SETTLING SELECTION PATTERNS IN THE SUBCARPATHIAN AREAS OF ROMANIA. SALT RESOURCES AS A DETERMINING FACTOR FOR PREHISTORIC OCCUPATION

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ABSTRACT

The paper presents a number of methodological aspects, based on GIS (Geographic Information System) applications, useful in complex studies of prehistoric economies, or, more specifically, of subsistence strategies employed by prehistoric agrarian communities. The study provides arguments for the existence of an economic potential in the Subcarpathian areas of Romania, and at the same time focuses on determining, by means of landscape analyses, a model of habitation of the prehistoric settlements from this area. Relying on a series of case studies, the main natural resources available in the area were identified, with a focus on the salt springs, which undoubtedly played a key role and should be considered a decisive factor in selecting the occupation areas. Directly related to this, a detailed characterisation of the terrain, by describing its main morpho-hydrometric characteristics, is provided. For the Subcarpathian area of Romania, the ethnoarchaeological investigations conducted recently as part of two research projects, alongside the archaeological researches performed throughout time, interpreted conjointly in a GIS environment, support the hypotheses regarding the archaeological potential of the area directly conditioned by the presence of salt resources.

Keywords: cartography, GIS, spatial analysis, salt resources, prehistoric sites

INTRODUCTION

Identifying the main factors that conditioned the selection of the location of prehistoric settlements can definitely be productive in obtaining precious clues for understanding the subsistence strategies or the social organisation of prehistoric communities. The option for a certain region is the result of a long selection process which takes into account both the economic needs, and the cultural ones. The specialised literature often addressed the issue and presented the preferences of the prehistoric communities as aggregates of several factors (such as the terrain defensive potentiality, aspect, visibility,

elevation, availability of natural resources, etc.), but there were very few systematic research initiatives in this regard.

On the basis of a tightly-knit methodology with a strong interdisciplinary undercurrent, employed during the last six years in the Subcarpathian areas of the region of Moldavia in North-eastern Romania, this paper aims to present an image as accurate as possible of a model of prehistoric occupation by defining certain specific quantifiable variables that determined the location of the settlements.

Alongside the morpho-hydrometrical particularities included in this analysis, the study focuses on a natural resource that is distinctive for this area, namely brine obtained from salt springs. Salt springs as determining factor for human settling were first treated in Romanian works in the 1950s, though the settlements taken into account were located at no more than a few hundred meters from the salt springs [1] [2]. This issue was readdressed after several decades by a series of pioneering ethnoarchaeological investigations, which revealed an intense exploitation of the salt springs on an area of at least 10 km around them [3]. On the basis of this factual reality, the hypothesis of the existence of settlement clusters around the most important salt springs found in North-eastern Romania was first put forward [4]. The continuation of the research as part of two Romanian projects with French participation opened new perspectives for approaching this problematics [5], [6], in the sense that it was observed that the supplying with brine is done in certain resilient areas of Romania to a distance of up to 30 km from the salt springs, and this is the case of the "settlements that get supplied directly from a salt springs" [7].

The central question of the study is to establish to what distance from a salt spring the spring plays a determining factor in selecting the location of a settlement by a human community.

On account of the complexity of this endeavour, this study will be limited to the analysis of just the most representative historical stage, the Chalcolithic, of a single salt spring from the piedmont area of North-eastern Romania, namely the ancient spring from Poiana Slatinei (near Târgu Neamț, Neamț county), exploited as early as 6000 BC [8] (Figure 1). The validity of this model is set to be tested for the entire saliferous Eastern-Carpathian area.

MATERIALS AND METHODS

The Eastern Subcarpathian area of Romania is well known for the high density of prehistoric settlements (particularly Chalcolithic ones, such as those belonging to the notable Cucuteni culture), as well as for harbouring hundreds of salt springs. The attempt to reconstruct as accurately as possible the paleo-environment and to shed light on the strong relationship between humans and the natural environment relied on an integrated ethnoarchaeological, as well as geo-archaeological analysis, dependent on multiple methodological aspects. Following the elaboration of the theoretical foundation from local and regional publications (archaeological repertoires, specialised journals, the existing cartographic data, etc.), there were carried out ample fieldwork, ethnoarchaeological inquiries, GPS measurements, analyses of the spatial distribution of the sites and salt springs, the examination of the morphometric characteristics of the terrain (elevation, slope, aspect).

