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SURFACE AND LOW ALTITUDE SURVEYS ON THE MILITARY VICI FROM SĂLAJ COUNTY (DACIA POROLISSENSIS)

Horaţiu Cociş[*]

Cuvinte cheie: vici militari, Dacia Porolissensis, judeţul Sălaj, cercetare de suprafaţă, Digital Surface Model, analize heat map
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Cercetări de suprafaţă şi de joasă altitudine la *vici* militari din judeţul Sălaj (Dacia Porolissensis)
(Abstract)

Aşezările civilie care apar, funcţionează și se dezvoltă lângă castrele auxiliare s-au constituit de-a lungul deceniilor în direcţii explicite de cercetare. Situaţia acestor aşezări aferente castrelor din provincia romană limitrofă Dacia Porolissensis este încă la un nivel incipient și speculativ. Prezentul studiu cuantifică o serie de cercetări perieghetice întreprinse în zonele aşezărilor civile de lângă castrele auxiliare de la *Buciumi* (com. Buciumi), *Românași* (com. Românaşi), *Brusturi-Romita* (com. Creaca) respectiv *Tihău* (com. Surduc). Deși pentru fiecare dintre ele există informaţii mai mult sau mai puţin relevante despre localizarea lor, lipsa unei cercetări intensive de suprafaţă cât și o cartare a extensiei ceramicii au fost motivele pentru care ne-am propus, în această primă fază, reluarea problematicii. Agricultura intensivă practicată în toate cazurile menţionate ne-a facilitat cercetarea de teren, fiind în final identificate perimetrele teoretice ale acestor *vici militares*. Cartările au fost făcute utilizând un GPS RTK Hi-Target V90, fiind înregistrate în totalitate concentraţiile de ceramică observabile la suprafaţă, utilizând un sistem de griduri. Pe baza punctelor obţinute s-au calculat în a doua fază densităţile acestor concentraţii de fragmente ceramice, obţinând astfel modele geostatistice bazate pe densitatea materialului. Nu în ultimul rând, suprafaţa astfel identificată a fost supusă unor procedee de fotografiere aeriană pentru a obţine ulterior modele digitale 3D ale terenului, cu un grad de fidelitate ridicat, cât și pentru a încerca identificarea, pe cât este posibil, a noi structuri pe baza diferenţei de elevaţie. Limitele metodelor sunt evidente, ele reprezentând *strict* distribuţia materialului pe suprafaţa aşezărilor și modelarea 3D a suprafeţelor cercetate.

Introduction. The state of research on the military vici from Sălaj (Dacia Porolissensis)

The highly militarized frontier of Dacia Porolissensis (with focus on Sălaj County) was and it continues to be an extremely fertile ground for the research of the military factor[1] and its related issues.[2] Yet, the questions raised by the civilian settlements called military *vici* (the terminological convention known as *vici militares*[3]) which have developed in the vicinity of these auxiliary forts,[4] except for some short descriptions of their (approximated) field extension based on pottery and isolated finds and without a clear context, are almost in unanimity unsolved.[5] It is observed a general focus on the military installations rather than on the civilian settlements that are in direct interaction with the garrisoned troops. The present study falls in the category of the extensive surface surveys, being not a theoretical approach regarding the history, organization and evolution of the military *vici*[6] but an attempt to establish their

* Zalău County Museu of History and Art, hcocis12@gmail.com.

1 Marcu 2009, 11–12; A history of research of the auxiliary forts from Sălaj County in Cociș 2018, 118–133.

2 See especially Petruț 2018, 25–34.

3 See especially the discussion regarding the communities born near the auxiliary forts in Nemeti 2014, 80–99.

4 Paul Salway outlined the fact the term for the civilian settlements developed near auxiliary forts is *vicus*, those who developed near the legionary fortresses being named *canabae*, the second term never appearing in the context of the smaller forts (Salway 1981, 9). See also Sommer 1984, 3–5; Sommer 2006, 95–145. Yet, there are certain situations when the term *canabae* appears in connection with an auxiliary fort, such as *fines canabarum Dimensium* (see Nemeti 2014, 80).

5 See especially Benea 1993, 267–292; Benea 1995, 231–241; Benea 2000, 33–61; Oltean, Hanson 2001, 123–134. See also the extensive geophysical survey undertook within the *vicus* from *Samum* (Căşeiu, Cluj County) in Isac *et al*. 2013, 24–25.

6 See in this direction Benea 2003; Nemeti 2014; See also Bérard 1993, 61–90; Cârjan 2013, 11–35.

field extension, using the *GIS* and *UAV* support. Following this state of affairs, we have to contextualize firstly the available info about the *vici militares* from Sălaj County in order to fit our demarche. In the well-known descriptive order from south to north[7] (see Plate I), we should start our discussion with the auxiliary fort at Buciumi.

The auxiliary fort at Buciumi,[8] located on the plateau called nowadays *Grădişte*[9] (Plate II. a), drew the attention of the Hungarian humanist Stephanus Zamosius (István Szamosközi) in the 16th century,[10] his description of the site being preserved in a later 17th century chronicle.[11] Starting with the 19th century and the field research undertook by Torma K. in the area,[12] the auxiliary fort was mentioned in various studies.[13] The excavations at the fort took place between 1963–1976,[14] in 1997[15] and after, between 2013–2015.[16]

Even if the auxiliary fort at Buciumi was extensively excavated,[17] the info regarding the *camp-followers* that developed near it is quite scarce. What we know from the older accounts is that the the military *vicus* was located on the south-eastern side of the fortification,[18] therefore in front of *porta principalis sinistra*.[19] What is worth to be mentioned is that in 1970 a series of electro-resistivity surveys have been made for the first time in order to establish the layout of the *vicus*.[20] The surveys (unfortunately still unpublished), doubled with some small archaeological trenches, pointed out that the *vicus* has a main street, a natural continuation of *via principalis* as well as a series of smaller streets which separates the civilian buildings between them.[21] The data regarding the baths of the fort are also reduced to a minimum. N. Gudea located and shortly excavated in 1966 a structure considered to be such a building at approximatively 150–200 m east of the auxiliary fort, in the point called *F*ântâna Benţii,[22] a toponym that is still used nowadays. The findspot is corellated with the earlier description of K. Torma who saw a quadrilater building and water pipes.[23]

Important data regarding this *vicus* came from a recent surface survey in the area of the auxiliary fort, integrated within a larger landscape project, by C. H. Opreanu and V.-A. Lăzărescu.[24] In a *Digitial Surface Model* based on *UAV*, they discovered the presence of a building in the vicinity of *porta decumana*, supposedly of Roman origins.[25] The necropolis could be located in the north-eastern side of the civilian settlement, probably following a while the road to the north.[26]

Going further north, the next frontier military headquarter, subject of our survey, is located at Românaşi[27] (Plate II. b). The auxiliary fort from the place called *Cetate*[28] was investigated in a lower grade than the previous example,[29] the first time in 1959[30] and after that, in 1996.[31] The earlier accounts are sporadic.[32] Based on the published info, it seems that the military *vicus* developed near this auxiliary fort is quite extended. North of the fort, the local inhabitants saw in the past decades traces of walls from the civilian settlements altogether with a large quantity of potsherds, bricks and tiles.[33] Due to the fact that the modern cemetery is located east of *porta praetoria*, the grave diggers discovered also stone foundations and Roman archaeological small finds.[34]

On the western side of the auxiliary fort there are also mentions about the existence of a large amount of potsherds and bricks, this area being also considered a part of the civilian settlement.[35] Based on Torma's statement, the two funerary

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7 The *rule* established by K. Torma and his research on the *limes Dacicus* (see especially Torma 1880); Cociş 2016, 41–43.

