TERRITORIAL EVOLUTION OF THE FORTIFICATIONS OF THE ANCIENT, MEDIEVAL AND MODERN CITY OF ALBA IULIA. MORPHO - TOPOGRAPHIC, CARTOGRAPHIC AND 3D MODELLING ANALYSIS

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***Abstract**: In the scientific literature, the problem of the Roman castrum from Alba Iulia is still discussed, especially due to the lack of research on the east side. Archaeological researches carried out across the old castrum perimeter of the Legion XIII Gemina, although small in number and size, were able to provide a relative and general image, over the size, organization and planimetry of the Roman military fortification. Through this study, corroborating the techniques and methods of Archaeological Topography, cartography and Geographic Information Systems (GIS) with the results of archaeological research, we tried to present in a technical perspective and 3D reconstruction the main fortifications that marked the history of Alba Iulia city.*

***Keywords:** archaeology, GIS, topography, 3D modelling.*

1. Introduction

Archaeological researches carried out across the old castrum perimeter of the Legion XIII Gemina, although small in number and in size, were able to provide a relative and general image, over the size, organization and planimetry of the Roman military fortification.

Researches have been specially "focused' on surprising the castrum walls and gates (limestone curtain), currently being certain the position and dimensions of three of its sides, archaeological surprised: the south one, (the entrance gate, the towers and the curtain, still in elevation); the north one (archaeological surprised in the northern foundations of Apor Palace, of the School Inspectorate, of the Theological Institute and of the military barracks - over 60 meters) and the west one (found in the western side of the Roman Catholic Bishop Palace and in the sector between the IVth Gate and the Orthodox Cathedral).

Over the years, several planimetric versions of the Alba Iulia Roman castrum had passed around; among them we remind [1]: G. Anghel 415x430m, M. Rusu 474x474m, V. Moga 430x440m, D. M. Istrate 440x470-480m.

Regarding the east wall, the researcher Vasile Moga mentions the existence of a fragment from the core wall (Moga 1998, 44) … "from east to west we measured the area between the IIIrd Gate of the Vauban fortress (at 22 m west from the shaft gate where in 1985, under the actual pavement, appeared a fragment from the core of eastern wall of castrum)".

[1] References are for the stone age of the castrum. Dimensions will be presented from north - south and east – west.

In 2006, on the occasion of the sewerage and water feed pipe inside the city, made on Mihai Viteazu Street, near the south-west corner of the Orthodox Cathedral enclosure, was discovered a part of the costrum wall and a tower. Archaeological discoveries have been raised with total station and the plan reference confirms the position of the castrum west wall.

On the occasion of publication the research within the fortress by the researcher Daniela Marcu Istrate, is proposed the size of 470-480m to the east and west side due to discoveries made in 2007 in the basement of Manutanța, building from the XVIII century (Istrate-Marcu 2008, 53/a, please also see note 131 / Plate 3).

In our intention to present the methods and techniques of digital topography, we need to give special attention to the second terrace of the MureF River, known as The Roman Plateau, the place where later was built the Roman castrum and the after fortresses, derived from the castrum route.

Even from the beginning we must specify that The Roman Plateau is located on the second terrace of the Mureş River (Buza 1986, 36) and not on the third terrace, as it was used in the specialty literature (Moga 1998, 44; Istrate Marcu 2009, 19) and the terrace elevation on which the roman castrum and medieval city had developed, is determinate by 238m elevation, Black Sea 1975, reference system.

- from topographic measurements, the current ground level from terrace edge is 237.5 to 238m, in some places up to 239m in the Black Sea 1975 reference system. This level is the eastern part of the terrace, representing the terraced canopy of the Vauban fortress, where is located The Horea, Closca and Crisan Obelisk and the III rd Gate of the fortress to the Centre district;

