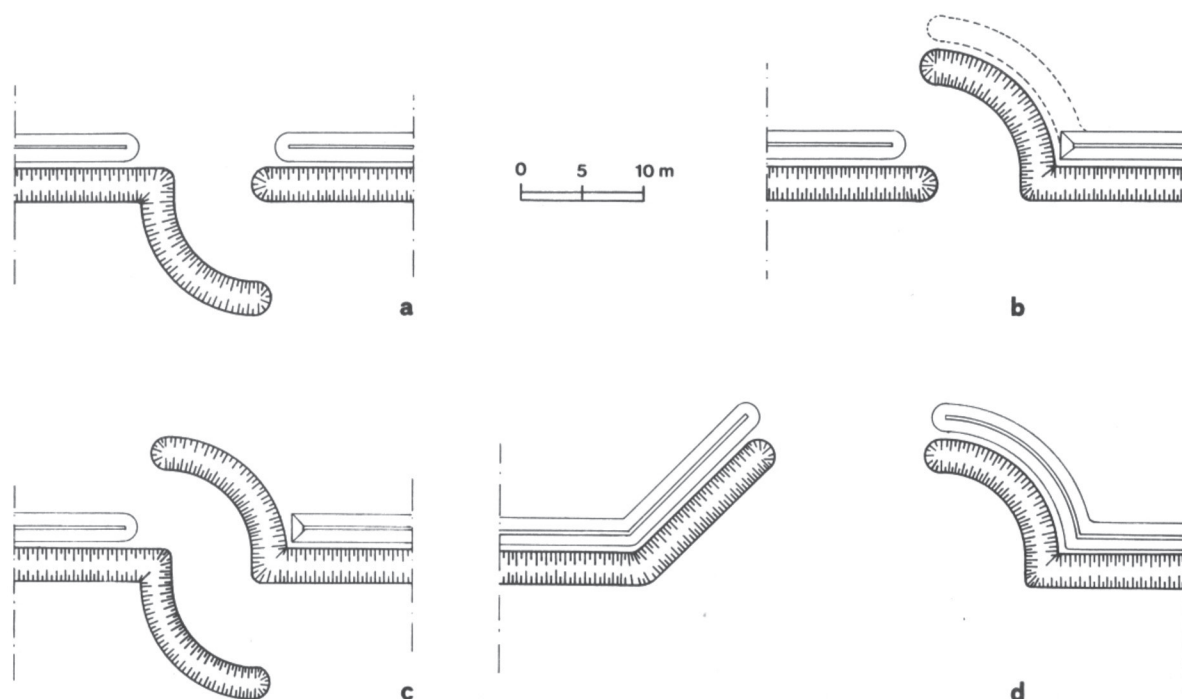


Fig. 4: *Clavicula*-type entrances in Roman legionary camps (source: Lenoir 1977).

an excel spreadsheet containing basic information such as description, dating, and a toponym. The spreadsheet can be imported and associated with individual features and structures enabling us to create interpretational maps containing temporal information.

Although our primary goal is to define the remnants of Roman military infrastructure it is impossible to ignore other archaeological features while dealing with this complex dataset. This is especially true when we consider that the actions of the Roman military in the area should be directly connected to the settlements and fortified places of the indigenous Dalmatae (Sanader, Vukov, Bužanić 2019, 121–134).<sup>12</sup> In that respect, one quickly concludes that it is very hard to divide the features along the classical division lines of antiquity and prehistory used frequently when dealing with pottery and other small artifacts. Recent publications from Spain, Portugal (Costa-Garcia, Fonte, Gago 2019; Menéndez Blanco et al. 2020) and Italy (Bernardini et al. 2015) on the topic of Roman military infrastructure show a wide variety of sites classified as Roman camps, challenging the general preconception that most of them should be regularly shaped with features

<sup>12</sup> This conclusion comes from the simple fact that the Roman military, when it comes to Dalmatia, wages war against the indigenous population and the complete romanization of the province takes place only after the Delmataean rebellion.