8 See Marcu 2009, 36–52.

9 The Hungarian name of Buciumi was *V*ármezö, literary translated as *the field of the fortress* (Gudea 1997, 9).

10 Gudea 1997, 12.

11 Russu 1959, 305–306.

12 Torma 1864, 11–12; Torma 1880, 75, 116, 127

13 For older accounts regarding the auxiliary fort see especially Russu 1959, 305–311; Gudea 1997, 12.

14 Chirilă *et al*. 1972; Gudea 1997, 14–15.

15 Timoc, Bejinariu 2000, 345–357.

16 Bejinariu *et al*. 2014, 170; Bejinariu *et al*. 2016, 124–125.

17 See Cociş 2018, 119–122.

18 Gudea 1997, 62.

19 See Gudea 1997, 98, Fig. 15.

20 Gudea 1997, 62–63.

21 Gudea 1997, 92.

22 Gudea 1997, 63–64. See also Ţentea, Burkhardt 2017, 27–28.

23 Torma 1864, 11. See also Goos 1876, 120; Tudor 1968, 243–254.

24 Opreanu, Lăzărescu 2016.

25 Opreanu, Lăzărescu 2016, 66, Fig. 20, 67,

26 See the description in Gudea 1997, 64–65.

27 See Marcu 2009, 100–101.

28 Tamba 1997, 9.

29 Cociş 2018, 121–122.

30 Macrea *et al*. 1962, 499–501.

31 Tamba 1997, *passim*.

32 See Torma 1864, 11–12; Goos 1876, 72. For the funerary monuments discovered here see CIL III, 840 and CIL III. 841.

33 Tamba 1997, 29.

34 We must underscore the fact that there was no extensive field survey carried out on the surface of the *vicus*; Tamba 1997, 29.

35 Tamba 1997, 30.

inscriptions discovered in the area of Românaşi are coming from the fields located west of the auxiliary fort,[36] thus indicating the possible location of the necropolis.[37] Based on a recent geophysical survey carried out on the surface of the auxiliary fort but also in the vicinity of *porta praetoria*, one can observe the road coming out from this gate, crossing the surface of the *vicus*,[38] the civilian settlement being developed along the main street, with obvious further side extensions and intersections.

Located in the narrow meadow of the *Agriş* River,[39] the auxiliary fort at Brusturi (known as the auxiliary fort at Romita[40]) is the next surveyed military center (Plate III. a). The fort was the subject of an ongoing archaeological and geophysical research. The earliest account of the ruins dates back to 1837,[41] being mentioned later by other several antiquarians and early archaeologists.[42] The first excavations took place between 1970–1974, being identified the baths near the auxiliary fort.[43] Further excavations took place in 1996–1997,[44] 2000[45] and 2018,[46] focusing especially on the defensive elements and the interior planning of the fort.[47]

The civilian settlement at Brusturi is rather a misfortunate case. As the authors of the monograph saw and as we confirmed in several cases, the surface of the *vicus* is covered almost entirely with alluvial sand, the thickness of the layer varying between 0.8–1 m.[48] Under this layer, in the right bank of *Agriş River*, a Roman habitation layer is visible,[49] *grosso-modo* south of the fort. In the area between *porta praetoria* and the baths,[50] also in the river bank, Al. V. Matei and Bajusz I. observed several traces of walls. In their opinion the civilian settlement is developed in the north no further than the baths, the epicenter being located somewhere south of the fort, outside of *porta decumana*.[51]

The position of the necropolis within the landscape of Brusturi fort and *vicus* is more approximated. Based on three funerary inscription[52] (only one with a certain find spot[53]), the necropolis is thought to be located under the actual cemetery of Romita, south-east of the settlement.[54] Finally, a last attempt to identify the *vicus* from Brusturi was made by a team led by C. H. Opreanu. Based on a magnetic susceptibility survey, they proposed the extension of the *vicus* specifically on the eastern side of the fort.[55]

A rather interesting case is the so-called *vicus area*[56] from the highly militarized center of Porolissum. Even if this example was not the subject of our survey, it is worth mentioning that the buildings located alongside the imperial road which passes near the auxiliary fort at *Pomet Hill*, was extensively excavated in the past decades.[57] Due to its layout,[58] the so-called *vicus* from Porolissum will fall somehow in the *street-type*[59] or *ribbon-type vicus*,[60] a *classic* type with the buildings developed alongside a road, most of the times in front of the *portae principales*,[61] throughout an extension of *via principalis*. In the case of Porolissum, the rule is not quite applied due to the fact that the *vicus* area is developed alongside the road that passes in front of *porta praetoria*.[62] But as C. S. Sommer noted, *the* (vici) *types are rarely appear in a pure form* (type).[63]

Our last case study is the auxiliary fort and the military *vicus* at Tihău[64] (Plate III. b). Unlike the rest of the cases mentioned above, the auxiliary

36 Torma 1864, 11–12.
37 Tamba 1997, 32–33,
38 See Opreanu, Lăzărescu 2016, 69, Fig. 23.
39 Matei, Bajusz 1997, 5.
40 The rectification in Cupcea *et al*. 2018, 17.
41 Hodor 1837, 532–535.
42 Early mentions in Torma 1864, 14, 32–33; Cosma 1870, 638; Goos 1876; Torma 1880, *passim*; Király 1893, 414–415.
43 Matei, Bajusz 1997, 101–113; Ţentea, Burkhardt 2017, 29.
44 Matei, Bajusz 1997, *passim*.
45 Unpublished excavations.
46 Cupcea *et al*. 2018, 16–20.
47 Marcu 2009, 101–113. The surface of the auxiliary fort was the subject of two extensive geophysical surveys (see Franzen *et al*. 2007, 161–167; Opreanu, Lăzărescu 2016, 71–74.
48 Matei, Bajusz 1997, 114.
49 Matei, Bajusz 1997, 114.
50 See Matei, Bajusz 1997, 156, Fig. 7.
51 Matei, Bajusz 1997, 114–116.
52 CIL III, 839; CIL III, 6249; CIL III, 7643.
53 CIL III, 839; see the commentaries in Hodor 1837, 532–533.
54 Matei, Bajusz 1997, 117–118, 157, Fig. 8.
55 Opreanu, Lăzărescu 2016, 74, Fig. 30.
56 The core concept was applied in time to the inhabited area located west, north and east of the auxiliary fort from Porolissum-*Pomet*, different from the *municiupum* area, located south and south-east of the fort.
57 The archaeological monograph of the *vicus* area in Tamba 2008.
58 See the bigger picture of the *vicus*, completed with an extensive geophysical survey in Opreanu, Lăzărescu 2016, 83, Fig. 37, Fig. 38.
59 For this type of *vicus* see especially Sommer 1999, 81; Sommer 2006, 97–98.
60 Hopewell 2005, 266.
61 Sommer 2006, 97.
62 Tamba 2008, 44.
63 Sommer 1999, 85.
64 See Marcu 2009, 115–116.