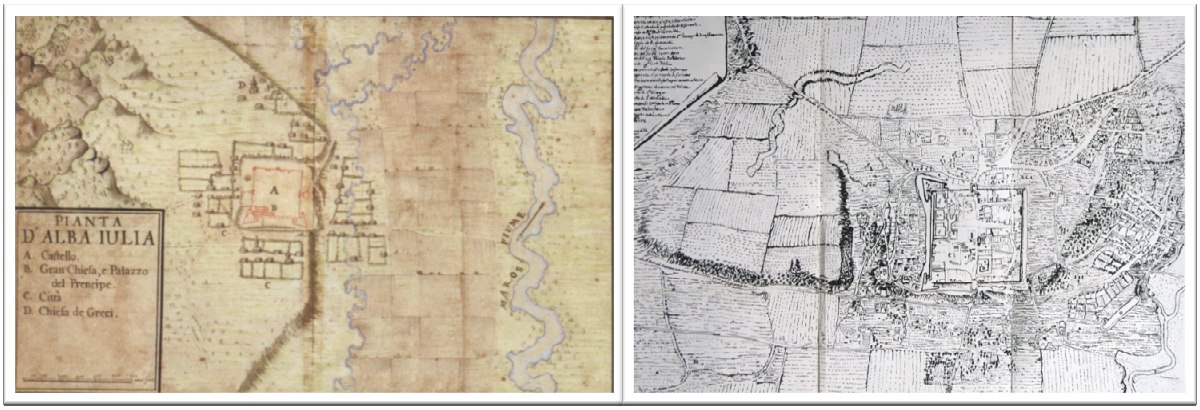

Fig. 1. 1687 plan, Luigi Ferdinando Marsigli (?), Alba Iulia, (Fig.128/source Feşer 2006)	Fig. 2. 1711 Plan, Giovani Morando Visconti, Alba Iulia

Studying the plans from1687 and 1711(Fig. 1/2) and the geomorphological plan of the area (Fig. 3.), it can be seen that terrace edge is approximately in line with next terrace on the west side, and in the corners of the fortress on the same alignment has a slightly curved shape .

Studying the Vauban fortress plan it can be seen the terraced canopy from eastern side that follows the terrace edge from old maps, being longer than the terraced canopy from the western side. Therefore, relief shapes were used to the construction of embankment, which gave the fortress its current form.

Thus we draw a circular curve on the elevation area 238 to form terrace edge, and we joined the east - west unclosed contour lines according to this axis.

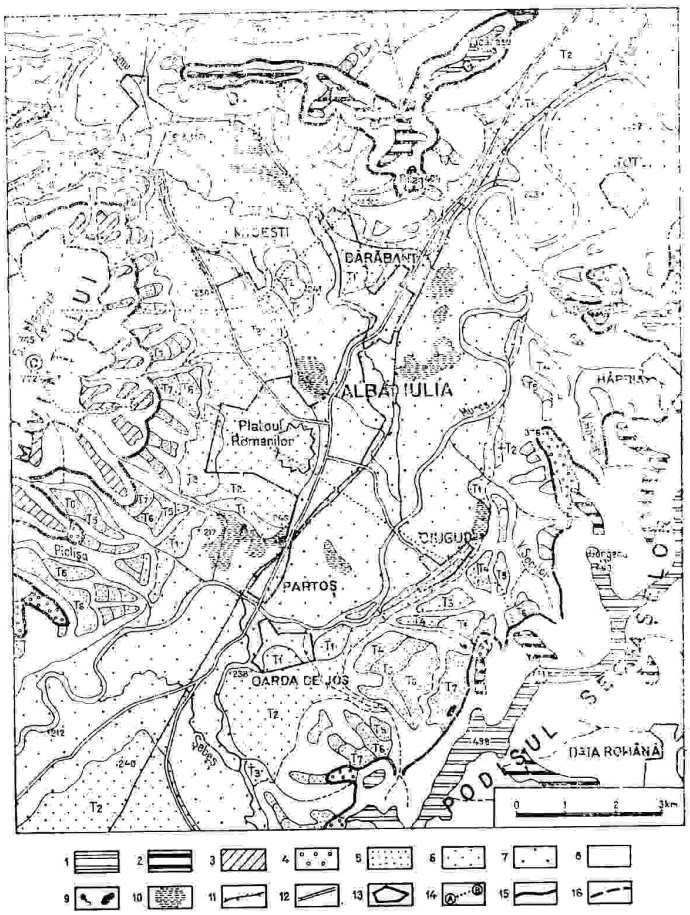

Fig. 1. — Harta geomorfologică a culoarului Mureşului la Alba Iulia. *1*, Nivelul superior al Podişului Secaşelor (430—550 m); *2*, nivelul inferior al Podişului Secaşelor (400—430 m); *3*, culmi piemontane; *4*, glacis format prin pedimentaţie; *5*, terase superioare (T_7—T_4); *6*, terase inferioare (T_3—T_1); *7*, luncă; *8*, versanţi; *9*, izvoare şi lacuri; *10*, vechi mlaştini, actualmente drenate; *11*, căi ferate; *12*, drumuri principale; *13*, localităţi; *14*, profile geomorfologice; *15*, limita culoarului; *16*, limita dintre munte şi piemont.

