

# Typological Repertory and Spatial Distribution of Gray Coarse Ware from Southwestern Dacia, IIIrd and IVth Centuries AD, with 3D and GIS Content

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## Abstract

The southwestern region of Dacia was one of the most intensively colonized territories of Ancient Rome, with which it maintained economic relations for centuries. These long-term relationships, and the Romanization of this territory, are best seen in the analysis of the coarse ware pottery. In this paper, we discuss our work to compile a typological repertory of that pottery, and our analysis of the spatial distribution of this kind of pottery. We have created three-dimensional digital models of the ceramic vessel types, along with precise maps of site distribution as well as the distribution of the coarse ware types. The product of this work is an e-repertory that functions like a MySQL database that operates within an interactive website that will facilitate future archaeological analyses of ceramics and site function in this region of Romania.

## 1 Introduction

The southwestern region of Dacia (Figure 1) was one of the most intensively colonized territories of ancient Rome, which ruled the region for 168 years (AD 106-274). Economic relations with the Empire had begun long before and lasted two centuries after the Aurelian retreat in AD 274. The interference between the Dacian material culture and the provincial Roman culture, the economic exchanges, and the Romanization of this territory are best illustrated through the analysis of the coarse ware ceramics.

For this project, we have analyzed all forms of Roman coarse ware from rural and urban settlements in southwestern Dacia. To accomplish this analysis, we reconstructed the range of pottery vessels in three dimensions using AutoCAD, and then created a repertory of vessel forms. For the analysis of spatial distribution of the vessels, a set of maps was made of the area showing the discovery points of the vessel forms in relation to modern environmental conditions. The maps can be simple or combined in different layers, depending on the needs of the user.

The whole project is an interactive method of documentation, complementary to classic manuals, addressed to both students and archaeology specialists. Through the compilation of all of these data, we have produced a database that can be enriched annually through the direct intervention of those who wish to present novel material from recent research.

## 2 Objectives

It is our hope that the work reported here will provide a contribution to the compilation of a typological repertory and an analysis of spatial distribution of this kind of pottery, the novelty being the updated modalities of three-dimensional (3D) processing of the ceramics, and also the accomplishment of precise maps with the distribution of the coarse ware in the two present-day districts that are found in the southwestern sector of Roman Dacia: Timis and Caras-Severin.

## 3 Methodology

The historic region of Banat consisted of the present day Romanian counties of Timis and Caras-Severin, and parts of Hungary and Serbia. Through different methods (systematic excavations, field archeological research, and haphazard findings), a few hundred Dacian-Roman settlements have been found, grouped around 210 present-day localities. These settlements have produced a range of pottery sherds that were used to develop a set of distinct vessels forms. A database was created that contains the range of pottery and site data. Using the database, the frequency of different vessel forms at sites was used to determine the nature of two sites.

**TABULA PROVINCIAE DACIAE**  
**HARTA ARHEOLOGICA A DACIEI ROMANE**  
 DUPA TABULA IMPERII ROMANII (L 34 - 35)



Figure 1. The map of Roman Dacia.

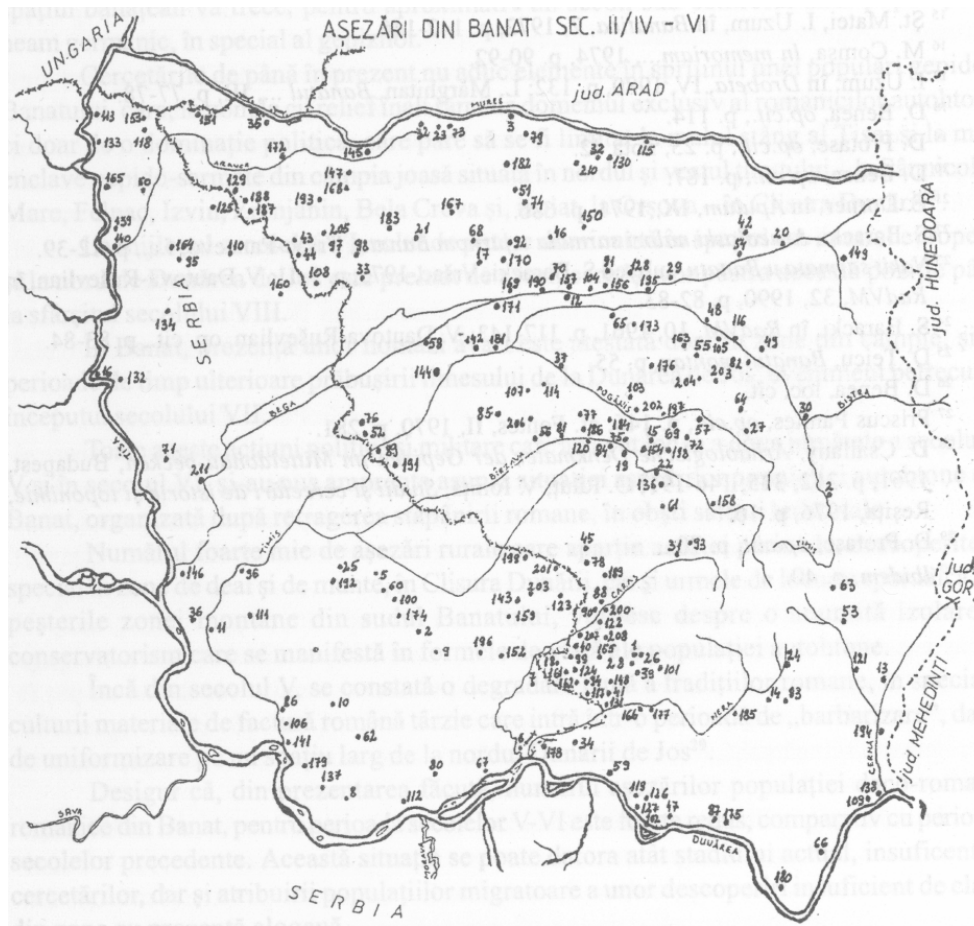


Figure 2. Old map of Banat.

### 3.1 Maps

These settlements were published, over time, in different specialty publications, and black and white maps were drawn illustrating the spatial distribution of these sites (Figure 2). Most of these maps are of very poor quality expressing with approximation the coordinates of the localities without any correlation between the archaeological sites and the surrounding environment. Also, these old two-dimensional (2D) maps do not represent correctly the terrain reality in Banat where we can find different environments: mountain, hills, plain, swamps, and sand dunes. When consulting an old map, we cannot find information about the empty space and connections between settlements. Because swamps were drained, the present-day land conditions do not justify the lack of archaeological sites, but if we create and study a specialized, GIS derived map, we can clearly see the terrain configuration.

For a proper spatial correlation, latitude and longitude coordinates were collected for each locality and were overlaid on the satellite image of the region. The coordinates were extracted through Google Earth (Figure 3) and air images from the Agriculture Ministry, and, even with some errors, the map is more precise than the previous maps of site locations. The images were edited through GIS and a

3D map of the region was created.

### 3.2 The Pottery Database

The database was done respecting the Romanian Heritage Institute's (cIMEC) standards. The pottery database was assembled based on data from the settlements, identifying each type of ware and its features (shape, dimension, color, composition, etc.). The data were entered into a GIS program (Idrisi Kilimanjaro) in order to create the map of the typological distribution.

**Case Study: "Begu" Valley.** We worked on the old maps and cadastral plans of the area, which were georeferenced, GPS calibrated, and layered over the satellite images. The resulting map was GIS edited and 2D and 3D versions with ground elevation were realized.