fort at Tihău-*Cetate*[65] was excavated in a lower grade. The first excavations took place in 1958, being uncovered a complex building inside the fort and also its defensive elements.[66] The next excavation was more a control trench made in 1997 to uncover the precinct wall.[67] The auxiliary fort was the subject of several geophysical surveys, the first one being made in 1999[68] and the second one, a more accurate investigation, in 2016.[69]

The accounts about the civilian settlement of the auxiliary fort are extremely low. We have only several data and mentions about bricks, coins and potsherds found somewhere on the plateau that lies near the fort.[70] The local inhabitants turned out to be a useful source due to the fact that some of them collected archaeological finds also from the surface of the *vicus*. Finally, we underscore again the fact that the orthodox cemetery affects continuously the area of the civilian settlement, uncovering fragments of worked stones, potsherds and event bronze fragments. What is interesting is the fact that on the first magnetic map one can see outside the fort a series of anomalies that could represent ovens or kilns,[71] hypothesis tested by the means of trial trenches and borings.[72]

By displaying this introductory part, it is now clear that the reduced amount of available data is not enough to integrate the situation of the *vici militares* from this part of Dacia Porolissensis in the wider frame of the Danube region.[73] Thus being the given situation, we found useful that in this inchoative phase to start with an extensive survey in order to delimitate as much as possible the areas of the *vici* by applying a suitable methodology.

The methodology.

In order to fulfill our objectives previously underscored, several methods were applied and adapted to the current situation. First of all, we pursued an extensive field survey in the areas of the civilian settlements,[74] based on all the available info. The goal of the surveys was to map the density and the extension of the potsherds and tiles in the freshly plowed soil. The mapping procedures were accomplished using an RTK GPS of highly precision, based on a georeferenced grid systems, uploaded in the GPS' mapping soft. The grid cells were 40 × 40 m. We used and adapted this method in order to create a systematic workflow for the field research.

The points thus recorded were introduced in a computational GIS-based algorithm called *Density Grid*[75] or more popular among archaeologist, *Heat Map*. In this particular case, the applied algorithm to estimate the density of the potsherds and tiles was the *Kernel Density Estimation* (KDE),[76] as a tool for spatial analyses. Based on the data collected

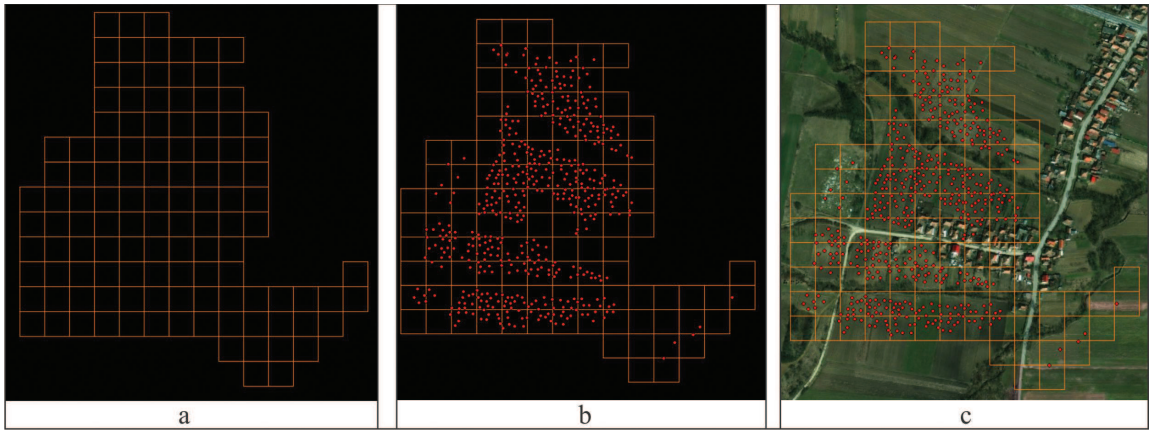

Fig. 1. The mapping method: a-georeferenced grid, b-topographical points resulted after the field survey, c-grid and points overlapped on the aerial plan.

[65] Protase 1994, 75, for toponimy and older accounts.
[66] See mainly Macrea *et al.* 1961, 384–386; Protase 1994, 75–101.
[67] Opreanu 1998, 79–81; Bennett 2006, 285; Opreanu, Lăzărescu 2016, 95.
[68] See the geophysics results in Haalebos 1999, 205, Fig. 10, 209, Fig. 12; Bennett 2006, 286, Fig. 4; 287, Fig. 5; 288, Fig. 6; Marcu 2009. 284, Pl. 16; Opreanu, Lăzărescu 206, 96, Fig. 53, Fig. 54.
[69] Opreanu, Lăzărescu 2016, 97, Fig. 56.
[70] Protase 1994, 94–95.
[71] Bennett 2006, 292–293.
[72] See the localization of the borings and trenches in Haalebos, 1999, Fig.12.
[73] For such examples see in particular Sommer 1988; Sommer 1997, 41–51; Sommer 2008, 253–284.
[74] The extensive field surveys were accomplished together with my colleague and friend Dan Deac, Phd. (Zalău County Museum of History and Art).
[75] See especially Kaur Mann, Kaur 2013, 2143–2147.
[76] For a definition of the algorithm and method see

in the field, KDE created multiple maps showing clearly the spots with a high density of material. The parameters used to create the density grids were a search radius of 6 m. and three cells per radius. Applying this method to all the surveyed civilian settlements, we were able not only to see the spreading of the archaeological material (= the theoretical extension of the site) but also to have a clear image of the archaeological density areas.[77]

We want to underscore the fact the current analyses represents only the situation *de facto*, at the moment. Due to the extensive agricultural works, if we repeat the analyses next year, the situation could be different. But even if the density grid will be changed, the physical extension of the sites based on the potsherds will be most probable quite similar.

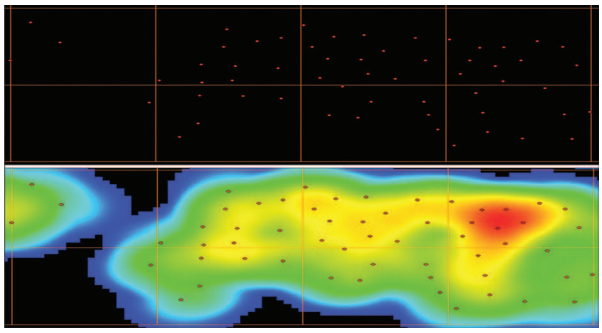

Fig. 2. Density grid of the potsherds and tiles as calculated by KDE.