such as *clavicula*-type entrances, rounded corners, and ditches. Some of the sites outlined in those papers are indistinguishable from what are usually considered to be the fortified sites of the indigenous prehistoric populations (Costa-Garcia, Fonte, Gago 2019, 34–37). These facts have also guided our interpretation process, and the process proves to be a complex interplay between fieldwork and ALS data interpretation. In that respect, we were forced to subdivide the structures visible on the data into three separate categories based on the number of features classically associated with Roman military camps:

I. New Roman military camps visible on ALS data

- all the sites in this category were previously unknown and they all have a regular plan (playing-card, trapezoidal or rectangular) and at least one *clavicula*-type entrance is visible (Fig. 4);

II. Roman military sites from literature

- all sites in this category are known either as potential Roman military sites or have been proven as Roman military sites through excavations and publications;

III. Potential Roman military camps/structures

- all sites in this category constitute structures that could potentially be a part of the Roman military infrastructure, but because they lack a regular plan or there is no presence of a *clavicula*-type entrance they have been attributed to the “potential” category.

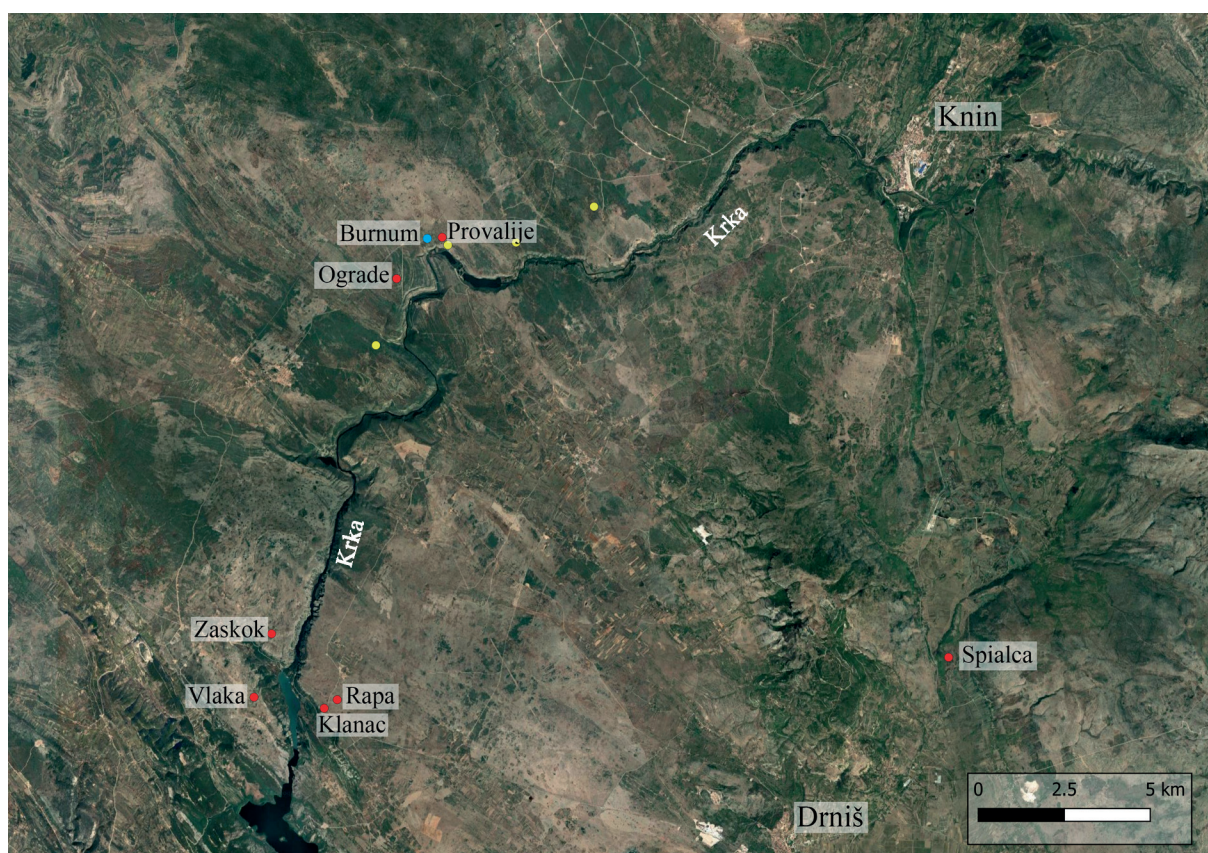


Fig. 5: Map of the area around the Burnum legionary fortress, marked in blue; yellow markers represent potential Roman auxiliary camps known from literature and sporadic field surveys, new Roman military camps found during the AdriaRom project are marked in red.