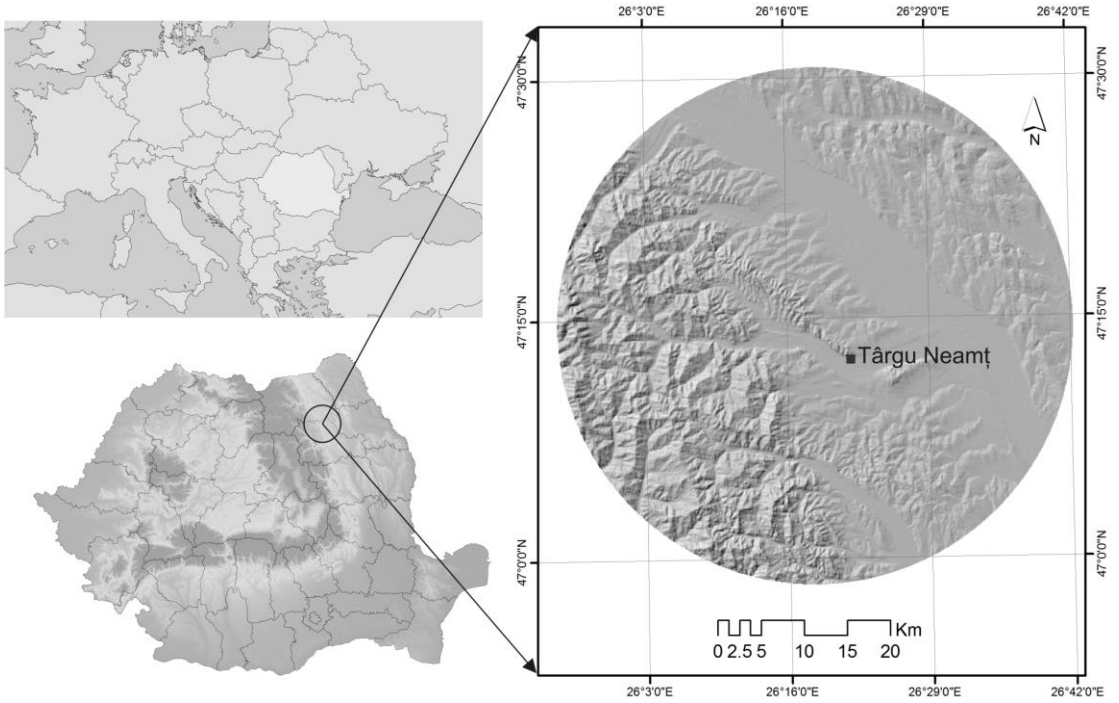

Figure 1. The study area in the Eastern Subcarpathians of Romania.

The extensive information collected was structured logically as a SQL database and integrated into a GIS project, in order to ascertain the model of occupation of the Chalcolithic settlements from the area under scrutiny.

Specifically, in the study area (30 km around the salt spring from Poiana Slatinei) there were identified, registered with the GPS and subsequently integrated into the GIS project, a number of 41 salt springs. Similarly, on the basis of the available archaeological repertoires and the analysis of the cartographic support (topographic maps at a scale of 1:25,000 and orthophotomaps at a scale of 1:5000), 129 Chalcolithic archaeological sites belonging to the Precucuteni and Cucuteni cultures were identified and placed on the map (Figure 2). A quick methodological mention should be made with respect to the terms 'site' and 'settlement' used in this paper, which in many cases refer to archaeological "points", that is, points of archaeological relevance that were identified predominantly through fields surveying. At the same time, the DEM (Digital Elevation Model) was produced by using the SRTM (Shuttle Radar Topography Mission; resolution of 90 m/pixel) imagery, overlapped by the respective theme layers required for the analysis (drainage basins, watersheds, soil types, landform units, etc.).

THE ANALYSIS IN GIS ENVIRONMENT

The GIS analyses were performed using the ArcGIS 10 software package. The elevation indicator was calculated, since in most cases it constitutes an efficient criterion for classifying and interpreting the settlements. This factor can generate essential information on the elevation level in which a settlement is found, allowing the identification of certain economic characteristics (the agrarian character of a community, animal husbandry, pastoral activities).