The field surveys and spatial analyses were doubled by a series of aerial surveys on the surface of the military *vici*, surveys that were made using the UAV (*Unmanned Aerial Vehicle*).[78] The methods were applied in the following purposes: oblique and vertical aerial photography and *Digital Surface Models* (DSM) based on drone mapping.

The aerial photography is a quite old and widespread method used in archaeology,[79] the results being astonishing even within the narrow subject of the military *vici* from Dacia.[80] In our case, the vertical and the oblique photos were achieved in order to check the crop marks of the soil[81] namely to search for brand new visible structures (or archaeological contexts in general). The photos were post-processed using a gradient scale editor, searching for visible and less visible crop marks,[82] framed within the post processing of passive remote sensing data.[83] The structures thus identified were georeferenced, being vectorized on general maps of the sites.

The second category of analyses based on data acquired *via* UAV[84] was the creating of *Digital Surface Models* of the military *vici*, in order to have a suitable topographical background for further analyses and to search for visible structures based on their variation of elevation. In order to do that, we used a photogrammetric-based workflow known as SfM or *Structure from Motion*.[85] The dataset (between 400 and 800 photos per digital model) was introduced in a software that applies a similar algorithm with SIFT (*Scale Invariant Feature Transform*),[86] identifying the common points (the so called *tie points*) within a data set of photos. By calculating the internal and external geometries of the camera altogether with the 3D references of the scene, the *sparse point cloud* was extracted in the process called *bundle adjustment*.[87] The next process is a densification one, mainly based on the algorithm or process called MVS or *Multi View Stereo* through which the *sparse cloud* is transformed in a *dense cloud*.[88] The resolution of the future models will strongly depend on the numbers of the points contained by the *dense cloud*. In our case, the altitude of the photos varies between 30–35 m, thus the *surface models* having a resolution of 0.2 m. Beside the GPS data that is framed within each photo, we used a series of *ground control points* based on GPS RTK measurements in order to create as much as possible high precision models.

By including the topographic points (Stereo 70) within the model, each pixel of the *dense cloud* received a set of coordinates (easting, northing and elevation = X, Y, Z), being thus georeferenced.[89] The *dense cloud* was therefore exported in a *.las* for-

especially Rosenblatt 1956, 832–837; Parzen 1962, 1065–1076; Botev *et al.* 2010, 2916–2957.

77 See a similar analyses with multiple categories of finds and a clear archaeological context in Opreanu, Lăzărescu 2015, 41–43.

78 Ştefan, Ştefan 2015, 25–35.

79 See an *excursus* in Rus 2015, 145–152.

80 See especially Oltean *et al.* 2005, 351–360; Oltean 2007, 129, 157.

81 Millican 2012, 548–563.

82 See Verhoeven 2012, 132–160.

83 Schowngerdt 2007, 2; Ran *et al.* 2017, 2421. For further details see especially Liu, Mason 2009.

84 There was not used any fight plan, the photos for the models being taken manually.

85 See especially Koenderink, van Doorn 1991, 377–385; Fonstad *et al.* 2012, 421–430; Westoby *et al.* 2012, 300–313;

86 For the *SIFT* algorithm see Lowe 2004, 91–110.

87 For the *bundle adjustment* process see Triggs *et al.* 2000, 298–372; Liu, Zayer 2012, 1–12.

88 For a similar workflow applied on the sites of *limes Transalutanus* see Ştefan, Ştefan 2016, 255–270. See also Ştefan, Ştefan 2016, 25–35.

89 See Micle *et al.* 2016, 731–742.

mat, with a previous point classification process, in order to obtain a *bare ground surface*, without the low vegetation interfered, in a GIS based software.

The methods briefly described were combined in all of the four cases in order to extract maximum of data. There were however situations where the positive or the negative crop marks left by the civilian settlements were not at all visible in the DTM's, therefore we decided to present only the conclusive results and to repeat the process in the near future. As for the low altitude aerial photos, it is highly recommended to repeat the UAV deploys again and again, in each season, in order to gather as much info as possible.

The limits of the methods are quite clear. First of all, we used only the surface surveys and the low altitude photography, therefore the results are conditioned by the presence of the archaeological material and the visible crop marks of the civilian buildings. Secondly, the aerial photography did not revealed all the substructures due to the fact that the vegetation was quite scarce. A future study will follow in order to complete the aerial data. But after all, only an extensive geophysical survey could reveal the real layout of those *vici militares*.

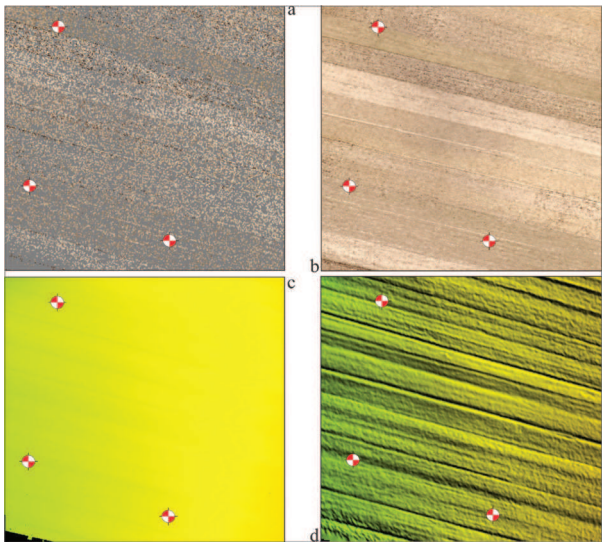

Fig. 3. DSM workflow based on UAV and RTK ground control points: a-sparse cloud, b-dense cloud, c-.las classification model, d-DSM;

The results

The first results after applying the selected methods and gathering all the data are quite interesting and promising. We will describe them in the same order established in the introductory section.

– The civilian settlement that developed near the auxiliary fort at Buciumi was mainly placed on the extension of *via principalis*, therefore in front of the *porta principalis sinistra*, based on the archaeological material (Plate IV). The extension of the pottery was identified on a length of 429 m from the *porta*, stopping somewhere near the *Lupule*ţului Valley. It is thus possible, as N. Gudea mentioned,[90] that the military *vicus* could have extendend on the south-eastern slopes. Unfortunatelly, the area is not plowed. We found out that the pottery is expanding also toward northwest, on the plateau near *Dealu Flămând*, a previously unknown area. The archaeological material was found also in front of *porta decumana*, where the aforementioned structure was previously identified *via* UAV.[91] Based on the pottery density, we believe that the civilian settlement is located also in the northern and north-western side of the auxiliary fort, being somehow an extension of the main core from the north-eastern side. The archaeological material was identified on a surface of 6.90 ha.

