

**Universitatea „Lucian Blaga” Sibiu  
Facultatea de Istorie și Patrimoniu „Nicolae Lupu”**

**ABSTRACT  
DOCTORATE THESIS**

**Digital cartography and spatial analysis elements of the Dacian –  
Roman rural habitat in South – Western Dacia between the 2<sup>nd</sup> and the  
5<sup>th</sup> century A.D.**

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## Chapter 1. Introduction

The identification of the intrinsic connections between man and environment is one of the desires that any archaeologist tries to reach through the systemic analysis of an archaeological complex reported to the surrounding environment. More than in any other historic discipline, Archeology uses methods and work techniques taken from Geography which, for Prehistory, for Antiquity or for the Middle Ages, can offer relevant scientific data regarding different aspects such as: choosing the position of a house, of a settlement, the preference for a certain territory, etc. It is a fact that man is a part of nature and that he lived within a communion with the environment, depending on staple resources, on geo-strategic advantages, on climate, etc. the observation and the analysis of these connections became in time obligatory for any pertinent study of Archaeology and evolved from a simple description of the geographic environment, at the beginning of any archaeological monography, to wide systemic studies of Landscape Archaeology, Geo-Archeology, Environment Archaeology and Ethno-Archaeology.

The generalization of inter and multidisciplinary studies in Archaeology in the last few decades, and their inclusion in the didactic programs of domain universities led to obligatorily and standardization of the usage of bio-geographic analysis in Archaeology. Thus appeared valuable Historic Geography, Archaeological Cartography, Sedimentology and Pedology in Archaeology, Archaeozoology or Ethnoarchaeology volumes. The monographic studies remained shallow while trying to reconstruct environment in Archaeology, partly because of the lack of archaeologist – geographer collaboration, and also because of the lack of facile scientific instruments which would allow the archaeologist to realize a complete research and which would combine Archaeology with Geography and Mathematics. The implementation of Geographical Information System in digital Cartography and of mathematic – statistic methods in spatial analysis offered two unexpected instruments for the archaeologist who quickly understood the utility of importing this two work methods from Geography to Archaeology.

Our efforts are heading to a geo-systemic analysis of the atrophic environment, mainly in the Banat territory in the period succeeding the Aurelian retreat between 271 and 275 A.D. when in this area we can observe, from an archaeological point of view, not a fall but a strengthening of the rural material culture.

In the relation between man and environment we will try to identify those elements that determined the choosing of a certain habitat, the relationships structured in time, the analysis of features of a certain landscape, all in the idea of reconstructing the geosystem and of conceptualizing the mental model that determined the man to take certain practical decisions (building positioning, its size, its annexes size, using certain architectonic structures and certain construction materials, implications in organizing the farm and its occupations, choosing the roads, etc.).

We consider that the attempt to offer scientific answers about the relationships established between man and geographic environment in the region of South-West post – Roman Dacia through the analysis of the rural habitat reported to the relief shapes specific to this area is meant to add to the archaeological data of a historic period barely studied and understood, through multidisciplinary methods and techniques which are modern and feasible work instruments.

*Digital Cartography and the analysis of spatial distribution* are applied in Archaeology in the context of **Landscape Archaeology**, part of the complex monographies of **Environmental Archaeology**. In other words, *digital Cartography and the analysis of spatial distribution* are two modern methods used for multidisciplinary analysis in Archaeology which have to use spatial data from Geography. Even though these are concepts with a certain age and with a large spread in international Archaeology, **Environmental Archaeology** and **Landscape Archeology** hardly developed in Romania, but the results of the first archaeological studies that use the two methods

of multidisciplinary research are promising and convincing and this is why their generalization is the next natural step.

## **Chapter 2. Archaeological Cartography elements**

*Topography* is a branch of Geodesy that deals with the technique of measurement over a part of the Earth's surface, determining the position of the elements of the Earth's surface on small areas (considered plane), and it also deals with the technique of graphic or numeric representation of the measured surfaces measured in order to create maps and plans used to detailed describe a place under the report of setting, configuration, etc. and the way in which are the elements of an assembly disposed in space.

There were developed a great variety of terrain measurement methods. There are standard methods used for specific purposes, for example Photogrammetry is used to create topographic maps, and the tachimetric methods are used to map construction sites. But, Archeology requires increased attention, because each new project is different from the precedent, and each method – including topography – must be improved in order to achieve the desired results.

The creation of a topographic plan is needed for the archaeologist for two reasons: (a) it exactly determines the perimeter of the site, of the mark points and of the surface – it will allow the archaeologist to accurately include the excavation plans (sections, cassettes, squares, etc.); and (b) it helps exactly establish the terrain shapes, thus it will lead to better understanding of the interdependency man – nature and to identifying the relationships between them.

The topographic measurement can be made with the help of the theodolite, tachimeter or, recently, Total Station. *The terrain step* supposes that, after identifying the site, the topographer decides which are the “sensitive spots” of the terrain with slope variations, with dumps and holes etc., which will be read in order to have a objective rendering of the terrain. Concomitant with the creation of the leveling network (successive altitudes) a squaring (10 by 10 m, 20 by 20 m) which will represent the reference system both for research units and for geo-physic prospects (resistivity and magnetometry).