**Case Study: "Tibiscum" Loc. Jupa, Caras-Severin County.** Topographic maps at scale 1:100, archaeological maps at different scales, and field data were used as source data for the creation of the spatial database. The following

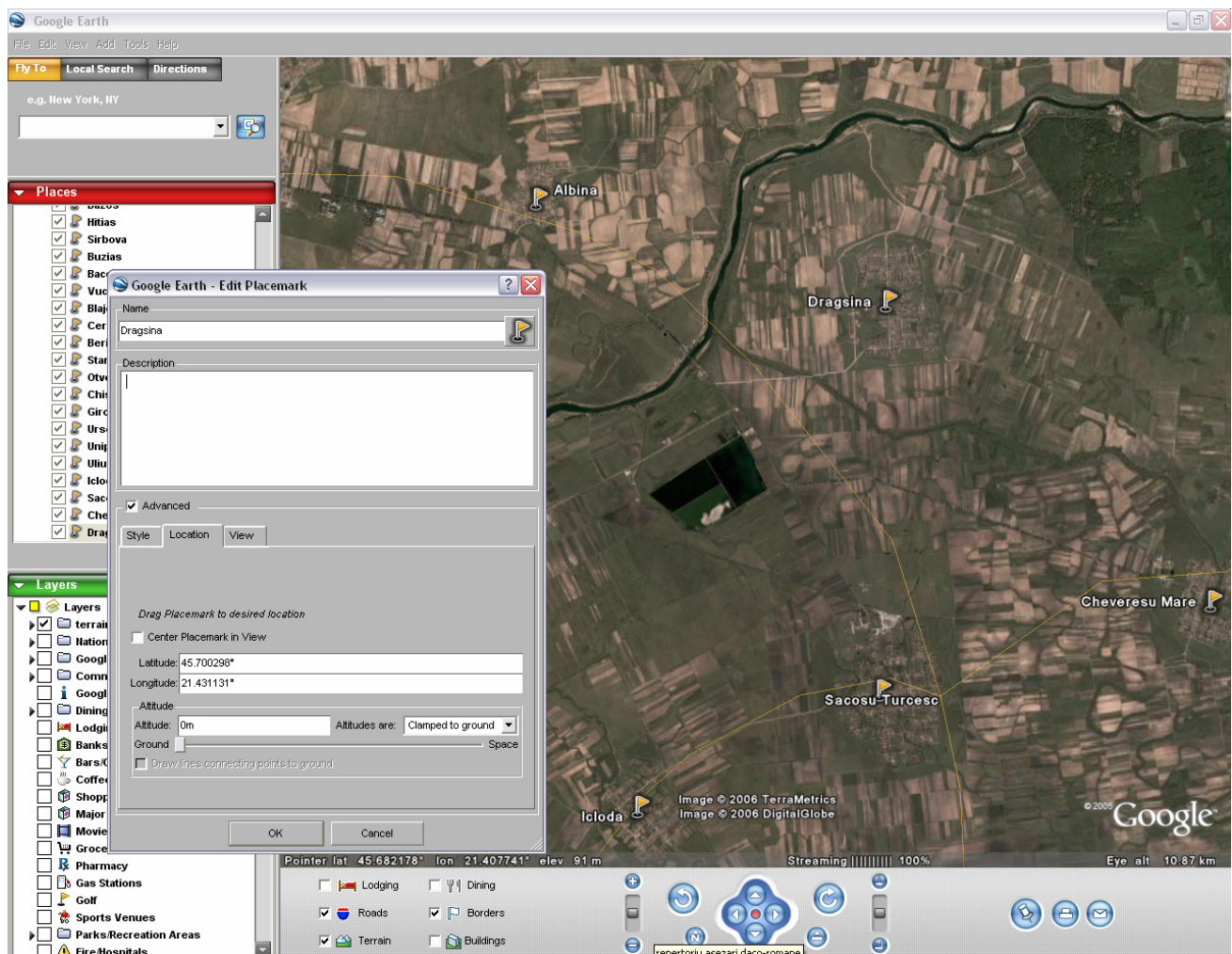
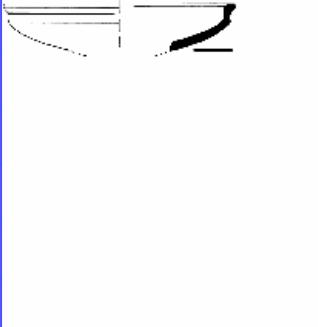


Figure 3. Acquisition of site coordinates through Google Earth.

|    | A   | B                       | C       | D        | E       | F      | G       | H           | I                            |
|----|-----|-------------------------|---------|----------|---------|--------|---------|-------------|------------------------------|
| 1  | Nr. | Așezarea                | Sec. II | Sec. III | Sec. IV | Sec. V | Sec. VI | Nr. așezări | Coordonate                   |
| 2  | 1   | Agadici (CS)            |         | X        | X       |        |         | 1           | 45° 5'8.53"N, 21°41'35.99"E  |
| 3  | 2   | Alibunar (VS)           |         | X        | X       |        |         | 10          | 45° 4'49.82"N, 20°57'56.11"E |
| 4  |     | Alibunar                | X       | X        | X       |        |         | 2           |                              |
| 5  | 3   | Arad (AR)               |         | X        | X       |        |         | 5           | 46°11'2.62"N, 21°19'37.37"E  |
| 6  | 4   | Armeniș (CS)            |         | X        | X       |        |         | 1           | 45° 5'0.16"N, 22°18'1.82"E   |
| 7  | 5   | Banatska Dubica (VS)    |         | X        | X       |        |         | 3           | 45°13'14.94"N, 20°51'7.04"E  |
| 8  | 6   | Banatska Palanka (VS)   | X       | X        | X       |        |         | 1           | 44°51'2.35"N, 21°19'28.04"E  |
| 9  | 7   | Banatska Subotica (VS)  | X       | X        | X       |        |         | 2           | 44°56'47.10"N, 21°22'47.74"E |
| 10 |     | Banatska Subotica (VS)  |         | X        | X       |        |         | 1           |                              |
| 11 | 8   | Banatski Brestovac (VS) |         | X        | X       |        |         | 1           | 44°43'40.36"N, 20°48'18.27"E |
| 12 | 9   | Banatski Karlovac (VS)  | X       | X        | X       |        |         | 8           | 45° 3'8.09"N, 21° 0'58.44"E  |
| 13 | 10  | Bantsko Novo Selo (VS)  |         | X        | X       |        |         | 3           | 44°52'2.86"N, 20°45'12.93"E  |
| 14 | 11  | Baranda (VS)            |         |          | X       |        |         | 1           | 45° 3'46.54"N, 20°26'12.94"E |
| 15 | 12  | Bazoșu Nou (TM)         |         | X        | X       |        |         | 1           | 45°45'1.07"N, 21°25'15.30"E  |
| 16 | 13  | Băile Herculane (CS)    |         | X        | X       | X      | X       | 2           | 44°52'0.41"N, 22°24'33.62"E  |
| 17 | 14  | Bănia (CS)              |         | X        | X       |        |         | 2           | 44°54'35.33"N, 22° 1'42.75"E |
| 18 | 15  | Bărbosu (CS)            | X       | X        | X       |        |         | 1           | 45°30'6.79"N, 21°37'17.46"E  |
| 19 | 16  | Becej (VS)              | X       | X        | X       |        |         | 3           | 45°36'31.04"N, 20° 6'7.72"E  |
| 20 | 17  | Becicherecu Mic (TM)    |         | X        | X       |        |         | 2           | 45°50'2.70"N, 21° 2'53.57"E  |
| 21 | 18  | Berliște (CS)           |         | X        | X       |        |         | 5           | 45° 0'47.31"N, 21°23'54.19"E |
| 22 | 19  | Berzovia (CS)           |         | X        | X       |        |         | 3           | 45°24'51.65"N, 21°37'48.49"E |
| 23 | 20  | Bichigi (TM)            |         |          |         | X      | X       | 1           | 45°51'33.31"N, 22° 8'23.21"E |
| 24 | 21  | Biled (TM)              |         | X        | X       |        |         | 18          | 45°53'16.06"N, 20°57'35.90"E |
| 25 | 22  | Bocșa Română (CS)       |         | X        | X       |        |         | 2           | 45°22'50.04"N, 21°45'58.63"E |
| 26 |     | Bocșa Română (CS)       |         |          | X       |        |         | 1           |                              |

Figure 4. Google Earth Coordinates table.

fisa ceramica

|                          |                                        |                                |                            |                   |                                                                                     |
|--------------------------|----------------------------------------|--------------------------------|----------------------------|-------------------|-------------------------------------------------------------------------------------|
| <b>nrcrt</b>             | <input type="text" value="19"/>        | <b>ardere</b>                  | inoxidanta                 | <b>imagine</b>    |  |
| <b>tipologie vas</b>     | strachina                              | <b>calitate pasta</b>          | buna                       |                   |                                                                                     |
| <b>descriere</b>         | buza evazata,<br>diametrul gurii 21 cm | <b>pozitie fragment</b>        | buza                       |                   |                                                                                     |
|                          |                                        | <b>degresant</b>               | nisip cu bobul mic si mica |                   |                                                                                     |
| <b>tehnica de lucru</b>  | lucrat la roata rapida                 | <b>tehnica decor</b>           |                            |                   |                                                                                     |
| <b>factura pasta</b>     | semifina                               | <b>motive decor</b>            |                            |                   |                                                                                     |
| <b>finisare interior</b> | neteda                                 | <b>loc descoperire</b>         | Tibiscum, S1/1983,         | <b>observatii</b> | prezinta urme de spartura veche<br>la exteriorul peretelui                          |
| <b>finisare exterior</b> | neteda                                 | <b>atribuire stratigrafica</b> |                            |                   |                                                                                     |
| <b>culoare</b>           | cenusiu deschis                        | <b>atribuire culturala</b>     | daco-romani                | <b>marcaj</b>     | T115                                                                                |
| <b>spartura</b>          | veche                                  |                                |                            |                   |                                                                                     |

Record: 17 of 181

Figure 5. Pottery database.