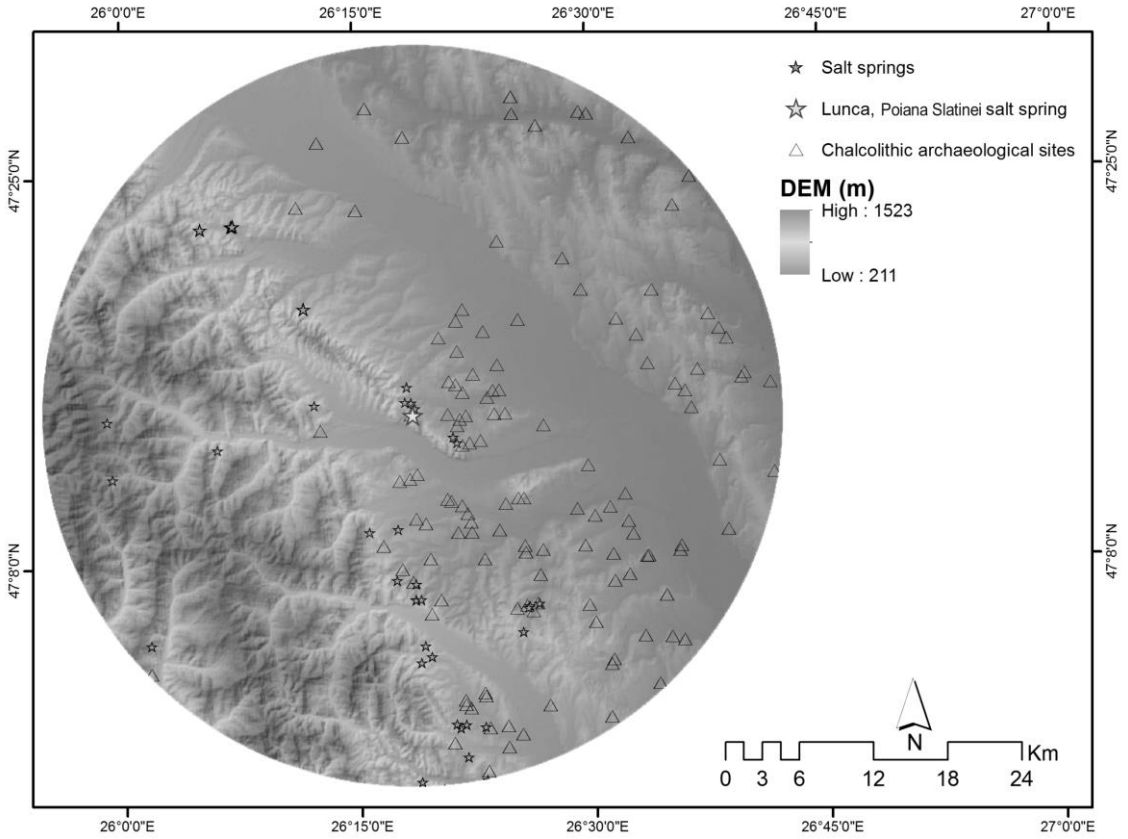

Figure 2. Spatial distribution of Chalcolithic sites and salt springs in the study area.

The slope map was generated on the basis of the DEM. The exact assessment of an area's slopes angles can generate useful information regarding the option of a human community to select a certain location for settling. A steep slope that requires considerable effort to be climbed is a criterion for selection, as it possesses defensive value. Conversely, steep slopes are often affected by erosion processes, which can sometimes led to gullying phenomena [9], and intermittent watercourses can affect the terraces most suitable to human habitation.

Another indicator necessary for the geo-archaeological analysis was versant aspect. Further on, other statistical analyses concerned the position within the landform units, the hydrological and pedological (soil type) indicators. These indicators can highlight the distribution of the settlements in space, their location being, quite obviously, conditioned by the presence of water or fertile soil in the vicinity.

RESULTS AND DISCUSSION

The calculation of the main morpho-hydrometric parameters (Figures 3–8; Tables 1–4) for the registered settlements and their analysis in direct connection with the presence of salt springs (Figure 8; Table 5) revealed a series of important aspects related to the location of the Chalcolithic communities from this area.