The topographic plan obligatorily must have: mark points (indicators, poles, etc.), terrain limits (roads, channels, rivers, lot, etc.), objective limits (defense vallum or ditch, village limits, stockade, fence, etc.) and also a protection area of about 200 to 500 m.

The second step is *the office one*, which has its own specific operation: measurement correlation, averages of horizontal and vertical angles, horizon reduction of distances, XYZ coordinates calculus, etc. Initially *relative* data are calculated and after compensation the *absolute* data are calculated. The rectangular report of points with coordinates follows and the polar report of points, which are done depending of terrain data and absolute data. These points will be connected in the plan and correlated to the terrain's realities. All this labour is nowadays replaced by software that downloads the source data, calculates and converts the points to scale images.

## **Chapter 3. Geographical Information System**

*Geographical Information System - GIS* represents a more often used concept in Archaeology. It is a natural repercussion of Landscape Archaeology development, as a sub-discipline of Archaeology, closely related to Geography and Informatics. Landscape analysis became essential in the archaeological study of the human habitat through its two components: the spatial distribution of the sites analysis and the paleo-geo-morphologic analysis of the geographic space where the sites are located. In this context an important accent is set on the geographic space and in the interpretation of spatial connections.

The importance of spatial relationships is a good enough reason for archaeology to concentrate on GIS, as early as 1987, when the Government of the United Kingdom published a paper regarding the use of graphic information, in which they highlight that since the invention of

maps, GIS has been the greatest advance in the use of geographic data (Lock 2003, 165). Given the obvious link between maps and archaeology, it is most understandable why archaeologists are using GIS more and more. All archaeological discoveries: artifacts, buildings, landscapes etc, have a spatial component, and between them there are spatial links. Archaeologists have tried to decipher this data using different traditional methods and techniques based on maps, plans and other means of spatial analysis. Whatever the method, the graphic representation of the spatial data has always been a major concern of archaeology (Conolly & Lake 2006, 10).

Scientists today think of maps as important analytical instruments of contextual archaeology, and archaeological studies are more and more focused on regional analysis, integrated in a system (or geosystem), and less on isolated sites. Both at micro- and macro-regional levels, the archaeologist couldn't cope without powerful computers, which can work with spatial databases, identifying and extracting the data needed for a specific task, from the mountain of either redundant or general data.

The Geographic Informational System is defined as an organized system based on computing techniques, meaning a coherent ensemble of hardware and software, data, persons, rules and methods, which allows the conceiving, defining, building, up-dating and use of maps, geo-topographical associated with descriptive data with territorial distribution (Băduț 2004, 7).

“Data” can be defined as a symbolic description of an object, phenomenon or action. The symbols use a structure based on an already defined syntax, recorded on a physical support which can be manually and/or electronically altered. Here we will be working with spatial data, graphic representations of maps, and attribute data, alphanumeric data organized in tables with columns and rows associated with spatial data, both recorded on magnetic support this forwarded to humans, after processing, constitutes information. To put it differently information is data which brings knowledge and is used in the process of decision making. Information must be: consistent (sufficiently comprehensive), relevant (to give out the necessary knowledge), exact, opportune (in due time) and with an accessible presentation. The outcome of processing data is therefore information. This becomes data when it no longer brings new knowledge. It can be further processed and new info can be obtained. This succession of processing, with intermediary results, will lead to the use of data as information, hence “the processing of information”. However, most books on the subject still allow the interchanging of the terms (Imbroane & Moore 1999, 15; Băduț 2004, 8; Dimitriu 2001, 55-57).

#### **Chapter 4. Spatial distribution analysis**

Basic principles have been set in the 60's, but only in the last 20 years did spatial analysis find its practical use in archaeology. This method is one of the most powerful instruments accessible to the archaeologist and is based on two components: cartography and statistics.

Spatial analysis can be defined as a geomathical science, used to study and process, both in quantity and quality, spatial information, represented cartographically and electronically by data and georeferenced and geoencoded, in order to decipher their distribution in space and identify new information for different practical ends (Taylor 1977, *passim*; Haidu & Haidu 1998, 224). This is why in many studies it will be encountered as spatial distribution analysis.

Its methods and processes are based on two laws, well-known in time series analysis and spatial analysis:

1. two neighbouring elements (data) are correlated better than two elements further apart, and the degree of correlation is determined by the time of space lag.
2. Phenomenons and objects of the real world which vary in time, will also vary in space, therefore the specific components of the time series (first of all tendency and seasonality) will influence the space variability of that phenomenon or object, this includes the lag as before.

The reason for spatial analysis lies in the phenomenological or stochastic between similar elements of space, found close to one another. As it is concerning elements of the same type, the term auto-correlation is used instead of correlation (Haidu & Haidu 1998, 224).

The estimation of the spatial distribution makes use of the results of the analysis of the variation in the studied characteristics (Scrădeanu & Popa, 2001, 114). Its objective is to obtain the image of the spatial distribution of a variable based on the values of that particular variable determined for different points in space. For an archaeologist these images are represented by maps and archaeological cross sections.