#### 4. NEW ROMAN MILITARY CAMPS

In this paper, we will present the sites from the first category. All seven structures were confirmed in the field and all of the ramparts visible on the data were identified on the ground (Fig. 5). For now, only small fragments of pottery dated to the Roman period have been found at the sites and more data on the temporal aspect of each of these camps will be available once the excavations are conducted. Although the surrounding karst terrain is mostly composed of stone the ramparts appear to be made of earth and stone rubble, with actual stone walls visible only on two of the camps.<sup>13</sup> The ramparts themselves form a regular layout which can be either square, trapezoidal, or playing card and one of the distinctive features are rounded corners of the camps/forts. Besides the regular layout of the ramparts, another defining feature of the camps in this category is the *clavicula*-type entrances. The earliest mention of *clavicula* shaped entrances and rounded corners in Roman

<sup>13</sup> The exact composition of the ramparts will be determined with excavations. The conclusions here are based on the preliminary field surveys.

military camps comes from the text *De munitionibus castrorum* by Pseudo-Hyginus, where in chapters 54 and 55 the following is described:

“54. The angles of the camps should be rounded because they make the projections and weaken the work which protects the defenses. They should be rounded from the angle of the cohorts which make the sides of the work 60 feet and until the line rejoins the outside line of the rampart, and this makes an angle of 90°.”

“55. In the same way the *clavicula* is traced around a circle from a line on the inside of the rampart from a point in the middle of the gate, the compasses wide open to the edge of the gate; from this center point you draw an arc in front of the road following the same line which is fixed at the center of the gate. Then with the compasses in the same place, you add the width of the rampart and draw another arc on the same line so that those going in are always unprotected and those coming in a straight line are kept out; and it gets the name *clavicula*. from this effect.”<sup>14</sup>

<sup>14</sup> Translation from Cambell 2018.