— Die geomorphologische Karte der Mureş-Senke bei Alba Iulia. 1, *Oberes Niveau des Secaşelor-Hügellandes (430—550 m)*; 2, *unteres Niveau des Secaşelor-Hügellandes (100—430 m)*; 3, *Piedmontsrücken*; 4, *Spulpediment*; 5, *obere Terrassen (T_7—T_4)*; 6, *untere Terrassen (T_3—T_1)*; 7, *Flußaue*; 8, *Abhänge*; 9, *Quellen und Seen*; 10, *alte Sümpfe, gegenwärtig drănieri*; 11. *Eisenbahlinien*; 12, *Hauptstraßen*; 13, *Ortschaften*; 14, *geomorphologische Querprofile*; 15, *Grenze der Senke*; 16, *Grenze zwischen Gebirge und Piedmont.*

Fig. 3. Geomorphological map of the corridor Mures in Alba Iulia (from Buza 1986)

After we have finished the terrace edge by contour lines we past to achieve the MNAT for the Roman period (before the construction of the Vauban fortress).

2. Roman castrum – Analysis of spatial distribution of archaeological discoveries

To obtain the size of the Roman castrum we have used the following data:

1. Topographic plan of the fortress conducted by topographic surveys with total station
2. Topographic surveys for castrum items presented at the beginning and visible on the field
3. Topographic surveys for the tower discovered in 2006
4. Reconstruction proposal of the Roman castrum according to Marcu - Istrate 2008(Fig. 4)
5. The Plan of the Medieval Fortress according to G.M. Visconti 1711