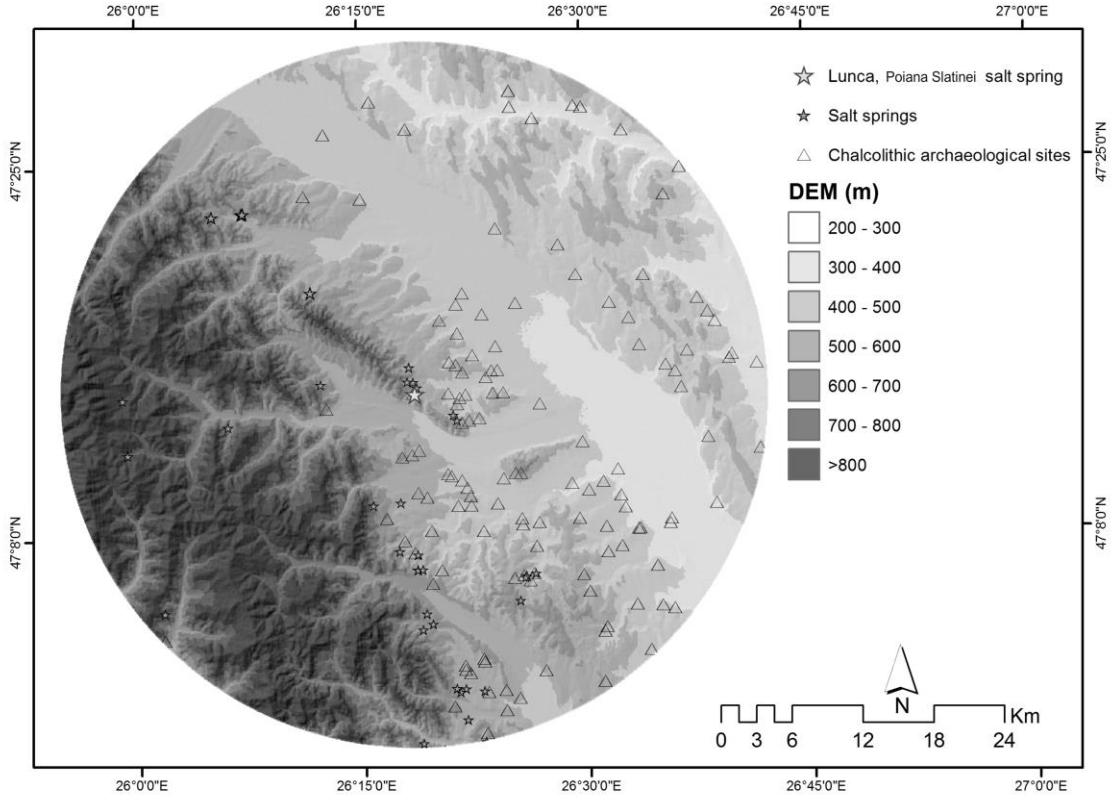

Figure 3. Chalcolithic settlements in relation to the elevation.