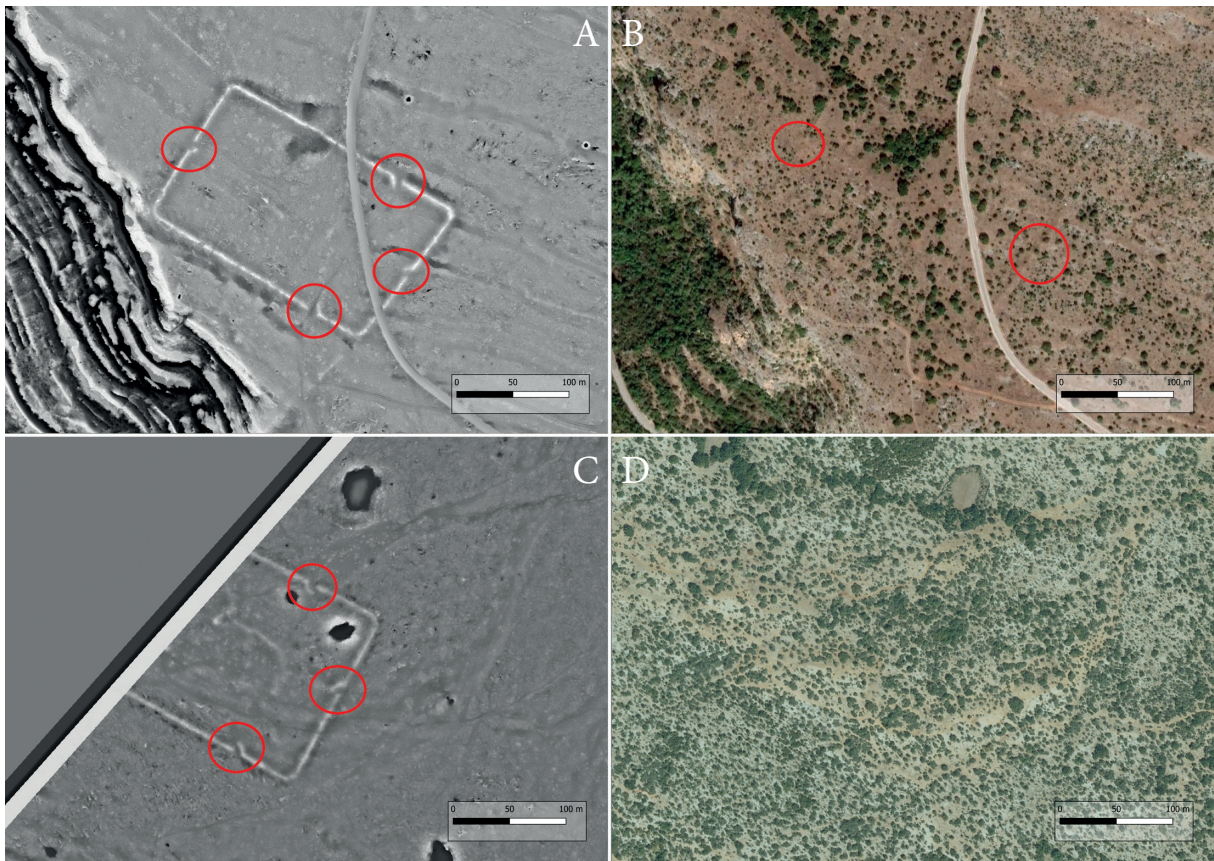


Fig. 6: Roman military camps of Klanac (P7L1S2; A, B) and Zaskok (P7L3S9; C, D) visible on ALS data (visualization: Local relief model (LRM), radius=20, transparency 70% + Sky-view. Source: AdriaRom project database).



Fig. 7: East clavícula-type entrance to the camp of Klanac (P7L1S2; Fig. 6: A, B), as seen from the interior of the camp (source: AdriaRom project database).