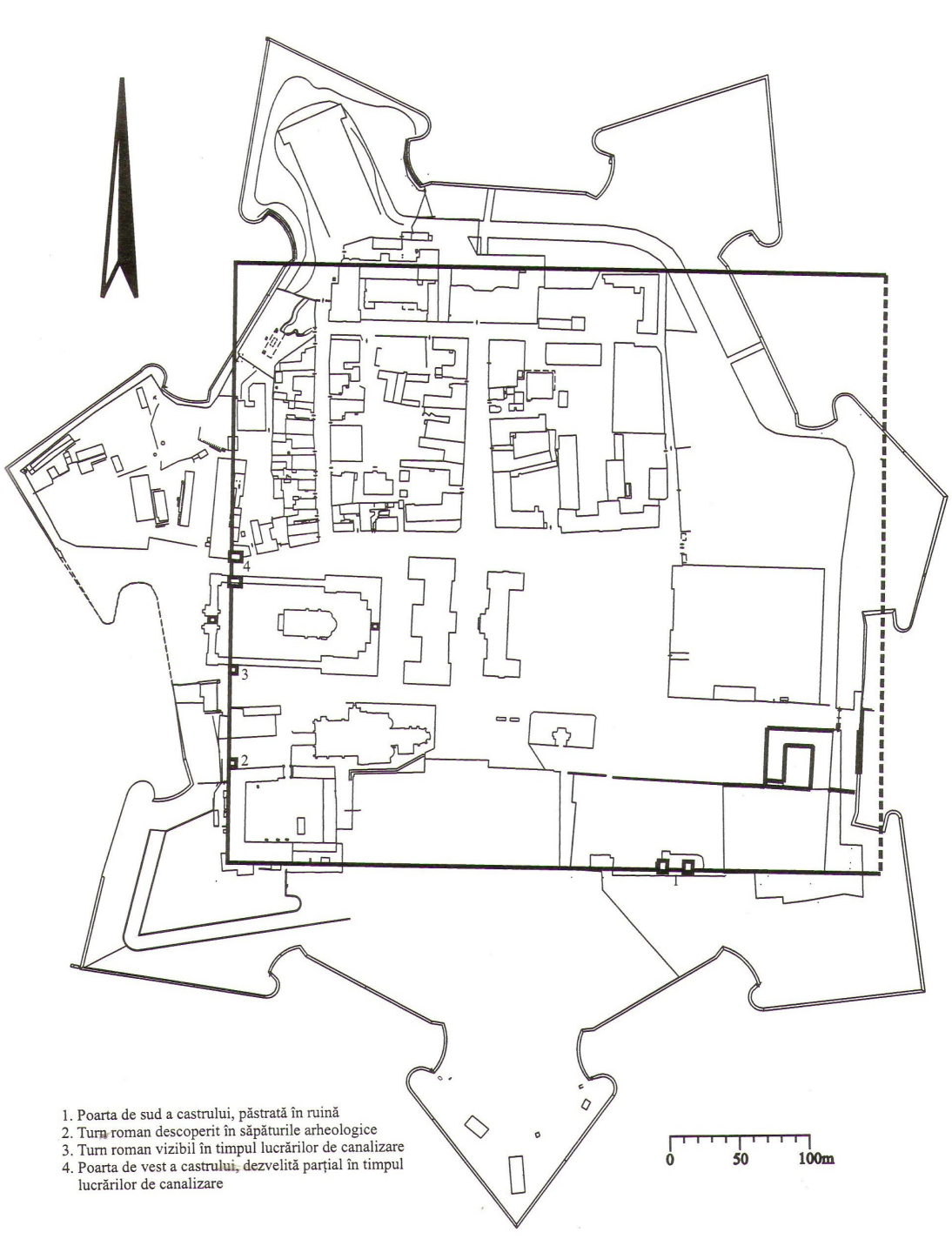

Fig. 4. Proposal for reconstruction of the castrum (Marcu-Istrate 2008, 509)

In the first phase we reported on plan the archaeological discoveries: the south gate of the castrum, the tower discovered during archaeological research, the Roman tower discovered in 2006, the western gate of the castrum, the north area archaeological surprised in northern foundations of Apor Palace, of the School Inspectorate, of the Theological Institute and of the military barracks - over 60 meters. Thus we obtained a distance of 427m (measured within the walls) between south and north side of the castrum, by drawing two parallels to the

wall overlapped by the Apor Palace and by the wall identified during the excavations at the south gate of the castrum (Fig. 5).

Fig. 5. Reporting findings on the topographical plan and overlap over the Vauban city plan plan Vauban

For the east - west side we considered the discovery from building of Manutanta and the assumption that the medieval fortress overlaps the enclosure of the Roman castrum, fact noticed by georeferencing Visconti 1711 plan in conjunction with archaeological discoveries for the south- west side. We have made a mirror image of the remaining part of the Bethlem Bastion of the medieval fortress (southeast corner) and have traced a path perpendicular to the eastern wall (Fig. 6) resulting east - west side of 435m.

Therefore we subscribe to the idea that the east-west side of the castrum would be about 440m.

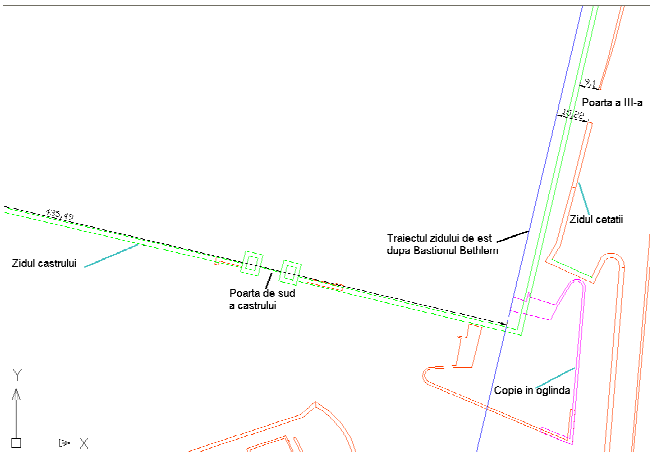

Fig. 6. Proposal for reconstruction of the eastern wall of the castrum

For the castrum reconstitution (Fig. 7) we have used the presumptions made by the researcher Marcu-Istrate, according to which the towers from the north side repeat on all sides, at approximately equal and symmetrical distances (Marcu-Istrate 2008, 53) (Fig. 4) The south and the west gate have been reconstituted after topographic surveys and archaeological plans (Moga 1998).