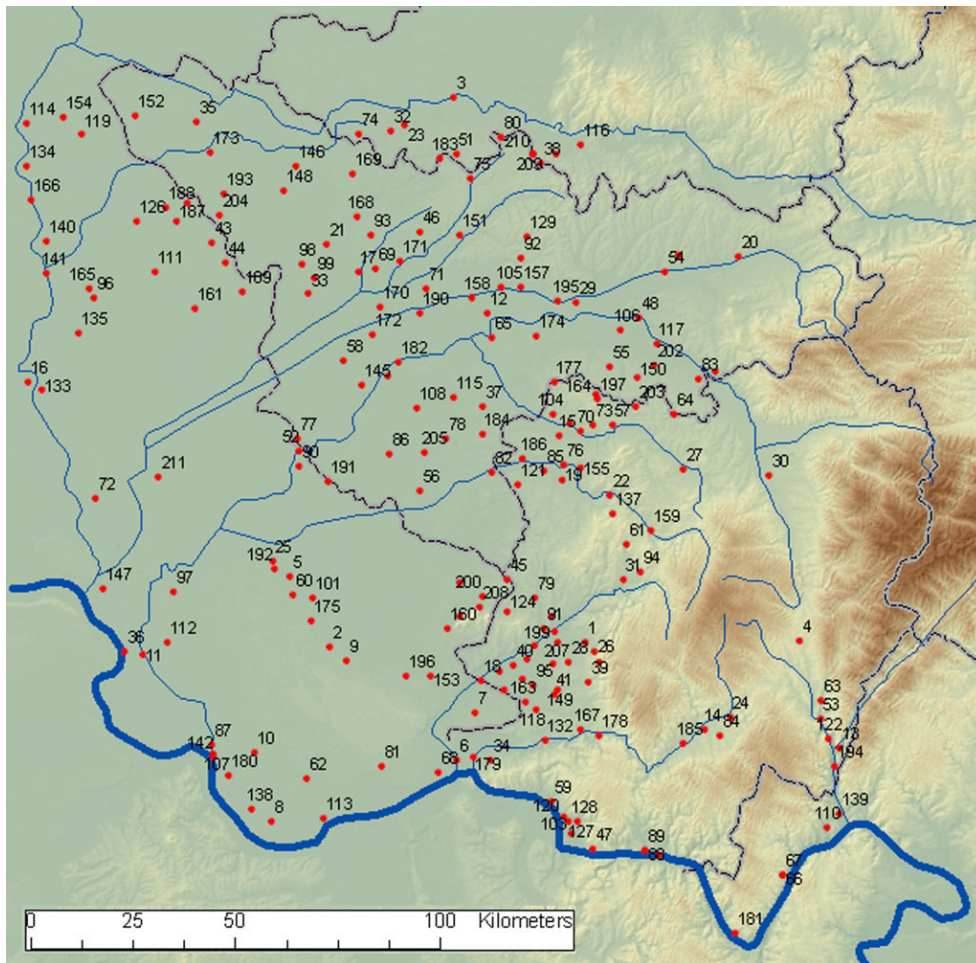


Figure 6. Map of archaeological sites in Banat, ArcGIS version.

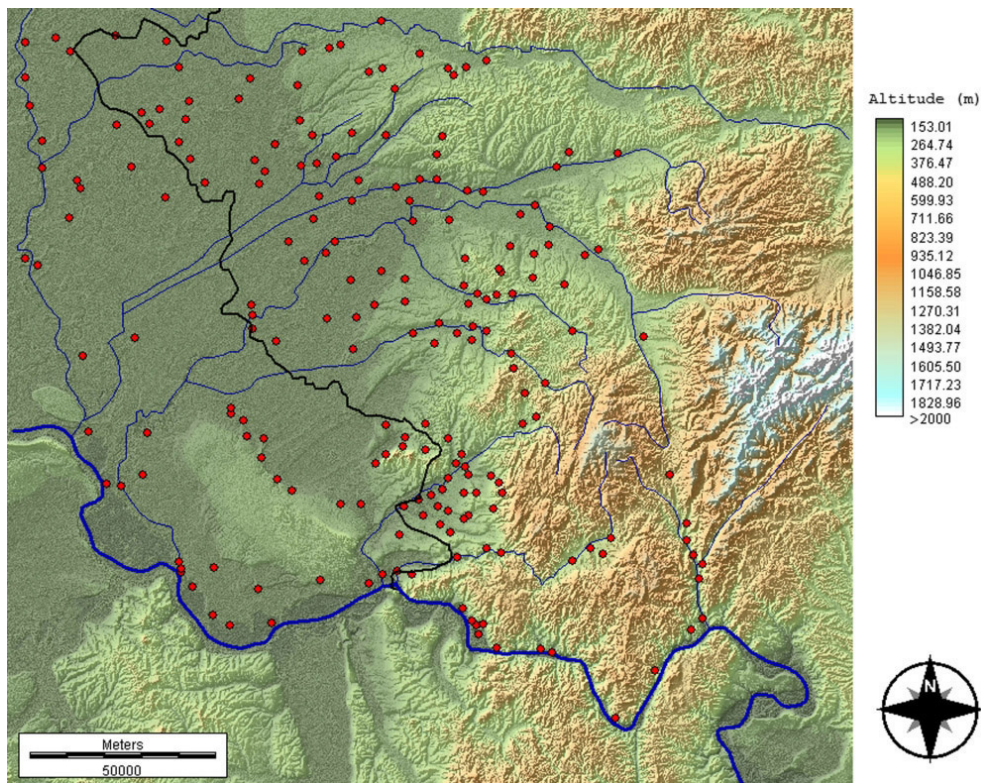


Figure 7. Map of archaeological sites in Banat, Idrisi version.

layers were made: the perimeter of the archaeological reservation, the buildings inside and outside the *castrum* (Roman military base), the walls and the gates of the *castrum*, and present-day localities such as the hydrographical system, the roads, and the methane pipe. Two kinds of digital models of the terrain were used to digitize the environment: the SRTM model (Shuttle Radar Topography Mission), with a resolution of 90 m for the whole Banat region, and models of the terrain obtained through the digitization of the level curbs (one meter equidistance) of the topographical plans for the Jupa *castrum*.

The creation of the database, the spatial analysis, and the 2D and 3D representations were done using the following software: CartaLinx, Idrisi Kilimanjaro (Clark Labs), and ArcGIS (ESRI).

### 3.3 The 3D Gray Coarse Ware Reconstruction

The pottery profiles were drawn on paper in the classic way and afterwards were digitized through flatbed scanning.

The images are imported into AutoCAD and a contour is created for each profile. Then, using Roman period pottery catalogues, a realistic shape is chosen for each piece. It must be corrected and verified at nodes and turns, because the final 3D shape must not have any mistake that would generate lines and rectangular planes to appear.

When the whole process is accomplished, all lines, points, and arcs must be linked in order to create one single object. This object represents the profile and, using an axis, a 3D shape will be created through revolving. A special shade and texture will provide similarity with the genuine ceramic

object, and a render process will offer the final result.