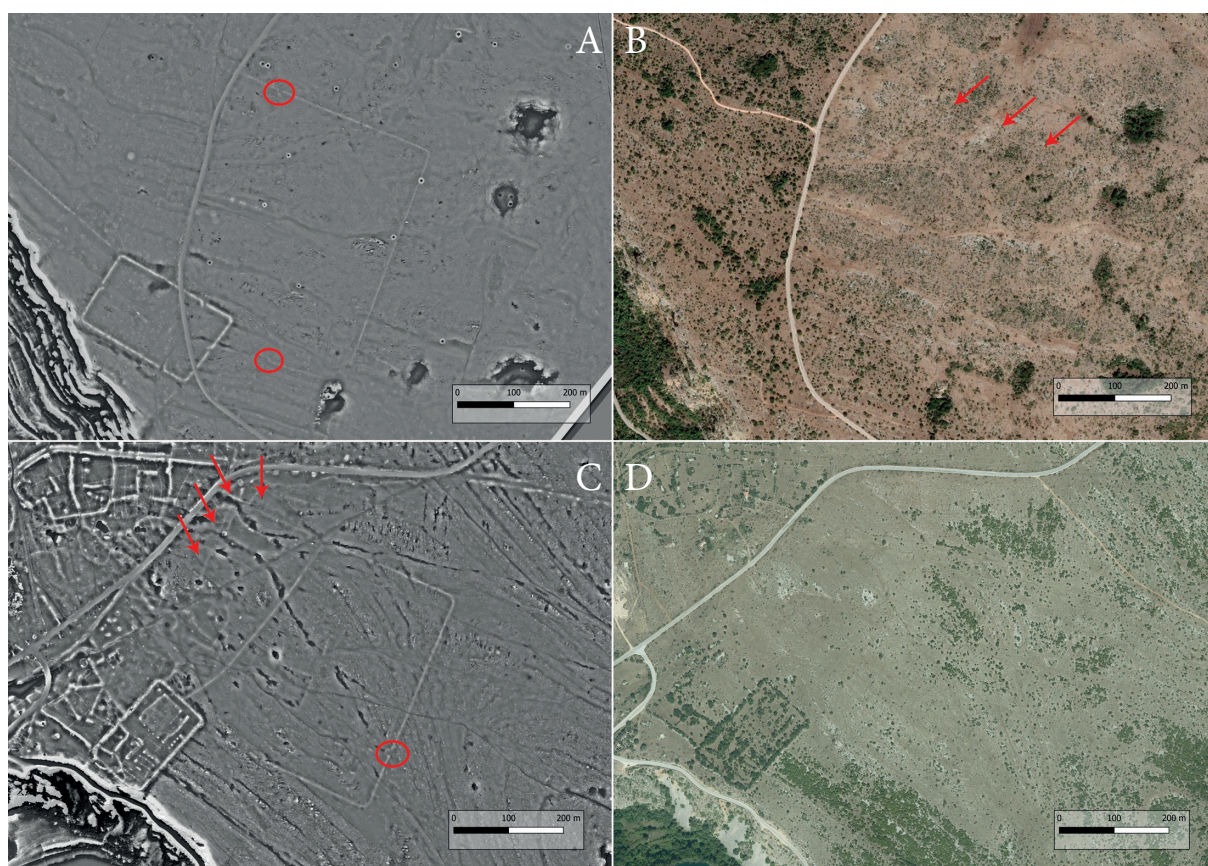


Fig. 8: Roman military camps of Rapa (P7L1S1; A, B) and Provalije (P6L5S33; C, D) visible on ALS data (visualization: Local relief model (LRM), radius=20, transparency 70% + Sky-view factor; QGIS. Source: AdriaRom project database).

Research in recent years has shown that *clavicula*-type entrances are present in Roman military camps from at least the 1<sup>st</sup> century BCE all over the empire, and they have been found in camps at Nadleški hrib and Obrežje excavated in nearby Slovenia (Laharnar 2013, 133–135), and also at Grociana piccola, near Trieste (Bernardini et al. 2021). These fortifications have been associated with the Octavian's Illyrian War (35–33 BCE) and the Delmataean-Pannonian Rebellion (6–9 CE) which are the same events that left their marks on our research area.

The two playing-card layout camps of Klanac (Figs. 6: A, B; 7) and Zaskok (Fig. 6: C, D) have visible stone blocks forming two faces of a wall protruding from the rampart. These two camps also differ from the rest of the sites in this category because the ramparts are preserved much higher and their approximate surface (3–4 hectares) is smaller than the rest of them. There are four *clavicula*-type entrances on both camps, and while the ones on the eastern and western ramparts are situated directly in the middle, the northern and southern ones are slightly off-axis towards the east (Figs. 6, 7). The camp Klanac (Fig. 6: A, B) also appears to have additional ramparts enclosing surfaces to the south and to the west between the camp itself and the sheer cliff present to the southwest.

The fact that the ramparts are seen in the field as a feature protruding from the local relief composed mostly of earth and stone rubble and not drywall is in direct opposition with previous research mentioned above. There is one interesting example in the second category which could be the key to understanding how a Roman military camp and its layout can be “mirrored” in the drywalls above them. The playing-card layout camp at Radići near the legionary fortress of Burnum has long been a part of the archaeological literature (Periša 2015; Cesarik 2017, 363–370) but has never been subjected to archaeological excavations. What is interesting about the camp is that it seems that there is the same earth and stone rubble rampart present in the field, but on top of it in recent times there was drywall constructed which now mirrors the layout beneath it. There even seem to be remains of a *clavicula*-type entrance facing to the south and the camp itself has a playing-card layout reminiscent of previously mentioned camps at Klanac and Zaskok. This camp could give us answers for some other structures in the data that have for now been relegated to the third or “potential” category.