The *Digital Surface Model* revealed again the structure previously identified,[92] but less visible due to the fact the specific agricultural plot was heavily plowed. A medium concentration of Roman potsherds and tiles were scattered on that spot. Furthermore, by editing the gradient of the photos, several crop marks that could indicate possible structures were spot in the same agricultural plot as the structure identified through photogrammetry. Because we do not possess data regarding the layout of the civilian settlement of the auxiliary fort at Buciumi, it is hard to frame it in a particular typology. But using the info provided by N. Gudea about the separate streets identified with the means of the electro-resistivity[93] to which we add the extension of the archaeological material and the structures identified *via* remote sensing, it is quite possible to deal with a combination of *street-type*[94] and *tangent-type*[95] *vicus.*

– Further north, the methods applied on the surface of the military *vicus* at Românaşi are even more convincing (Plate V). The first localization of the civilian settlement was only partially correct[96]; it is obvious that the physical extension of the archaeological material has been approximated based more or less on local accounts. After the recent extensive field walking combined with the gradient analyses of several aerial photos, we are finally able to see the real extension of the

90 Gudea 1997, 62.
91 For the structure see Opreanu, Lăzărescu 2016, 66.
92 Opreanu, Lăzărescu 2016, 66, Fig. 20.
93 Gudea 1997, 62.
94 See Sommer 2006, 97–98.
95 Sommer 2006, 103.
96 Tamba 1997, 29–32.

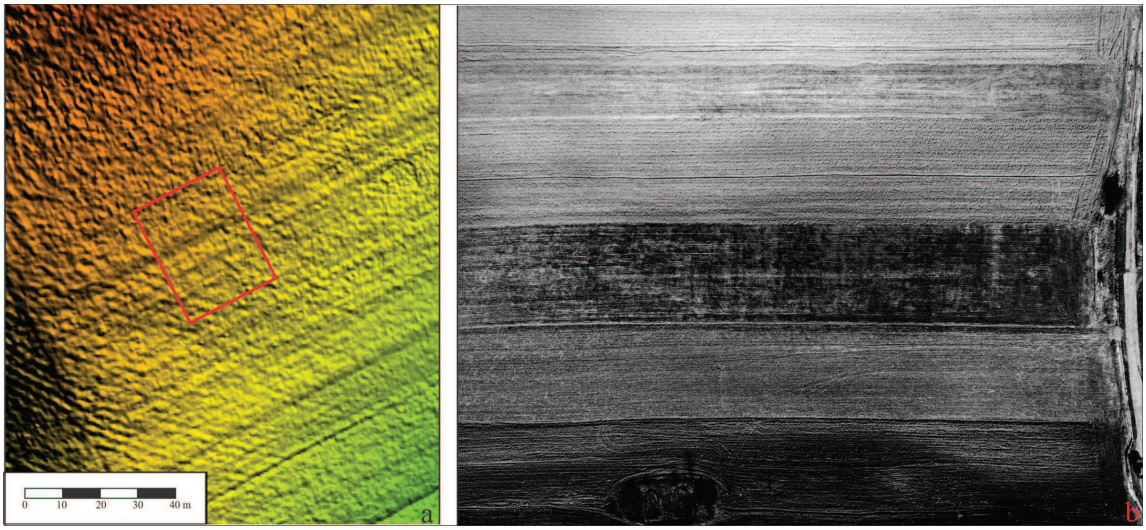

Fig. 4. The civilian settlement of the auxiliary fort at Buciumi: a-the second identification of the building in front of porta decumana; b-crop marks of possible buildings in front of porta decumana (gradient-black and whites).

archaeological material, the density spots within the settlement and even crop marks belonging to the civilian buildings of the military *vicus*.

Based on the recent geophysical survey on the surface of the auxiliary fort and outside of it,[97] we can tell that the layout of the civilian settlement is in close connection with the extension of *via praetoria*,[98] therefore the *vicus* is located mainly in front of *porta praetoria*. East of this main gate, the archaeological material stretches on length of approximatively 300 m. According to the locals, the archaeological material, mainly bricks and tiles, was found also in their gardens and under their houses. Thus, it is clear that a part of the *vicus* is overlapped by the modern village.

The archaeological material was recorded south-east and north-east of the fort, on the both banks of *Ciumărna Valley* and its tributaries. The situation of the area located west of the fort it is quite unclear. Despite the fact that the older accounts recorded a large amount of archaeological material (potsherds, nails, bronze fittings)[99] and the alleged location of the necropolis is also somewhere there,[100] we did not manage to record such a density of finds but only some scattered potsherds on a relatively small surface. At this point, the area with potsherds, bricks and tiles covers a surface of roughly 11.1 ha.

In addition to this data, the gradient analyses of several vertical and oblique photos revealed a series of crop marks, north-east of the fort; the crop marks are belonging to two distinct buildings and most probably to a road (primary or secondary) whose trajectory is indicating a direction to the *porta praetoria*. Combining the kernel density grid of the archaeological material with the georeferenced aerial photos, we observed a clear overlapping of the crop marks with the calculated hot-spots.

In terms of typology, we presume at this stage that the military *vicus* at Românaşi follows the same pattern like the one from Buciumi, being a *street-type vicus* with several (?) streets ramifications, orientated in this particular case east of *porta praetoria*.

– If in the above mentioned cases the analyses have yielded conclusive results, the surface of the civilian settlement that have developed near the auxiliary fort at Buciumi-Romita (due to its thick layer of alluvial sediments) did not respond to our methods). We were able to map only several potsherds, grouped in four small areas: near the baths (probably left from the old excavations), near the north-eastern corner of the fort, near *porta decumana* and some of them at approximate 200 m south-east of the fort (Plate VI). Even if the older field surveys have established the existence of the civilian settlement outside of *porta praetoria* and *porta decumana*, on a north-south axis,[101] the current attempt does not reveal any extra data. The aerial surveys were also unsuccessful.

New data was achieved instead on the territory of Romita. Based on the older accounts, we managed to find a rather preserved segment of the Românaşi-Romita-Brusturi road, thus the

97 See Opreanu, Lăzărescu 2016, 67–70.
98 Opreanu, Lăzărescu 2016, 68, Fig. 22.
99 Tamba 1997, 30.
100 Torma 1864, 11–12; Tamba 1970, 32–33.
101 Matei, Bajusz 1997, 114–116.

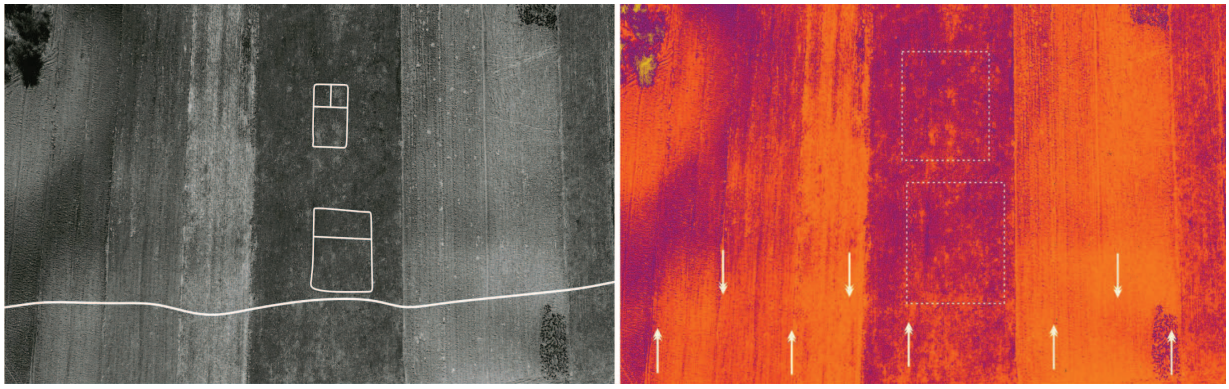

Fig. 5. The civilian settlement of the auxiliary fort at Românași: a-interpretation of the crop marks (gradient-black and whites); b-crop marks of two civilian buildings (gradient-YVOB).