In a theoretical study focused on the determining of the enclosing area of a settlement, G. Fazecas made a short listing of the methods used by archaeologists to analyze the economy of a settlement in relation with the natural environment and the polemics formed around this subject (Fazecaș 2000, 449). We must keep in mind that in order to analyze the productivity of a human community archaeologically identified, both in situ (number of inhabitants, the size of the site, the area used for obtaining resources), as well as extra situ (the economical potential of an area: what kind of natural resources can be found and how far away are they in relation with the settlement) must be correlated, the author pointing out that this method helps to a better determining of the exact position of the site in its surrounding environment.

Given that we are not in possession of many archaeological artifacts found in systematic excavations, the number of post-roman settlements exhaustively dug being low: *Grădinari* – „*Seliște*” (CS), *Hodoni* „*Pustă*” (TM), *Timișoara* „*Cioreni*” (TM), *Timișoara* „*Freidorf*” (TM), *Jabăr* „*Cotun*” (TM), *Moldova Veche* „*Vinograda*” (CS), *Dumbrăvița* „*La Stejar*” (TM), *Becej* „*Bodar-zidar*”, „*Donije Ugarice*” și „*Beljanka*” (Voivodina), *Criciova* „*Râțul lui Mocrean*” (TM), *Dudeștii Noi* (TM), *Jabuka* (Voivodina), *Subotiča* (Voivodina), *Vrsač* (Voivodina) și *Pancevo* (Voivodina), the present study is not one in situ, but it refers to the relationship between the settlements and the surrounding environment, especially landscape analysis, by means of field research having been identified around 400 post-roman settlements, an impressive number which justifies the interest it arouses.

## **Chapter 5. Case Study: The spatial analysis of the rural daco-roman habitat in SW Dacia, in the II-V centuries AD**

### **Methods and techniques of spatial analysis**

#### **a. The topographical plan. Graphic processing and dissemination**

Technically speaking, the publishing of cartographical data related to the topographical surveys must be accompanied by the analytical files of the archaeological sites, which contain data regarding the placement of the site, archaeological data, and images, cartographic and bibliographic data. Following is a case study extracted from the list of post roman archaeological sites, with an analytical file, a topographical sketch and a 2D and 3D topographical map.

## Fișa analitică a sitului: Unip "Ocoale"

### 1. date despre localizare sit

- a. cod sit: 158519.01
- b. cod SIRUTA: 158519
- c. cod LMI: TM-I-s-B-06088
- d. localitate: Unip
- e. unitate administrativă superioară: Sacoșu Turcesc
- f. punct: "Ocoale"
- g. reper localizare: La 1,34 km SSE de biserica din Unip și la 300 m V de cel mai apropiat aliniament de stâlpi de înaltă tensiune ce trece pe la E de localitate.
- h. reper hidrografic: Situl se află pe malul stâng al unui braț fosil al Râului Pogăniș, afluent stânga al Timișului.
- i. parcelă cadastrală:
- j. regim juridic:
- k. forma de relief: campie
- l. descriere geografică: Din punct de vedere geografic situl este amplasat în Câmpia Timișului, subunitate a Câmpiei de Vest, pe un grind mai înalt din zona puternic meandrată și cu numeroase brațe fosile, de divagare, de pe cursul inferior al Râului Pogăniș, în apropiere de confluența acestuia cu Râul Timiș.
- m. suprafață sit: 6,14 ha
- n. stare de conservare: buna
- o. date GPS: latitudine, longitudine, altitudine: 45°38'53.25"N; 21°20'39.88"E; 92 m Alt.

### p. stare actuală: teren arabil

### 2. date arheologice despre sit

- a. cod ansamblu: 158519.01.01
- b. nume ansamblu: Așezare
- c. tip ansamblu: 111 așezare deschisă
- d. datare: epoca post-romana, ev mediu timpuriu
- e. perioada: 33 ep post-romana
- f. cultura:
- g. faza culturală:
- h. observații: situl nu a fost investigat prin săpături arheologice sistematice

### 3. imagini

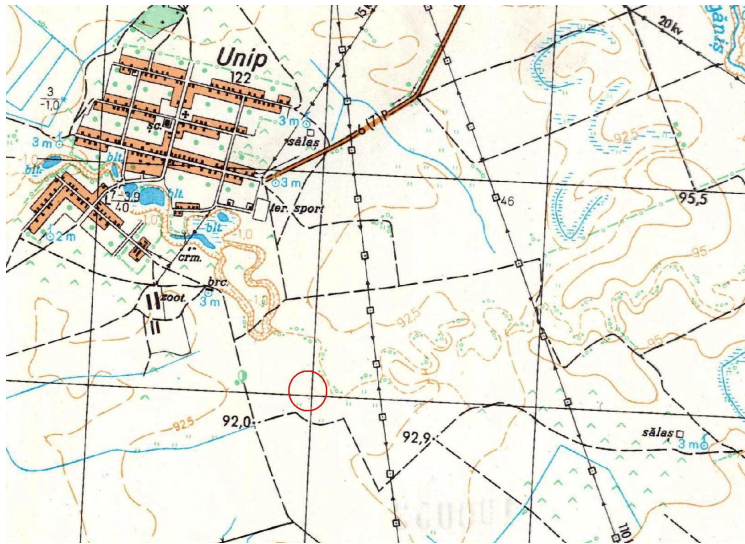
- a. fotografii de suprafață:



b. fotografii satelitare:



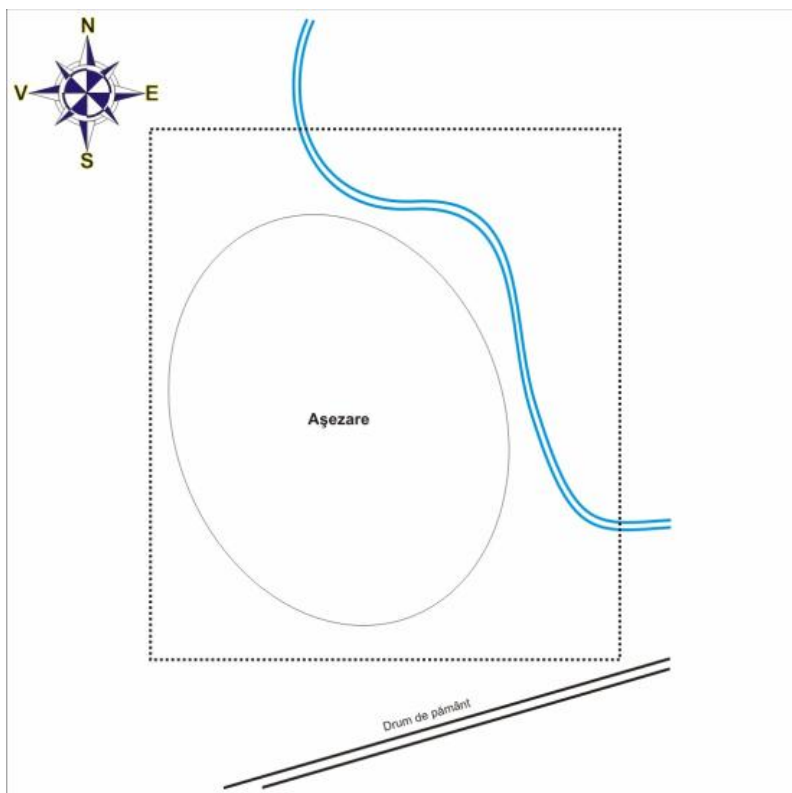
4. **date cartografice**  
a. harta sitului: (vezi anexa)  
b. harta topografică:



c. harta GIS: (vezi anexa)

5. **bibliografie:** F. Medeleț, I. Bugilan, *Contribuții la problema și la repertoriul movilelor de pământ din Banat*, în *Banatica*, 9, 1987, p. 175)

6. **alte informații despre sit:** În Lista Monumentelor Istorice a Județului Timiș în respectiva locație este menționată, în mod eronat, o așezare paleolitică. Situl ocupă o terasă morfologică, delimitată pe laturile de E și N de un meandru fosil al Râului Pogăniș și este reprezentat de o așezare post-romană, suprapusă de o alta medieval timpurie. Investigațiile arheologice de suprafață din toamna anului 2007, prilejuite de căutările pentru identificarea sitului, au relevat existența în amontele acestui braț fosil, pe ambele laturi ale sale, a unor bogate așezări datând din epoca bronzului și până în evul mediu târziu.



### Unip "Ocoale"

**Așezare post-romană și medievală**

COD SIT LMI 2004: TM-I-s-B-06088

Suprafața SIT: 6,14 ha

Perimetru SIT: 1037 m

Coordonate GPS:  
N 45°38'53,25"  
E 21°20'39,88"

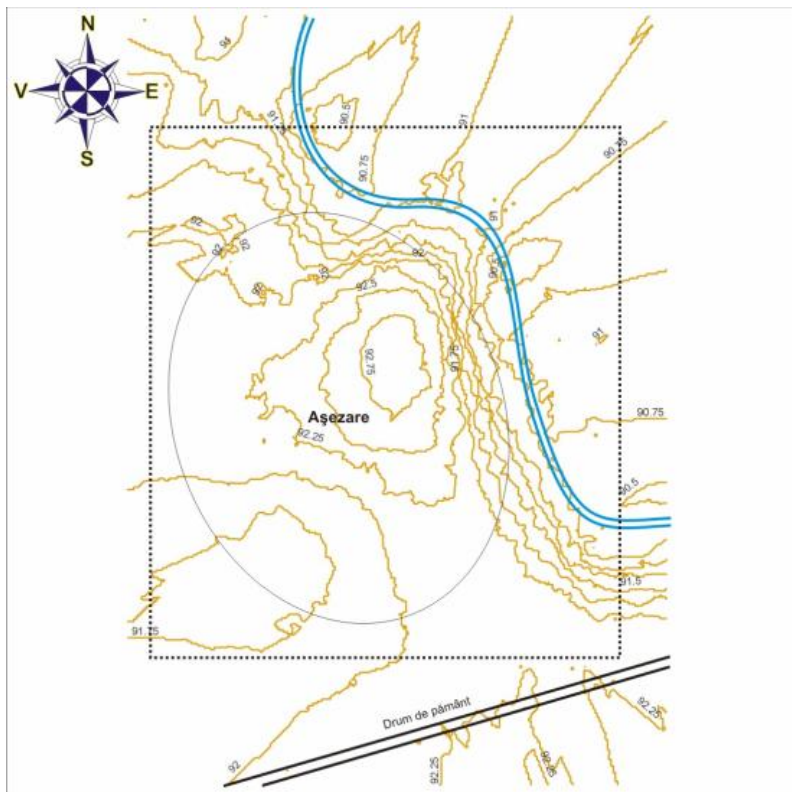
Coordonate Dealul Piscului / Stereo 70:  
215152.636, 467418.140