Returning to the first category, the rest of the camps have similar ramparts which are lower in relief than

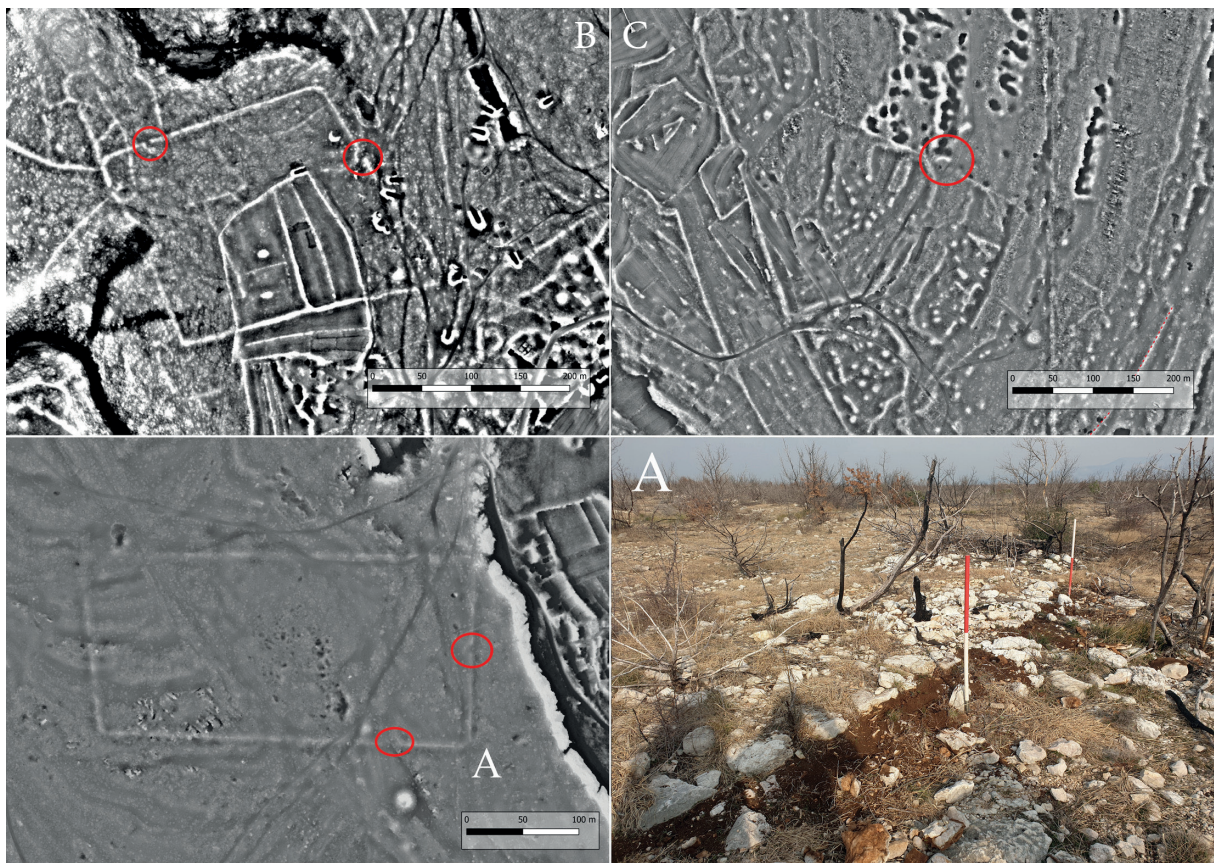


Fig. 9: Roman military camps of Vlaka (P7L2S7; A), Spialca (P5L4S15; B) and Ograde (P6L2S556; C) visible on ALS data, with a field photograph showing one of the curved corners of the camp Vlaka (visualization: Local relief model (LRM), radius=20, transparency 70% + Sky-view factor; QGIS. Source: AdriaRom project database).

those of the playing-card style camps, which could be an indicator that these ramparts have no permanent stone walls and were only fortified by earth and stone rubble. These observations point us to the possibility that the rest of the structures in this category could in the future be categorized as temporary Roman military camps. Although excavations and detailed surface surveys will answer some of our questions, the structures themselves already show some interesting parallels. This is especially true when considering the similarities between the camps Rapa (Fig. 8: A, B) and Provalije (Fig. 8: C, D).