In the same way as building a classic typology, the whole range of shapes is included in a 3D digital catalogue that represents with high fidelity all features of different gray coarse ware types.

### Typological Repertory and Spatial Distribution of Gray Coarse Ware: Interpretations (First Case Study).

The analysis of ceramic fragments from both urban and rural sites led us to the conclusion that certain types of pottery are in substantial majority, i.e., jars, flagons, and dishes. Considering their dimensions and use, in conjunction with analogy with other artifacts, they can be attributed to a community of farmers and metal craftsmen.

All of these settlements lay next to rivers at about 300 m away, on the sunny and non-windy slopes, and in the middle of the forest at about 25 km from the iron ore mine at Bocsa. Melting pots are found here, but not on the plain.

### Typological repertory and spatial distribution of gray coarse ware: Interpretations (second case study).

Most of the pottery has been found in buildings 1, 2, 7, and 8, and also in those areas where kilns were found. The typology of the pottery discovered at these locations is more varied than in rural settlements and the ware quality is better. The existence of different storage jars with different functions supports the contention that the inhabitants were farmers and merchants.

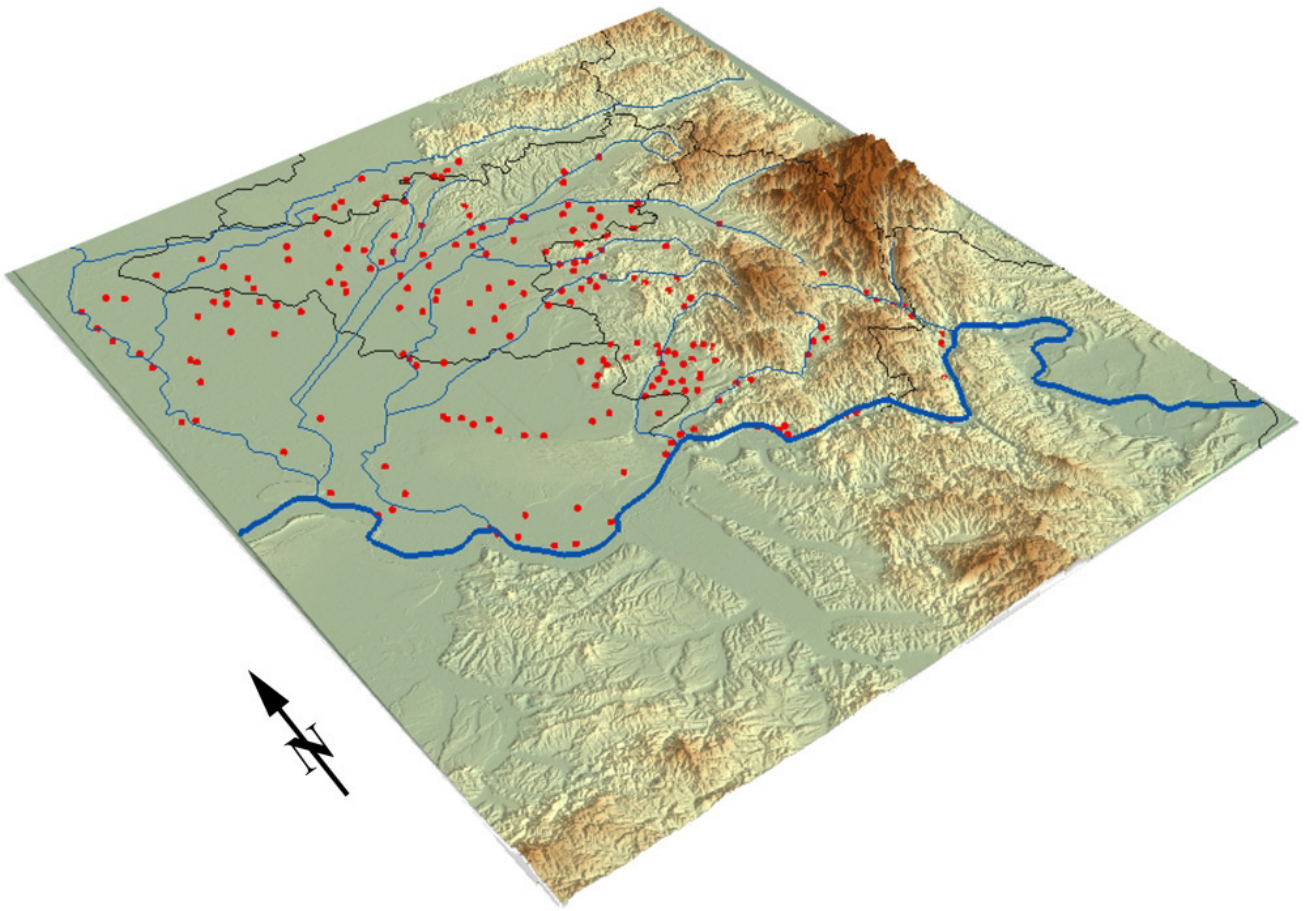


Figure 8. ArcGIS 3D modeling.

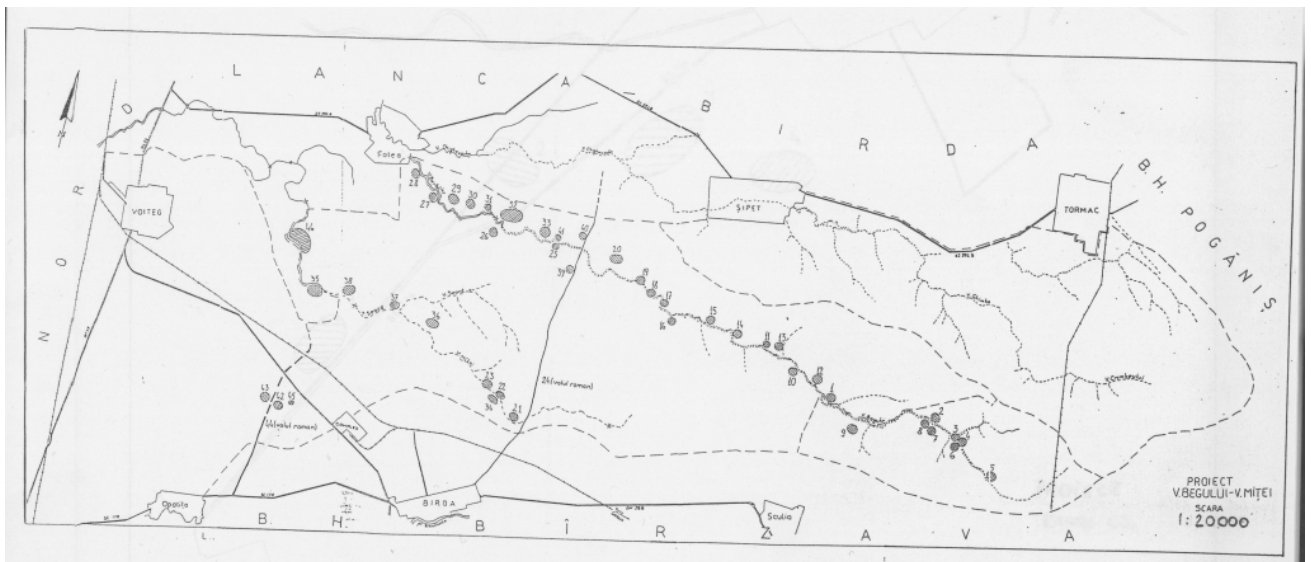


Figure 9. Old map of the "Begu" Valley.