#### LEGENDA

Zonă protecție sit

Braț mort al Râului Pogăniș

0 100 m



### Unip "Ocoale"

**Așezare post-romană și medievală**

COD SIT LMI 2004: TM-I-s-B-06088

Suprafața SIT: 6,14 ha

Perimetru SIT: 1037 m

Coordonate GPS:  
N 45°38'53,25"  
E 21°20'39,88"

Coordonate Dealul Piscului / Stereo 70:  
215152.636, 467418.140

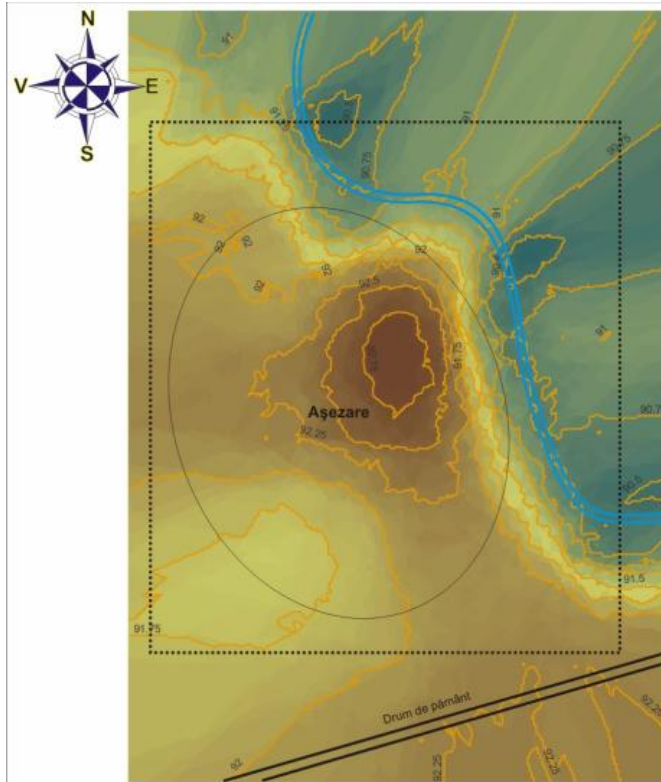
#### LEGENDA

Zonă protecție sit

Braț mort al Râului Pogăniș

0 100 m

Echidistanța curbelor de nivel: 0,25 m



**Unip  
"Ocoale"**  
Așezare post-romană și medievală

COD SIT LMI 2004: TM-I-s-B-06088

Suprafața SIT: 6,14 ha

Perimetru SIT: 1037 m

Coordonate GPS:  
N 45°38'53,25"  
E 21°20'39,88"