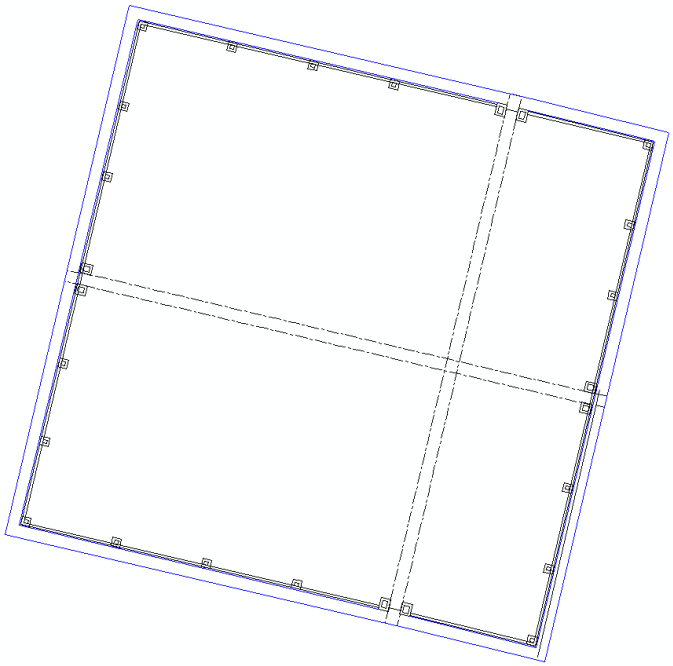

Fig. 7. Proposal to reconstruct the castrum

3. Medieval Fortress

For the reconstruction of the medieval fortress we have used Visconti 1711 plan. Thus, we used for georeference the topographic plan of the Vauban fortress and common elements of the plan Visconti - the two bastions on the south-east and south-west side that are still preserving buildings corners (Fig. 8).

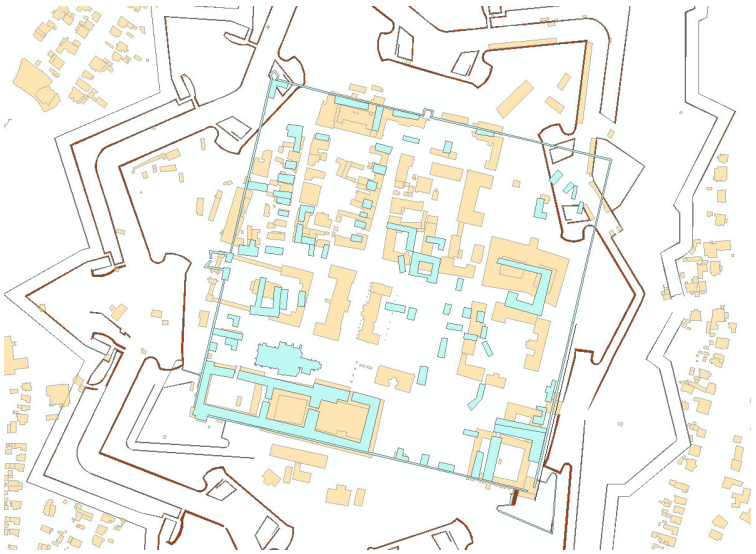

Fig. 8. Georeferencing and the vectorization plan Visconti 1711

4. The 3D reconstruction of the 3 fortifications

The obvious advantage of using GIS in archaeology is the ability to integrate data of disparate types and origins in a single computer environment - spatial distribution maps, images, text, databases, etc. which then can be modelled to be useful to the protection, management and planning of urban development process and heritage protection.

The most illustrative example is that urban and economic development at local, regional and national level involves consultation of a data set containing references to spatial location on the territory of archaeological sites and of historical monuments that could be affected, the spatial distribution of discoveries and last but not least the spatial distribution of previous research.

In recent years, 3D modelling and reconstruction in archaeology is increasingly used in the valuation and presentation of results of archaeological research. From habitat reconstructions to objects reconstruction, 3D modelling is a “tool” that should be indispensable in archaeological research.

The advantage of using 3D technology is vastly superior to 2D technology, but requires multiple resources and relatively high costs. Current computerized techniques allow us to view real size objects in 3 dimensions, rendering and texturing objects with the real appearance of the object, not only in colours and not least in terrain view.

For 3D models we chose ArcGIS Desktop Platform 9.2, produced by ESRI.

To achieve the 3D representation of terrain we started from the current MNAT made of vector contour lines. Comparative cartographic study between old maps found and the actual situation shows major modification in the hydrographical basin and the geomorphology of the region. Human intervention left signs.