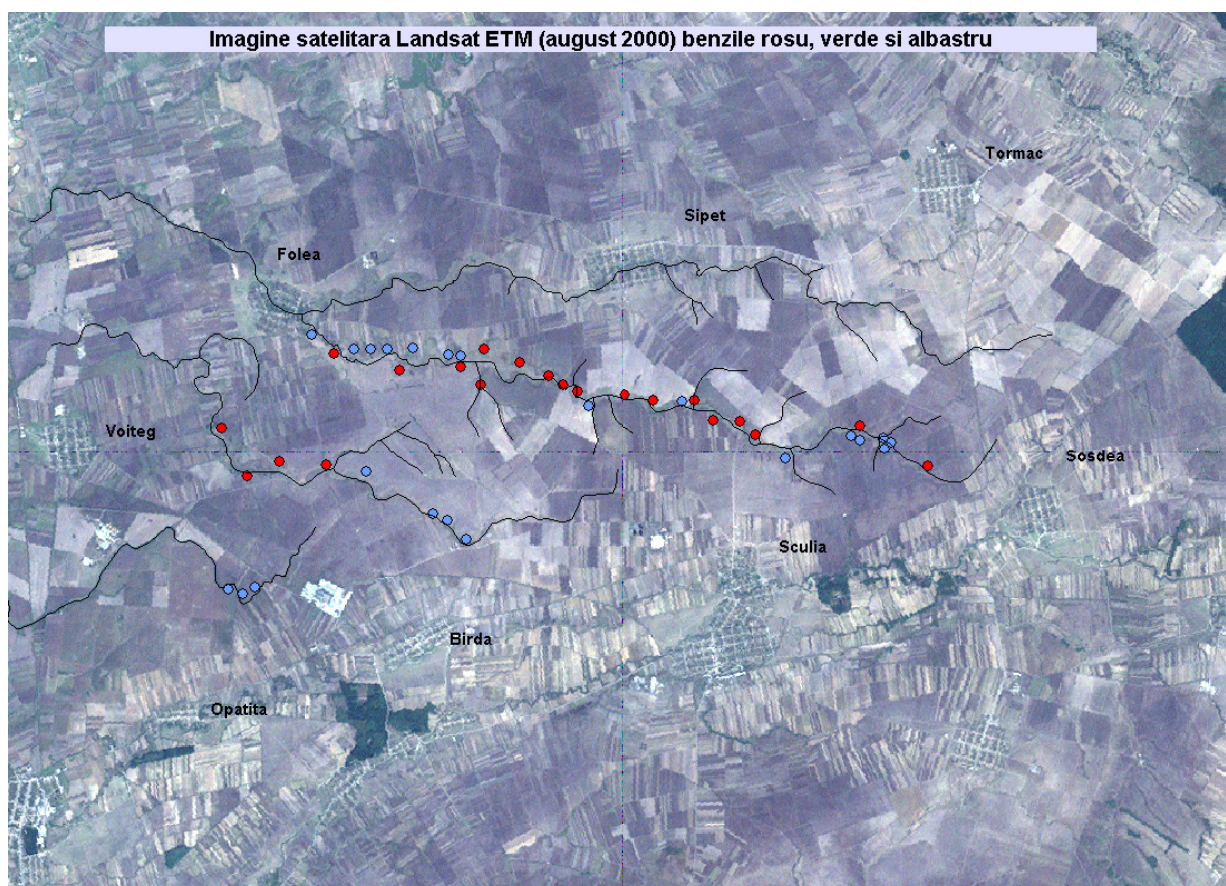


Figure 10. Editing of a satellite image of the "Begu" Valley.

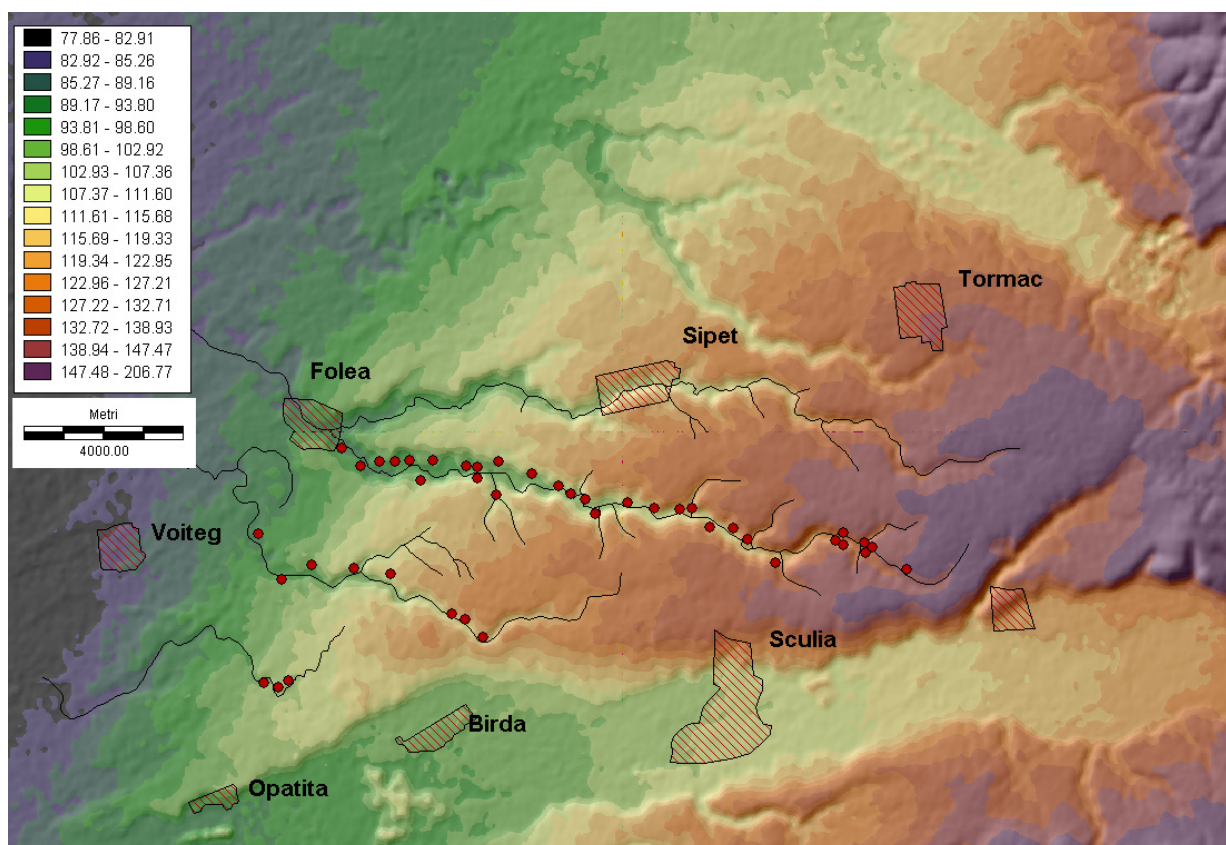


Figure 11. "Begu" Valley archaeological sites distribution map.



## 4 Perspectives

Our future plan is the compilation of an e-repertory making the data within it available for users through an interactive website. The repertory is made as a MySQL database, with the querying and the results made through a webpage designed in PHP. The user will be able to choose a search type based on typological elements (origin, color, form,

ceramic composition, decoration, texture, utility, etc.), place, and date. The two case studies cited above provide only a first glimpse at how the e-repertory database can be used for research in the study area.