Coordonate Dealul Piscului / Stereo 70:  
215152.636, 467418.140

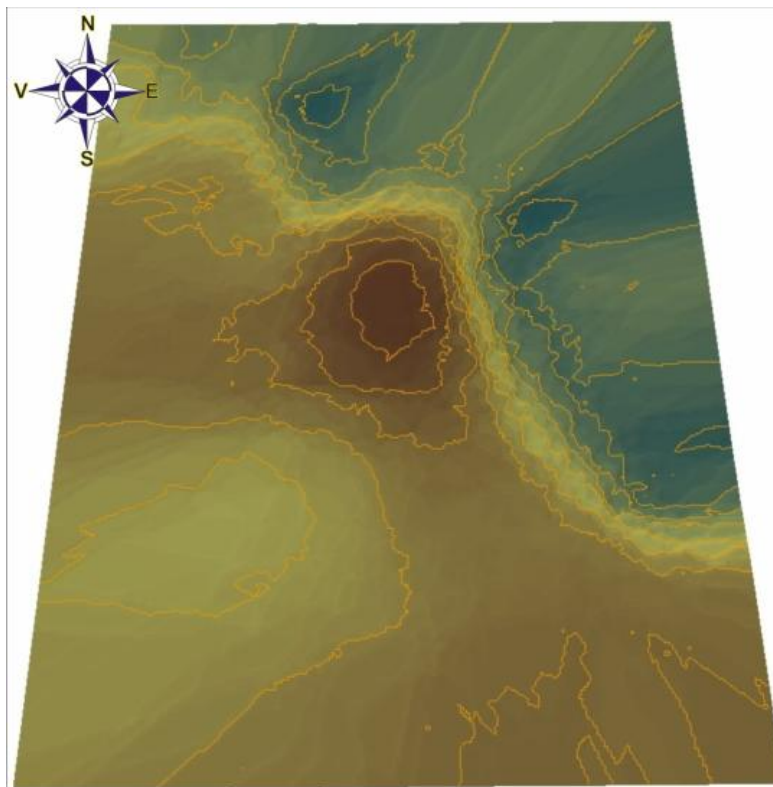
**LEGENDA**

 Zonă protecție sit

 Braț mort al Râului Pogăniș



Echidistanța curbelor de nivel: 0,25 m



**Unip  
"Ocoale"**  
Așezare post-romană și medievală

COD SIT LMI 2004: TM-I-s-B-06088

Suprafața SIT: 6,14 ha

Perimetru SIT: 1037 m

Coordonate GPS:  
N 45°38'53,25"  
E 21°20'39,88"

Coordonate Dealul Piscului / Stereo 70:  
215152.636, 467418.140



Echidistanța curbelor de nivel: 0,25 m

## **b. The archaeological analysis of the geomorphologic elements**

Morphometric methods. Altitude and the values resulting from the processing of altitude are the base elements of morphometric methods. The establishing of the different altitudes, in field or with the help of a map, so by means of classical topographical methods, allows the defining of relief characteristics such as: altitude, the density and the depth of fragmentation, critical points in morphological evolution etc. all these are made evident by graphics and maps. It is useful to specify in the case of a depression the positioning of its components: meadows, terraces, accumulative piedmonts, erosion piedmonts, leveling surfaces (Ielenicz 2007, 30).

Morphological methods. These allow the defining of the relief and also highlighting its evolution in time, which necessitates a detailed analysis of topographical maps. From these evaluations certain derivative indices are extracted such as sinuosity coefficient, irregularity of the interfluvial coefficient etc. all morphological evaluations direct or derivative are presented as graphics or maps.

Morphometric indices.

A series of morphometrical indices are present in geomorphology. (altitude, fragmentation, slopes) which allow a characterization of the relief. The starting point is constituted by the topographical map, usually at a scale of 1:25000. although this constitutes still the main source of data collection, MNAT (The Numeric Model of Terrain Altitude) automatically obtained from images or offered free of charge (e.g. SRTM - *Shuttle Radar Topography Mission*) allow the interpreting of the relief much quicker.

## **c. Pedagogical analysis**

Soils because of the complexity of genetic factors are significantly different both related to altitude as well as in the same geographic unit. at the highest altitudes in the Godeanu, Tarcu and Cernei Mountains you can only find soil poor in organic substances. In the alpine pastures one can find podzolic and ferri-luvial soils.

The largest surfaces in not so high mountains are covered in fir trees, with typical acid, brown soils.

In the Western Hills, regarding relatively flat surfaces, a clay layer and conditions which prevent water from flowing in certain times of the year allow the forming of luvisols while on the inclined mountain slopes have eutric cambisols and luvisols. Red pelvisols appear as a result of thermophile forests (Ianoş 1995).

In the lowlands most frequent are the border zone soils (50%), while the region soils and transition have each a percentage of 25% (Pop 2005).

From the region soils we can observe the chernozem. In the contact area with the hills we can also find luvisols and eutric cambisols (Ianoş 1995).

From the border soils, so frequent we can find hydrosols, characteristic to subsidiary areas, salsosols in areas with salty terrains, frequent in the White Cris plains, psamosols in the sandy areas of the Banat, and aluviosols in the meadows alongside the rivers from this region.

## **d. Predictive Analysis**

### *Method of thinking*

Cartographic modeling using SIG has at its base the methodology of thinking using complex data sources. After establishing the physical-geographical factors involved in the location of known archaeological sites, followed their quantification as digital maps. Because those factors are expressed in different measurement units (meters, km, grades, etc.), it is necessary the standardization of these data in order to integrate them into the model. Because

almost all analyzed factors vary continuous in space, these represent sets of data with continuous character, so that the most suitable method of standardization is that of using fuzzy functions. With these functions can be standardized on a scale from 0 to 255 (bytes).

An important aspect is choosing the type of function for each factor at a time, which describes best the gradual changeover from 0 (unfavorable conditions for localization) to 255 (unfavorable conditions for localization) and the establishment of the values of the critical points in which the belonging to a set raises from 0 to 255.

After the standardization of the factors it begins their combination to form the final map of the geomorphologic risk. This combination can be done linear, where each factor has an equal importance, or well-balanced, where each factor gets a different value. In this study we used the second method, the well-balanced multi-criteria evaluation.

The considered factors have been determined through a complex analysis of physical-geographical characteristics for each known archeological sites using Geographical Information Systems, which permitted the statistical analysis to the pixel levels of the values of the physical-geographical elements. This statistical analysis and the field observations led to the conclusion that the most important factors in localization of known sites are: altitude, slope, the surface exposed to the solar radiation and the distance to the water sources.