For the fortifications from Alba Iulia we tried a full size reconstruction using ArcScene application. Here, we present the resulted models.

Fig. 9. 3D reconstruction of the Roman camp

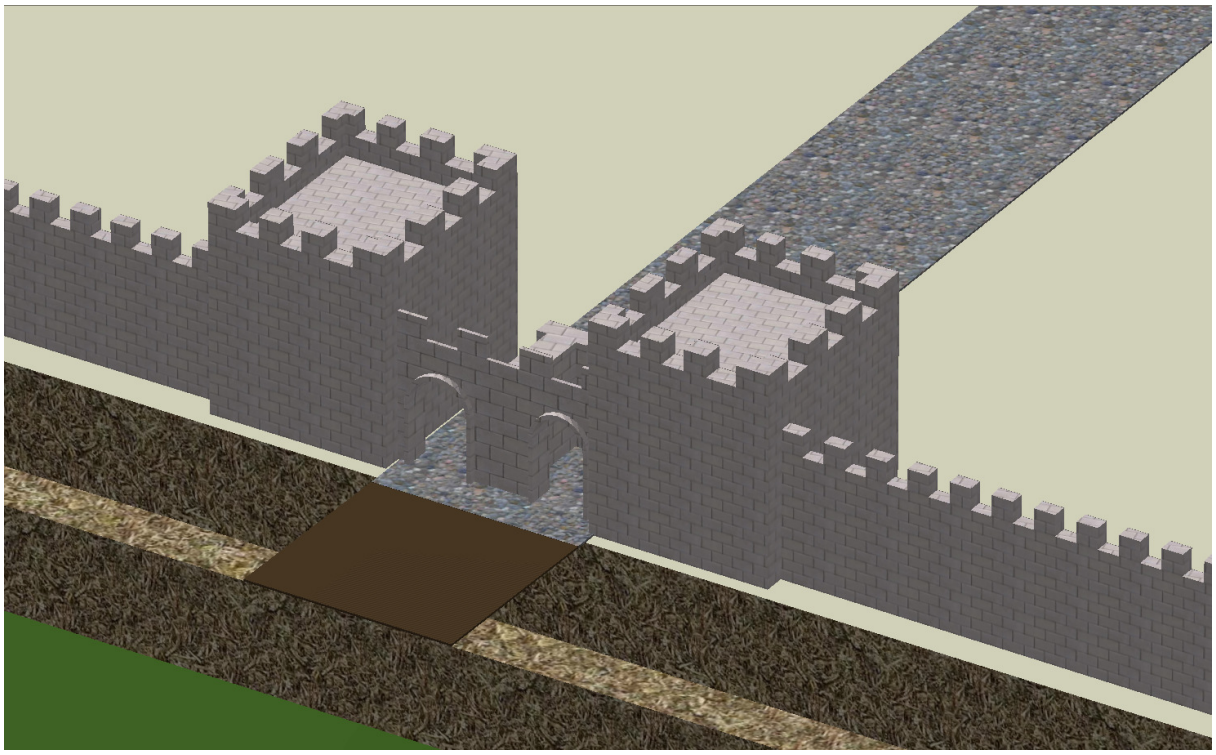

Fig. 10. 3D reconstruction of the sud gate of Roman camp

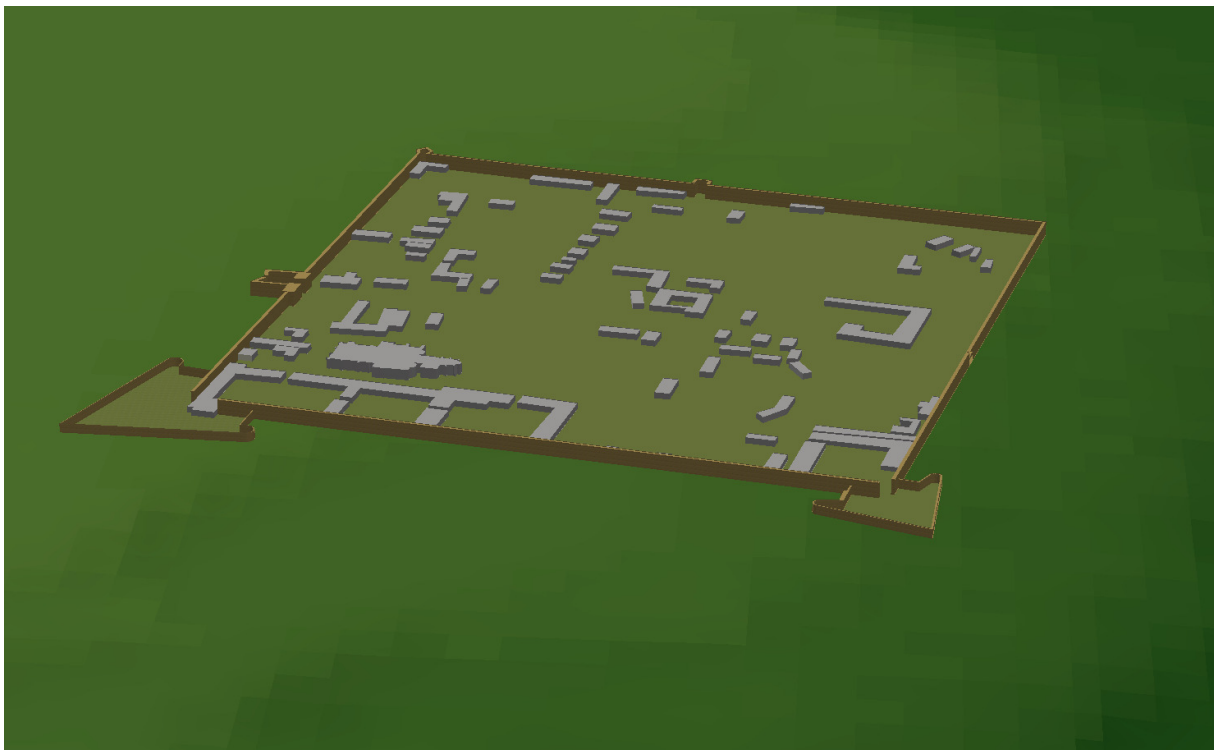

Fig. 11. 3D reconstruction of the medieval city

Fig. 12. 3D reconstruction of the Vauban city

5. Conclusions

To improve the methodology for archaeological research service (both field and office), topography, through the techniques and methods presented, and not only, is a complex interdisciplinary research method in archaeology - archaeological topography. Archaeological topography is not limited to preparing a topographic plan, through the reference of archaeological research units and through discoveries. The topographic plan is only a tool and not a goal; the aim of archaeological topography, beside the relief surface representation, is to lay emphasis on the separation of the anthropogenic relief microforms from the natural ones (3D models), data collection to achieve a three-dimensional databases, etc. for representing an archaeological site in all its complexity.