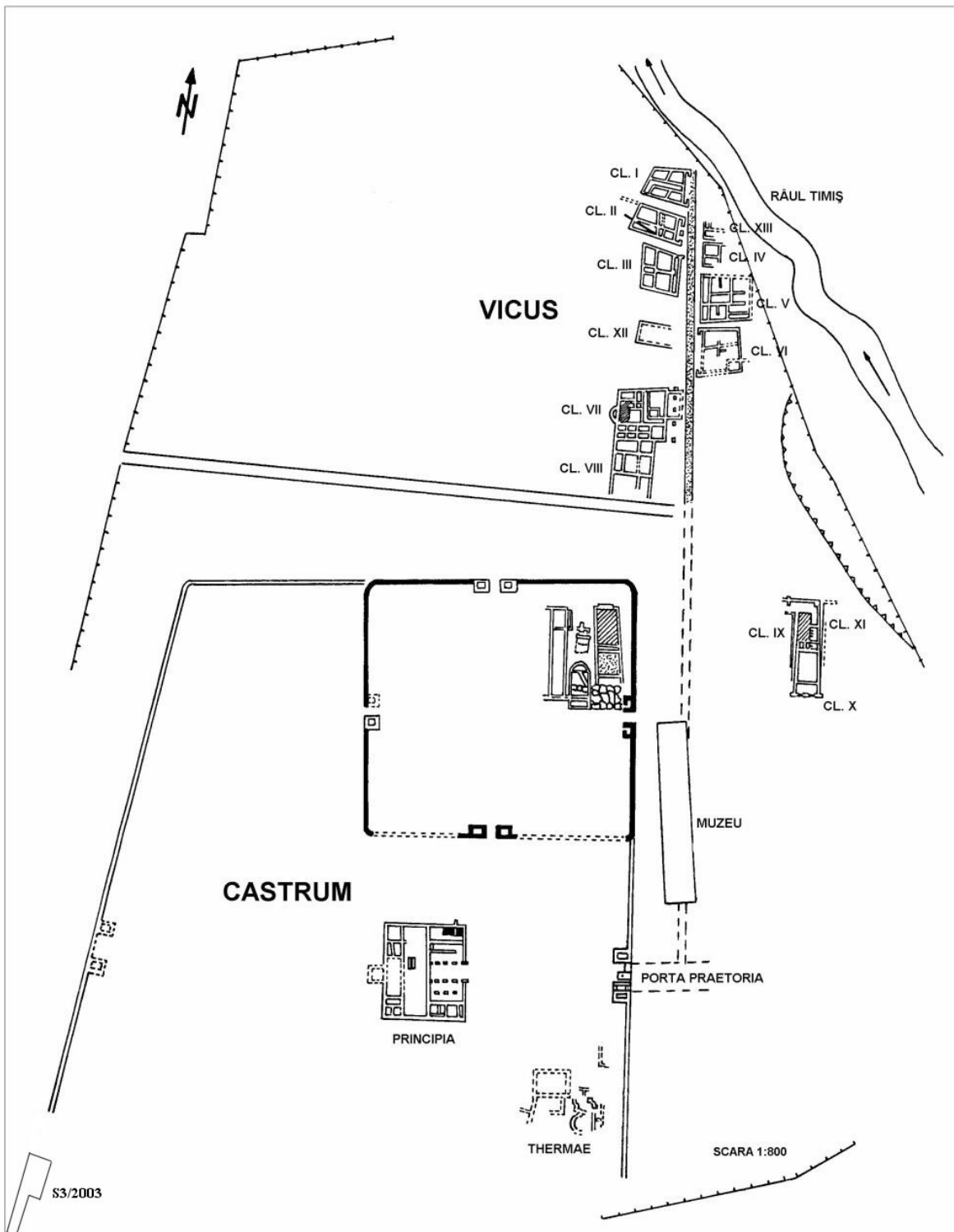


Figure 12. Old map of the Tibiscum castrum, Caras-Severin County.



Figure 13. GIS map of Tibiscum castrum, Caras-Severin County.

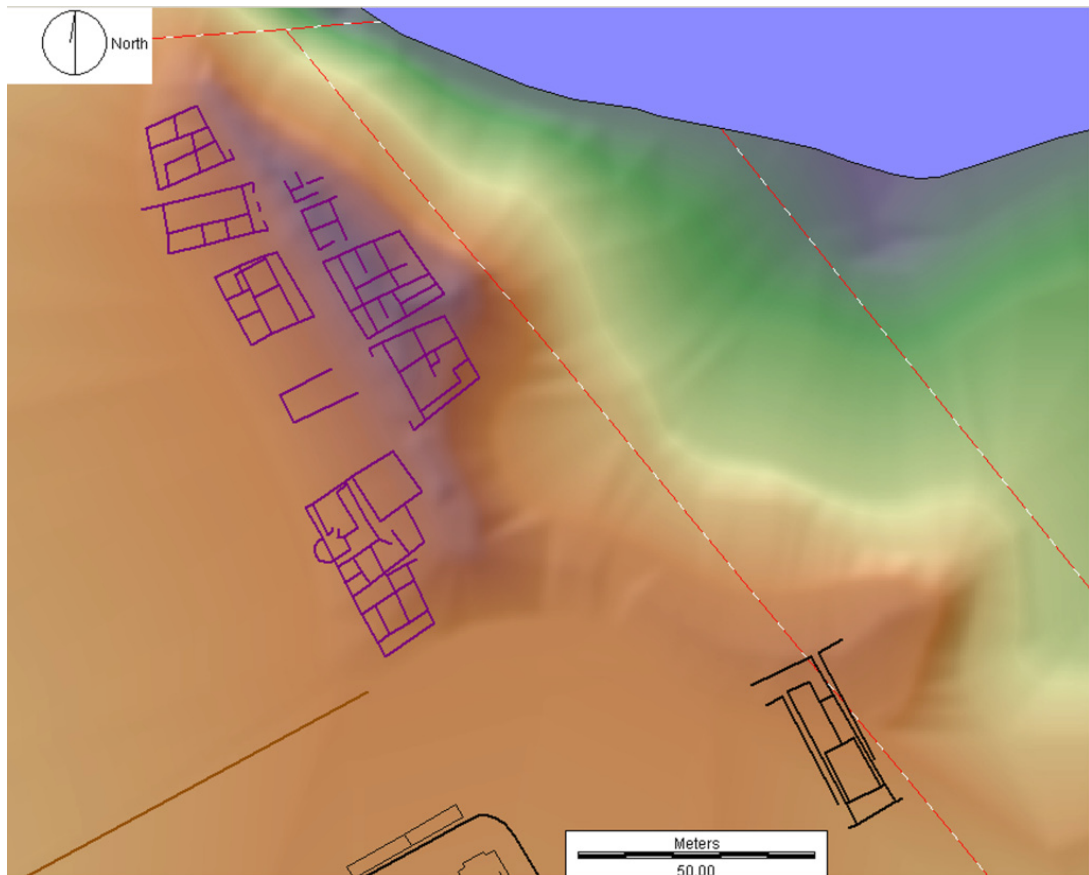


Figure 14. GIS map of Tibiscum vicus, Caras-Severin County.

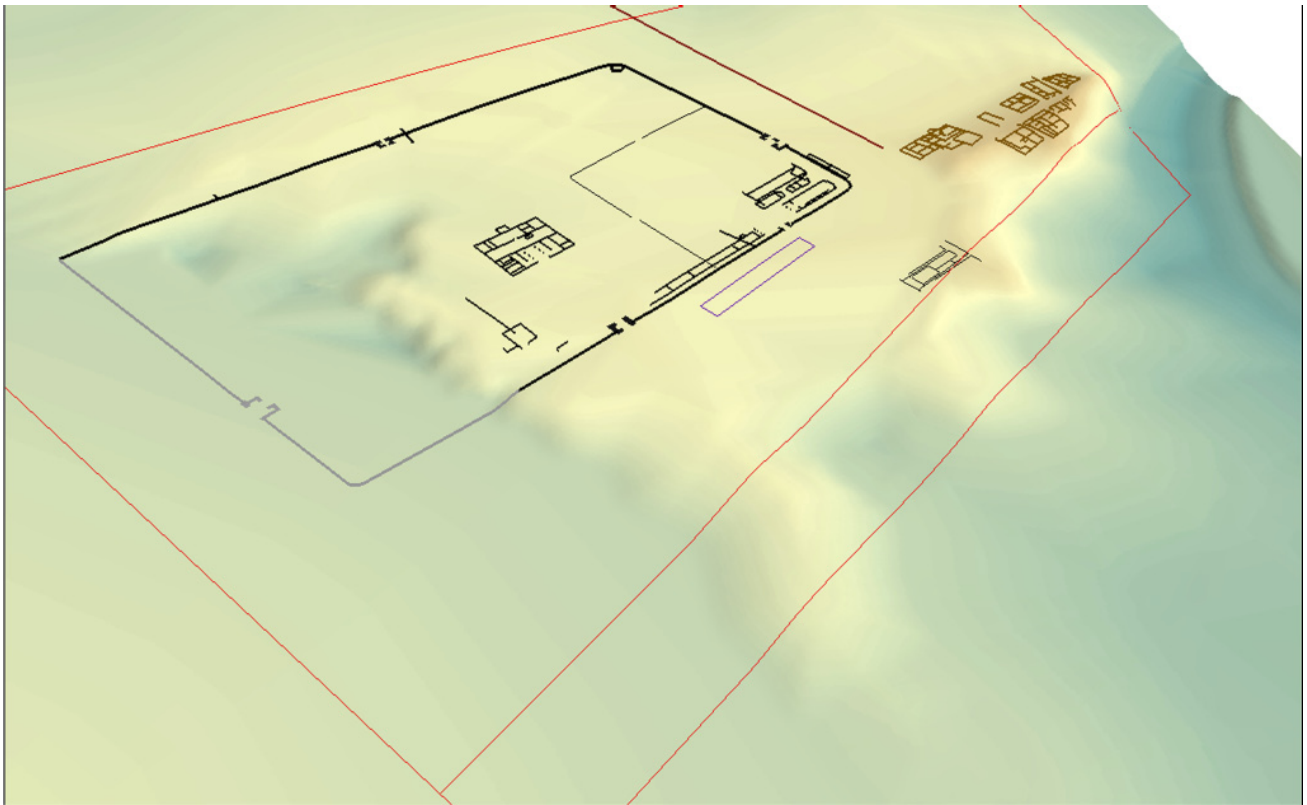


Figure 15. GIS map of Tibiscum castrum and vicus, Caras-Severin County, 3D modeling.