**Altitude.** The altitude values have been represented cartographically and analyzed by using a **Numeric Model of Soil (NMS)** obtained through **remote sensing satellite (SRTM files)** with a resolution of 90 m. The model has been improved by increasing the spatial resolution to 10 m.

**The slope** has been obtained automatically using NMS, and the result were values between 0 grades (horizontal surfaces) and 57,44 grades (very inclined slopes from the valley sides).

**The aspect (the surface exposed to the solar radiation)** has been determined using NMS and it was calculated as the direction of the horizontal projection normal to the surface of the side and is measured in clockwise direction, towards the direction of geographic north.

**The distance to the water sources** has been determined by calculating the Euclidian distance in all directions from the digital map of the network basins.

Based on statistical analysis of the factors considered values have been differentiated the most favorable indicators. These values represent small differences depending on the morphological characteristics of the establishment of relief in which archeological sites are located.

Even if you do not always take into consideration those factors that are very precise, archaeological field research results have shown that these predictive models have an 80 % precision, a very satisfying percent, in our opinion. Of course that in addition to environmental factors should be taken into account and the politico-military, economic, social, cultural, etc. But we believe that this is a good start, especially on the ground that the data confirms this fact. Remains a desideratum the completion of such data in a complex data and information interface to enable rapid assessment and performance potential of an archeological area (no matter what that is and any period of time it would belong).

## Chapter 6. Conclusions

Throughout all Banat's historical area have been repertoires, so far, a number of 335 municipalities around which have been identified post-Roman settlements (which can be dated from the Province period, II century BC, till the end of IV century - the beginning of the V century BC).

Their spreading range is very broad, encompassing the entire space of historical Banat, and in terms of relief, only in the mountains have not been identified (by now) settlements dating from this period.

Being aware that the data are not so satisfying, many areas being researched not even periegetic, we tried during our work to capture only those settlements, about which we had certain information and we were able to verify on the field. On the occasion of checking data from reference literature, we have identified, over the years, a number of other post-Roman settlements, especially in Timis County.

Analyzing these facts using geographical methods, proved to us appropriate to the extent that can provide additional working tools for explanation of historical archeological issues related to habitat.

Although expected that this era is far from have said the last word, we believe that our approach has brought some clarification of interdisciplinary character, and maybe, most importantly, has opened new opportunities for research in new methods and old, but practical and easy to any archaeologist.

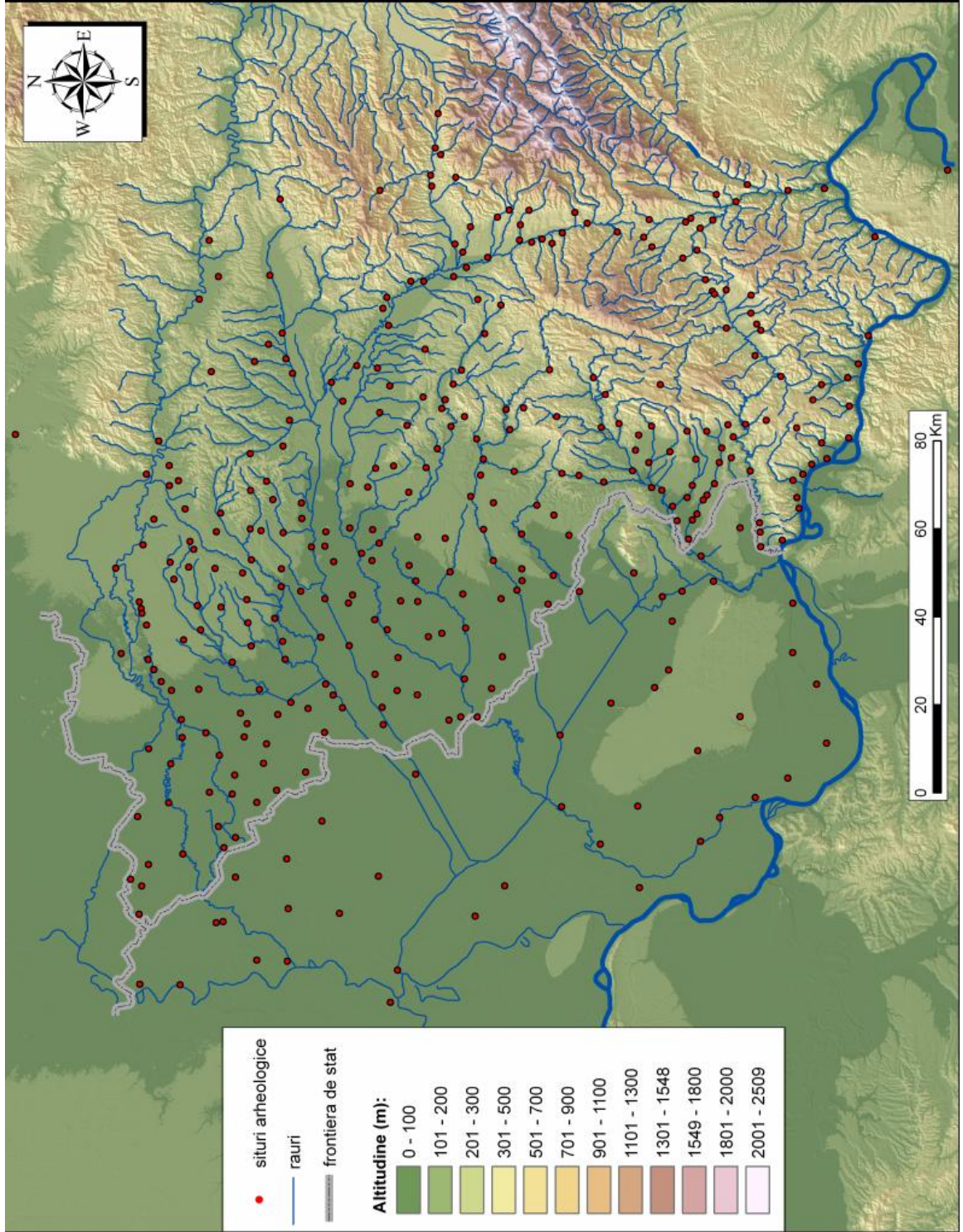
Analysis of their dispersion reveals that the entire area of Dacia south-west has been intensely lived in this era, including the Aurelian withdrawal, and that geographically speaking, there is no area that has not be offered favorable living conditions. Stunning adaptation to environmental geographical conditions made this population to find opportunities of living in the muddy areas or in the mountain depressions.