road that entered in the fort at Brusturi *via porta decumana*. The road segment should be (based on the available description) near the necropolis of the fort and of the civilian settlement.[102]

– Our last objective is also the trickiest. The civilian settlement of the auxiliary fort at Tihău seems to be a hard to conquer objective in the absence of any extensive geophysical survey carried out on *Cetate* plateau. Based on the first geophysical survey, 100–150 m north, east and south of the auxiliary fort[103] one can clearly see a complete lack of civilian structures, except for the kilns and ovens previously mentioned.[104] The field survey followed by the results of the kernel density analyses indicates a gap of 100–150 m in front of *porta praetoria*, gap without any archaeological material; this *empty space* is basically located in the area with no magnetic anomalies.

The potsherds and tiles were scattered on a surface of 8.7 ha, between 280–300 m east and south-east of the fort (Plate VII). The aerial photos and the post-processed data din not capture any crop marks of possible civilian structures. The only marks observed were several black spots, most probably the kilns previously identified in the geophysical survey.

Combining the available geophysical data with a recent *Digital Surface Model*, we believe that both the linear magnetic anomaly and the linear crop mark identified by us could represent the traces of the road that entered in the fort throughout *porta praetoria*. Due to its topographical layout, the only possible location for the civilian settlement is in front of this main gate. There are two possibilities: either the military *vicus* is somewhere else (although very unlikely) or a little east and south-east, toward *Grădişte Hill* (outside the surface covered by the magnetic survey) as the density of the archaeological material is indicating. Based on the *DSM*, at a distance of 230 m south-east of the fort, there are several crop marks that could indicate the presence of a structure. However, the only way to find out its real layout is an extensive geophysical investigation in that specific area.

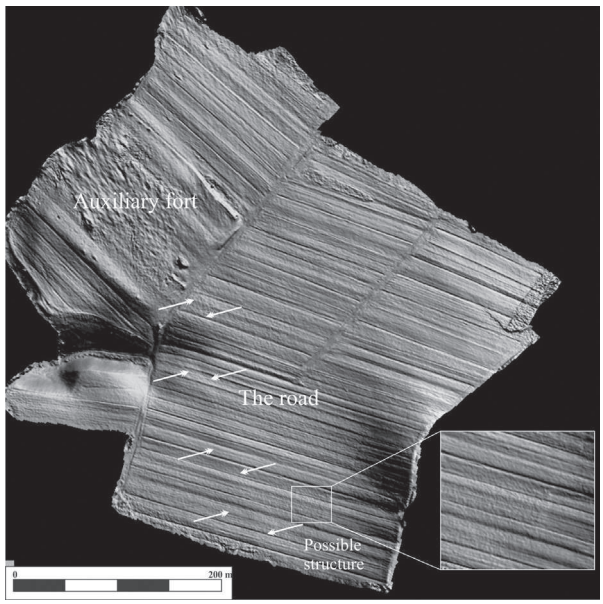

Fig. 6. Digital Surface Model of the fort and vicus at Tihău; the road and the possible structure.

Instead of conclusions

The aim of this paper was mainly to reopen the dossier of the civilian settlements that had developed near the auxiliary forts in this part of Dacia Porolissensis. The topic is its infancy, thus, a further research including geophysics and archaeological excavations is strictly needed if we want to increase our level of understanding; the so-called *camp followers* have their own community with a specific way of life. The *agency* and the *structure* of

102 See Matei, Bajusz 1997, 117–118.
103 Haalebos 1999, 209, Fig. 12.
104 Bennett 2006, 292–293.

these settlements are organically bounded by the auxiliary forts, thereby a broader study of the mentioned communities could help in a higher grade the understanding of the soldiers' community.[105] After more the 100 years of research focused on the auxiliary forts, a shift on their civilian settlements is strictly needed in order to bridge this huge data gap.

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[105] See in this direction Haynes 1999, 165–174; Haynes 2013.