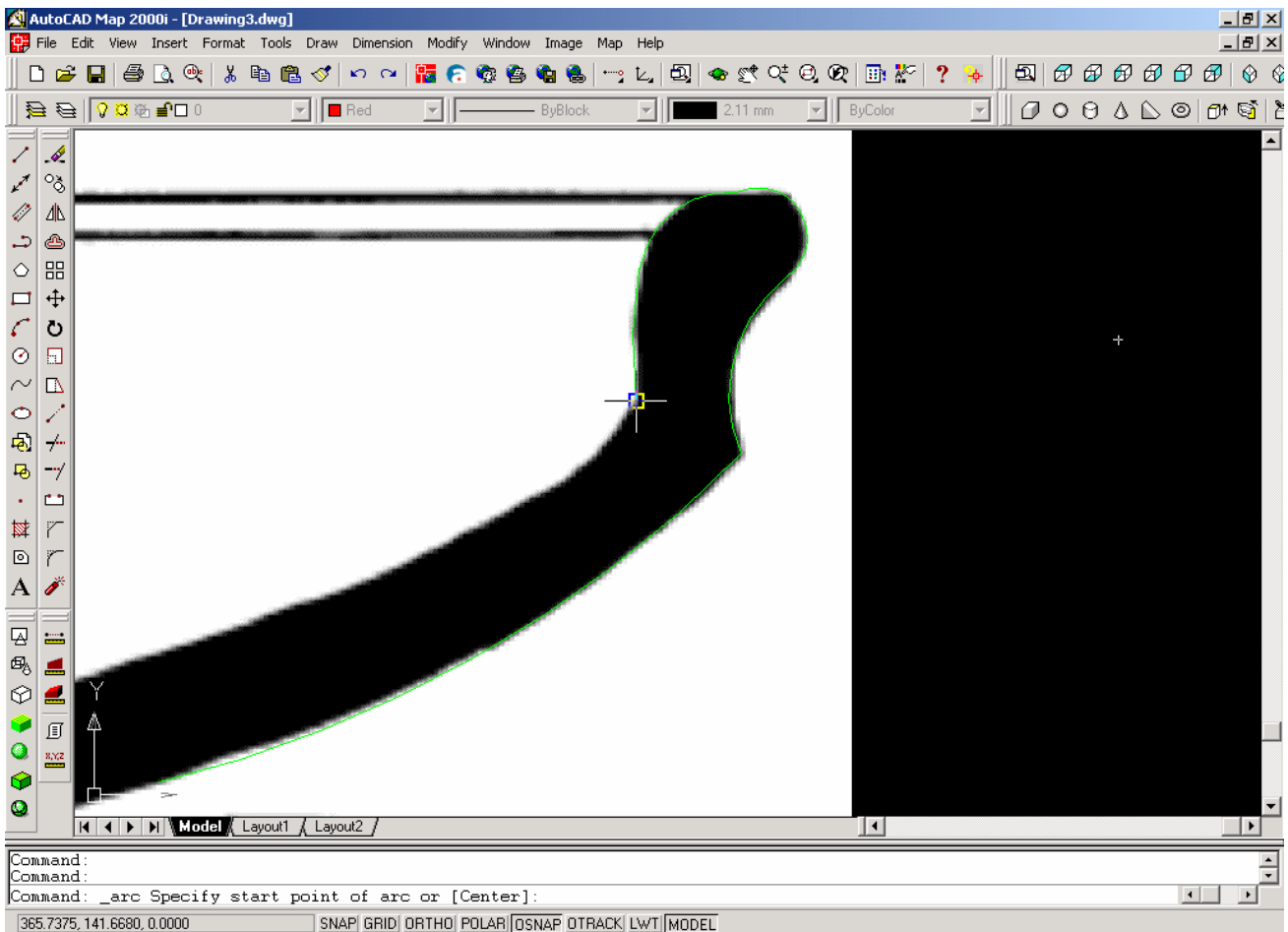


Figure 16. Drawing the profile shape in AutoCAD.

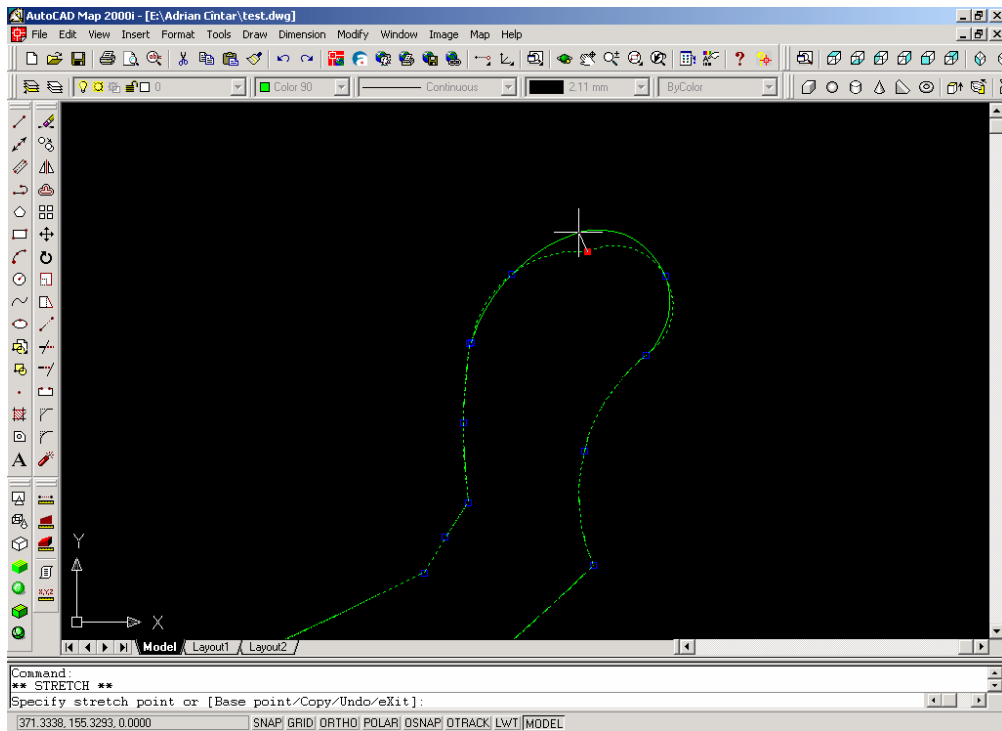


Figure 17. Profile check and correction.