The advantages of using archaeological topography, cartography and Geographic Information Systems Research, storage of information and analysis in archaeology are multiple, and our paper is only a small part in this way. We believe that presentation from a technical perspective view in order to define spatial research of archaeological sites, using old and new methods, assisted by digital performance equipment, has given enough arguments to be seen as complementary tools for carrying out extensive and complete research, to protect archaeological heritage.

6. References

1. *Moga V., Prefecţi ai castrului Legiunii a XIII-a Gemina de la Apulum, în Apulum, XIII, 1975, 651-657.*

2. *Moga V.,, Din istoria militară a Daciei romane. Legiunea XIII Gemina, Cluj-Napoca, 1985.*
3. *Moga V., De la Apulum la Alba Iulia. Fortificaţiile oraşului, Bucureşti, 1987, p. 80.*
4. *Moga V., Cercetări recente în castrul de la Apulum. Palatul Apor Alba Iulia, în Apulum, XXVII-XXX, 209-222.*
5. *Moga V., în Castrul roman Apulum în Apulum, XXXI, 1994, p. 131-137.*
6. *Moga V., Castrul roman de la Apulum, Cluj, 1998.*
7. *Moga V., Monumente romane inedite din Apulum, în Apulum, XXXV, 1998, 135-143.*
8. *Moga V., Alba Iulia, jud. Alba [Apulum]. Punct: Castrul legiunii XIII Gemina - Porta Principalis Dextra, în CCA, 2003.*
9. *Marcu Istrate, D., Catedrala Romano-Catolică „Sfîntul Mihail" şi Palatul Episcopal din Alba Iulia. Cercetări Arheologice (2000-2002), Alba Iulia, 2008;*
10. *RepAlba 1995 - ***, Repertoriul arheologic al Judeţului Alba, Alba Iulia, 1995.*