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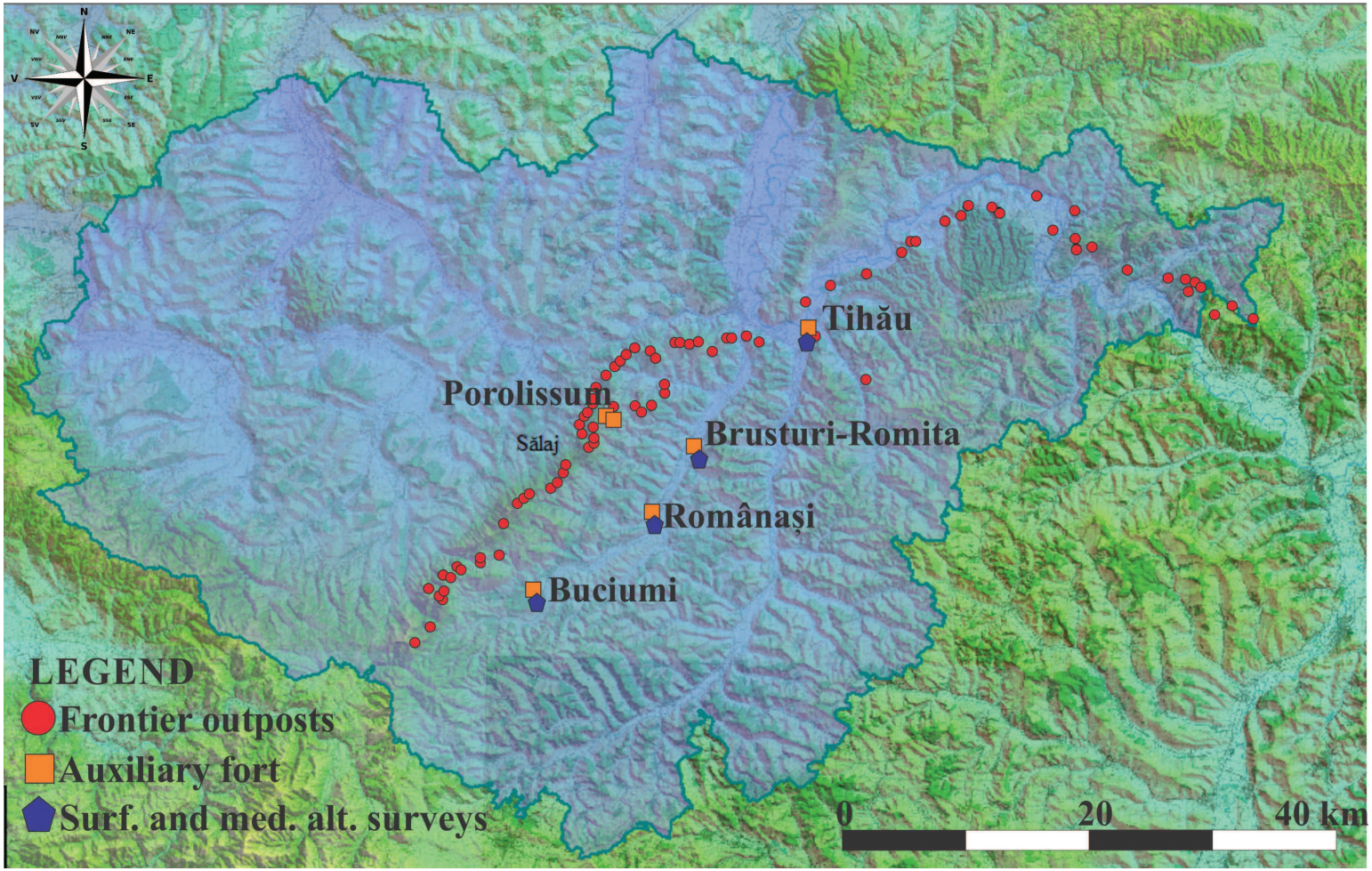
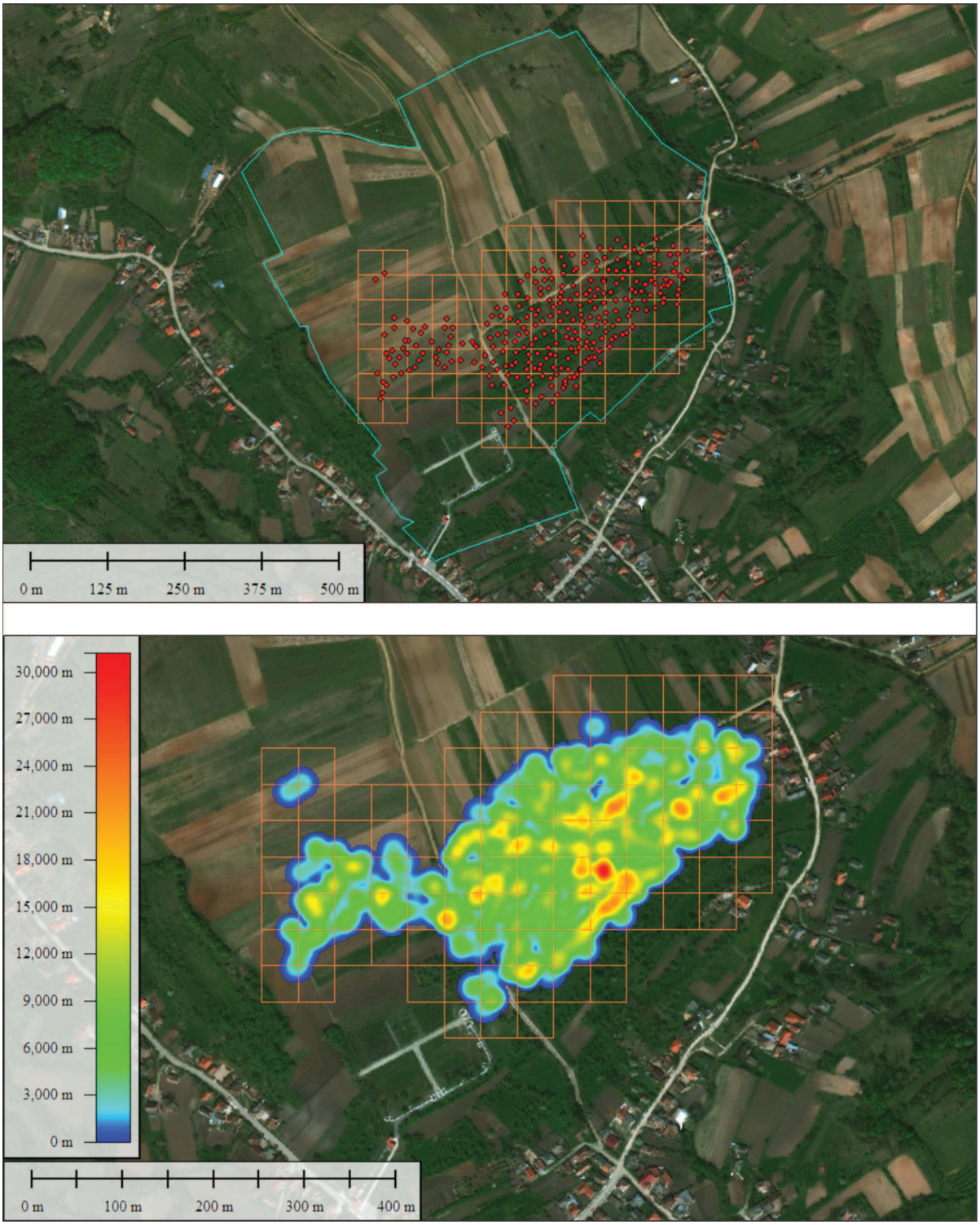


Plate I. The spatial distribution of the investigated sites.
Planșa I. Distribuția spațială a siturilor investigate.

Plate II. a. Buciumi-*vicus militaris*. b. Românaşi-auxiliary fort and *vicus militaris*.
Planşa II. a. Buciumi-*vicus*-ul militar;b. Românaşi-castrul auxiliar şi *vicus*-ul militar.

Plate III. a. Brusturi-auxiliary fort and *vicus militaris*. b. Tihău-auxiliary fort and *vicus militaris*.
Planşa III. a. Brusturi-castrul auxiliar şi *vicus*-ul militar; b. Tihău-castrul auxiliar şi *vicus*-ul militar.



Pate IV. Buciumi. Surface grid-based survey and *Kernel Density Estimation*.
Planşa IV. Buciumi. Perieghează caroiată şi estimarea densităţii.

Plate V. Românaşi. Surface grid-based survey and *Kernel Density Estimation*.
Planşa V. Românaşi. Periegheză caroiată şi estimarea densităţii.