Both camps seem to be overlaid by playing-card-style camps indicating that their original construction may be somewhat earlier than that of the camps above them. They both have *clavicula*-style gates placed off the central axis of the camp and although not all of the ramparts are preserved, we can approximate the surfaces they enclosed at 15 and 18 acres respectfully. Finally, they both seem to indicate a completely square layout, which could along with the previously mentioned points suggest that these could be the remains of temporary camps meant to house an entire legion. The rest of the camps in this category fall under the trapezoid type layouts, namely the

camps of Spialca (Fig. 9: B) and Vlaka (Fig. 9: A), both have two *clavicula*-style entrances preserved and they measure approximately 5 hectares in surface. The list of seven camps is completed by a possible camp at Ograde (Fig. 9: C) which is the least preserved and its original shape can't be determined. It seems possible that a single *clavicula*-style gate is visible along a 300 m long northern rampart which angles to the west with a rounded corner (Fig. 9: C). This site holds the least promise, with regards to it possibly being a Roman military camp, but non the less our methodological approach forces us to consider it as a possible candidate. The fact is that the ramparts are an expression in the relief and that they are constructed of stone and earth, they form a more or less regular pattern with one possible rounded corner, and a feature in the shape of a *clavicula* style gate is present.

## 5. PRELIMINARY CONCLUSION

The results presented in this paper aim to show a preliminary interpretation of LiDAR/ALS data which will be presented in its complete form once all of the

project activities, namely systematic surface surveys, geophysical prospection, and archaeological excavations, are completed. Obviously, in this paper, the primary focus is on the remnants of Roman military infrastructure, but, as was already established earlier, this is just one segment of the data we acquired through aerial laser scanning. We consider archaeological excavations to be necessary because only archaeological excavations can ensure the exact dating of recorded structures. Small finds (ceramics, coins, glass finds, metal objects, bone objects, gems), which are commonly unearthed during excavations, are essential for the dating of layers and structures. Without the analysis of small finds, it is not entirely possible to chronologically place the newly

discovered structures identified with non-destructive techniques. The amount of surface finds present at each site seems to be quite small or at some locations does not present at all.

The classical approach which focuses mostly on ancient sources and epigraphic inscriptions to determine the potential locations where the Roman military was deployed and stationed can now be complemented with a wealth of new data thanks to remote sensing. Dealing with this amount of new information in the scope of a single project was and still is challenging, but we hope that our future efforts will yield some interesting results concerning the actions of the Roman military in the Dalmatian hinterland.

### Abbreviations

- EDCS – *Epigraphik-Datenbank Clausz / Slaby*  
(<http://www.manfredclausz.de/>)
- CIL – *Corpus Inscriptionum Latinarum*  
(<https://cil.bbaw.de/>)
- NH – Pliny the Elder, *Naturalis historia*  
([http://penelope.uchicago.edu/Thayer/e/roman/texts/pliny\\_the\\_elder/home.html](http://penelope.uchicago.edu/Thayer/e/roman/texts/pliny_the_elder/home.html))
- App, Illyr. – Appian, *Illyrike*  
(<https://www.livius.org/sources/content/appian/appian-the-illyrian-wars/>)
- Strab. – Strabo, *Geographica*  
(<http://penelope.uchicago.edu/Thayer/E/Roman/Texts/Strabo/home.html>)
- Tab. Peut. – *Tabula Peutingeriana*  
(<https://upload.wikimedia.org/wikipedia/commons/5/50/TabulaPeutingeriana.jpg>)
- Geograf. Rav. – *Cosmographia Anonymi Ravennatis*  
(PINDER, M., PARTHEY, G., 1860., *Ravennatis anonymi cosmographia et Guidonis geographica: ex libris manu scriptis*, Berlin)
- Dion – Cassius Dio, *Historia Romana*  
([http://penelope.uchicago.edu/Thayer/E/Roman/Texts/Cassius\\_Dio/home.html](http://penelope.uchicago.edu/Thayer/E/Roman/Texts/Cassius_Dio/home.html))

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