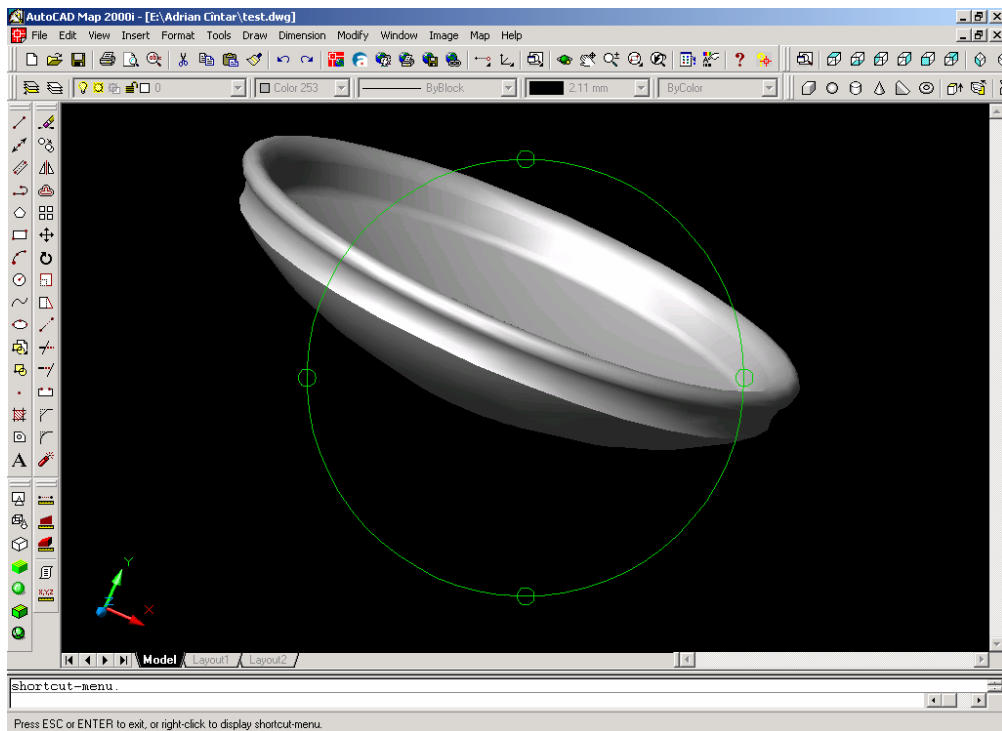


Figure 18. The 3D shape is revolved and verified.

| Descriere           | Imagine 2D | Imagine 3D | Animatie video |
|---------------------|------------|------------|----------------|
| <a href="#">top</a> |            |            |                |
| <a href="#">top</a> |            |            |                |
| <a href="#">top</a> |            |            |                |
| <a href="#">top</a> |            |            |                |
| <a href="#">top</a> |            |            |                |

Figure 19. Digital catalogue.

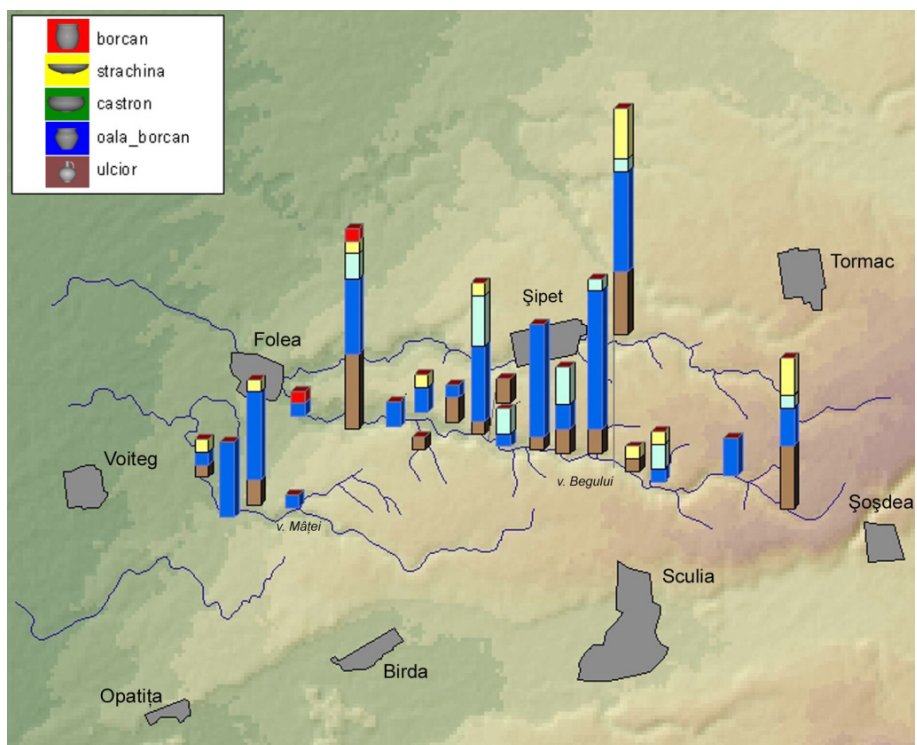


Figure 20. Typological repertory and spatial distribution of gray coarse ware on the “Begu” Valley.

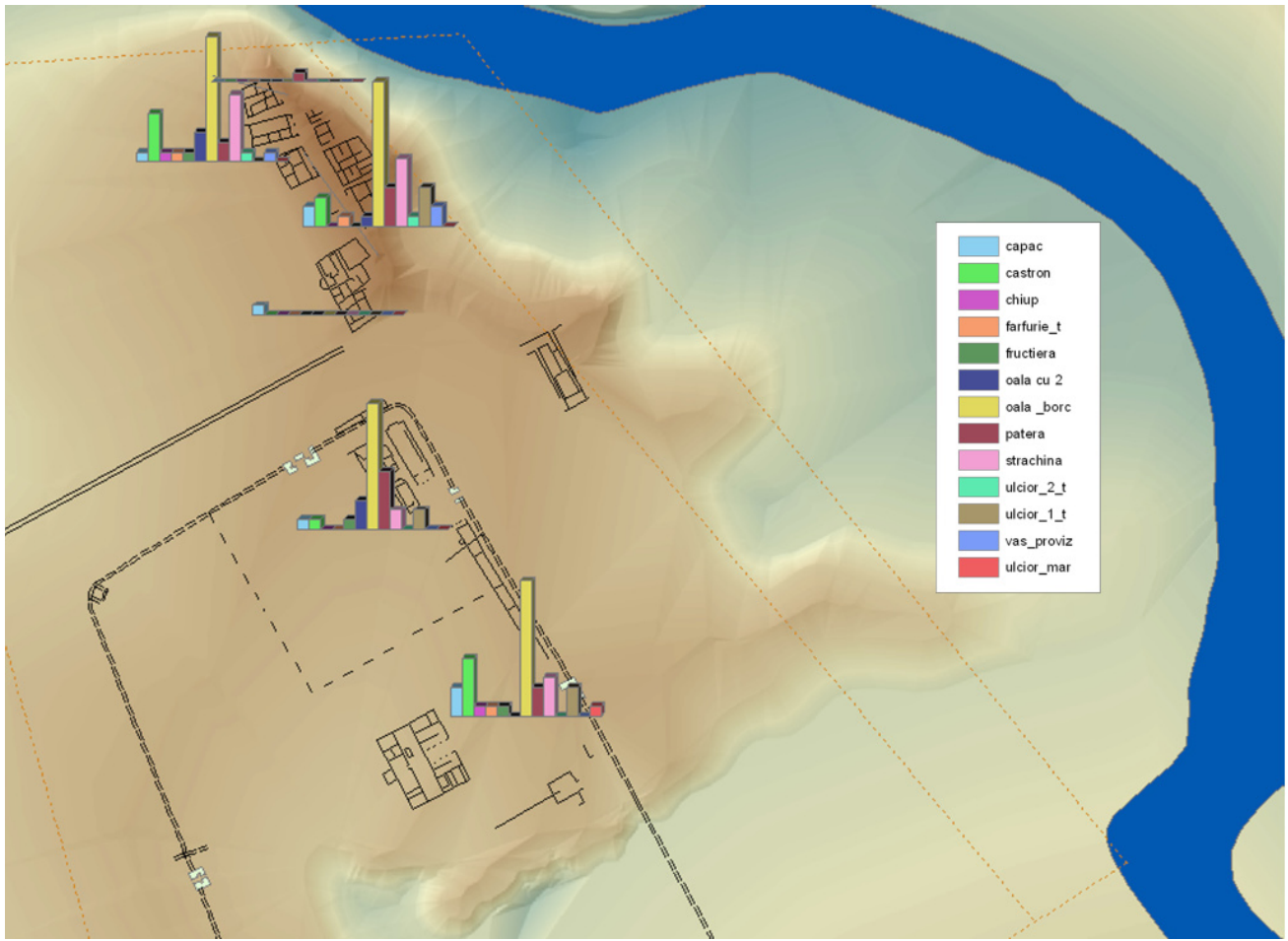


Figure 21. Typological repertory and spatial distribution of gray coarse ware at the Tibiscum castrum and vicus.

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