Our approach was not an attempt to analyze them historically, but only introduced two methods of interdisciplinary work; we didn't risk engaging in historical interpretations, cultural or ethno-archeological, signaling only the geographical features that were governing their daily life.

We allow, finally, outlining the features, even if they were presented during the exhaustive work:

- use of modern means of data acquisition allows the identification and precise location of any archaeological sites (urban / rural, military / civil / religious, closed / open, etc..) sets limits (eg settlements, fortified premises, necropolis, etc..), distance (eg roads, linear fortifications, etc..), perimeter and occupied area (hectares), form (morphology) and spatial coordinates (latitude, longitude and altitude) of a site; allows the demarcation of protected areas and provides technical legal framework for inclusion in the immobile list of property Monuments (Section Archeology) and the recovery of data for law (establishing ownership), administrative (downloads of archaeological task for the start of work on planning agricultural, industrial or infrastructure), tourism and cultural (the inclusion of archaeological sites in the archaeological, historical-cultural and ethnographic tourist circuit).
- exact location of an archaeological site facilitates carrying out geological analysis (analysis of the geological material: steel, iron, salt, etc.), soil (soil analysis and sediments), geomorphological analysis (analysis of the forms of relief and hydrographic network) climatic analysis (wind, precipitation) and phyto-fauna analysis (species of plants and animals) complex for the extraction of scientific data in November, interdisciplinary, the man-nature relationship.)
- analysis of multilayered maps, which corroborates archaeological data with geographical data making it easier for the archeologist to identify sources of raw materials (wood, stone, salt, clay, iron) and food (areas with potential for collecting, cultivating land, grazing, fishing, etc.. ), thus indicating the employment of the inhabitants of a particular habitat.)

- determining the exact distance and possible routes of access fosters research intercommunal relations (to invade areas, transport, cultural contacts materials, the types of properties, etc..) for the realization of social-economical studies.
- establishing precisely the dimensions of human settlements in relation to the communities around them, and geo-strategic nature of it (open or fortified settlement), allows classification of these settlements, ordering the political criteria for dependence or independence, achievement of repertoire data (based on order, and weighting mathematical series) to identify the centers of power and peripheral communities.
- investigating geographical features on the choice of placing the foundation of a settlement, the Sacredness of a religious space or geo-strategic advantage, (exposure, slope, distance to water resources and raw materials, etc.) permits recognition of patterns, rules and knowledge (technical, religious, biological, etc.) of a human community in relation to space and chronological belonging to the period.)
- observation, analyze and interpretation of the geomorphological constant changes in territory, area or wider areas (draining rivers, tree planting / deforestation, swamp, erosion, etc.) facilitates the implementation of predictive models to identify new archaeological sites with potential in areas considered nowadays unfit for living, but used to be lived in the past, systematically unknown and unexplored locations, archaeological speaking.)
- complex research data (satellite images, aerofotograms, topographic removal, etc..) allows observation of the effects of anthropogenic changes in landscape (draining, grubbing, sewers, deforestation, pollution, etc.) but also on human communities (systematization, urbanization, construction of roads, etc.) in the analysis of swarming phenomena, migration and dereliction of natural perfect locations and adaptability to new environmental and affects of antropization, uniformization standards of the landscape.)
- geostatistical studies allow the corroboration of data (qualitative and quantitative) for the extraction of observations with quantifiable character, both spatial and temporal (diagrams of complex developments in space and time of human communities), which can be powerful tools of (expert systems ) in the hands of archaeologists, through software-specific data processing spatial data.)





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