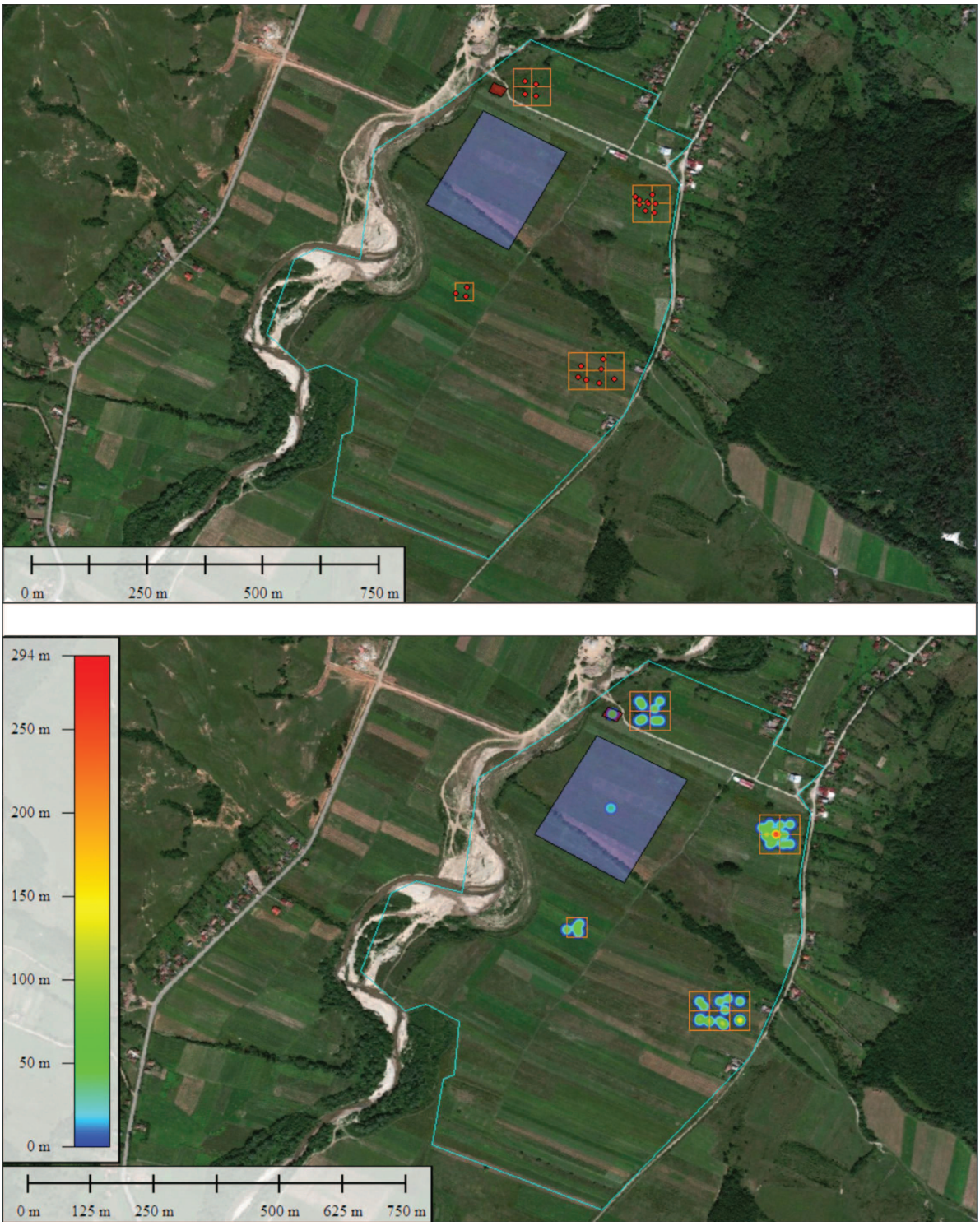


Plate VI. Brusturi. Surface grid-based survey and *Kernel Density Estimation*.
Planşa V. Brusturi. Prospecțiune caroiată şi estimarea densității.

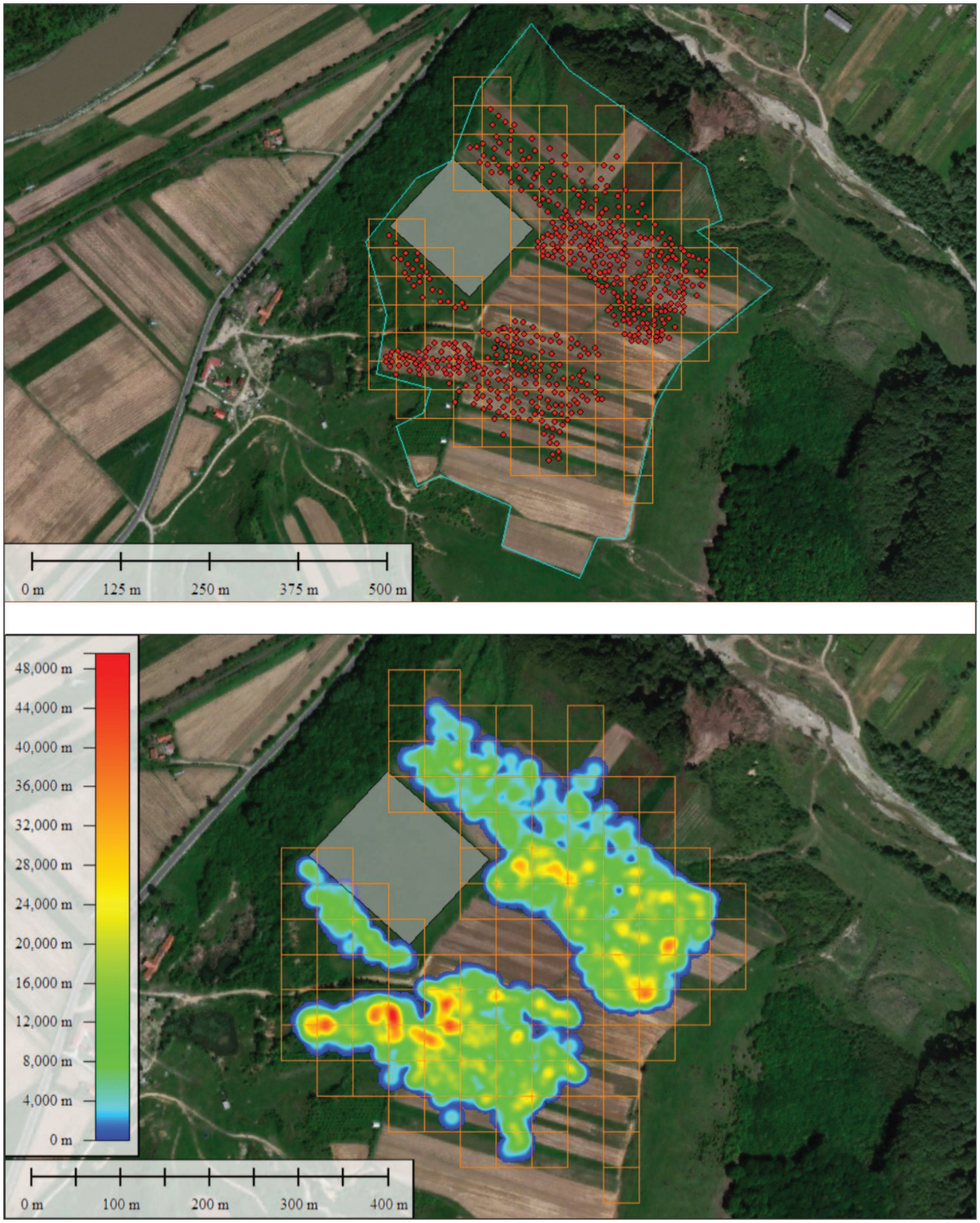


Plate VII. Tihău. Surface grid-based survey and *Kernel Density Estimation*.
Planşa VII. Tihău. Perieghează caroiată şi estimarea densităţii.