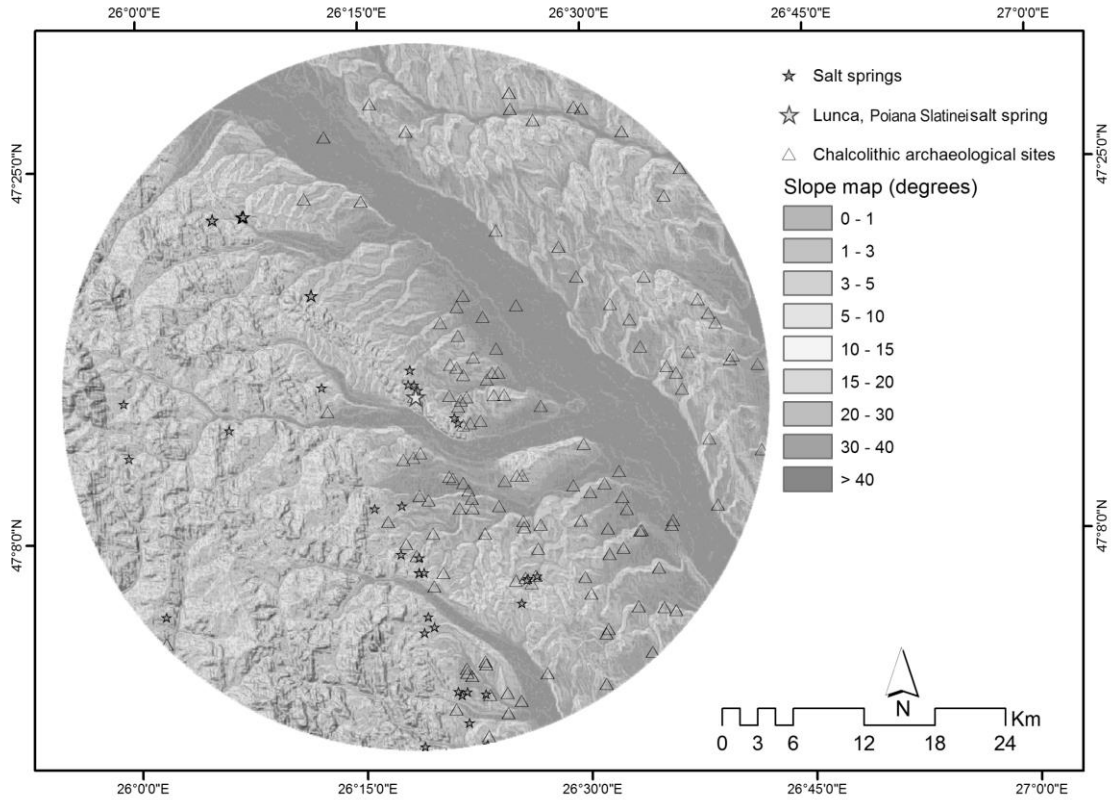

Figure 4. Chalcolithic settlements in relation to the slope.

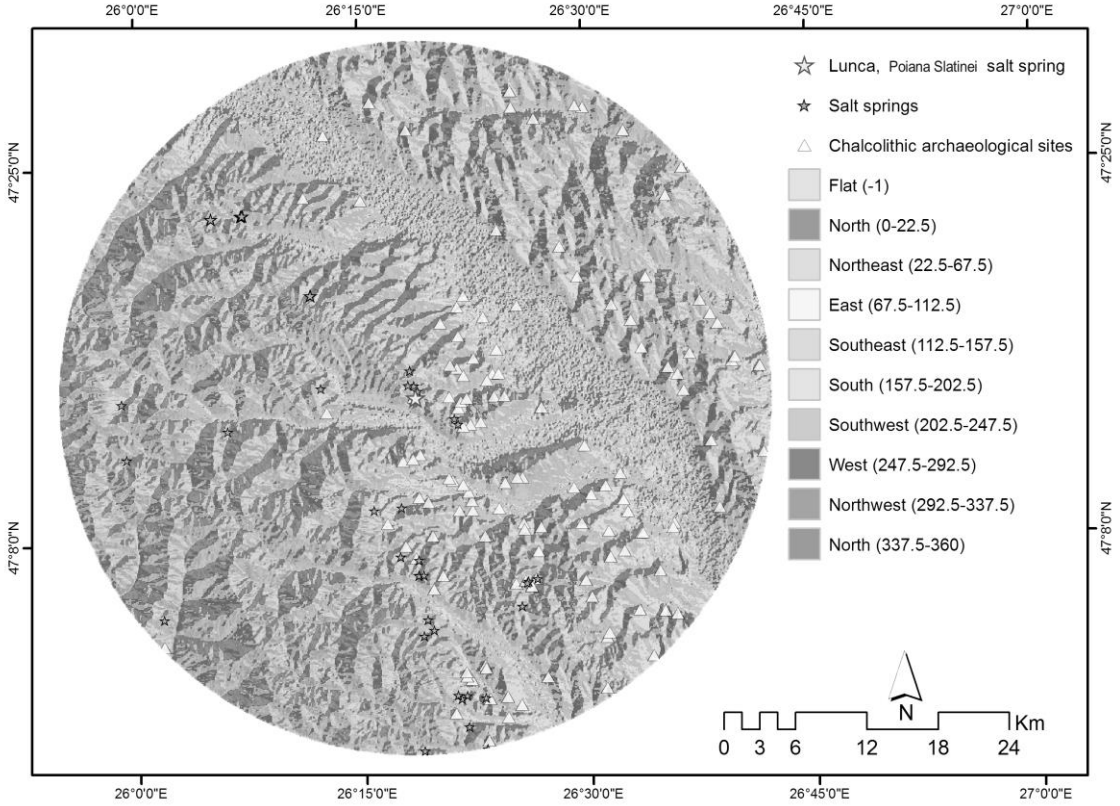

Figure 5. Chalcolithic settlements in relation to the aspect.

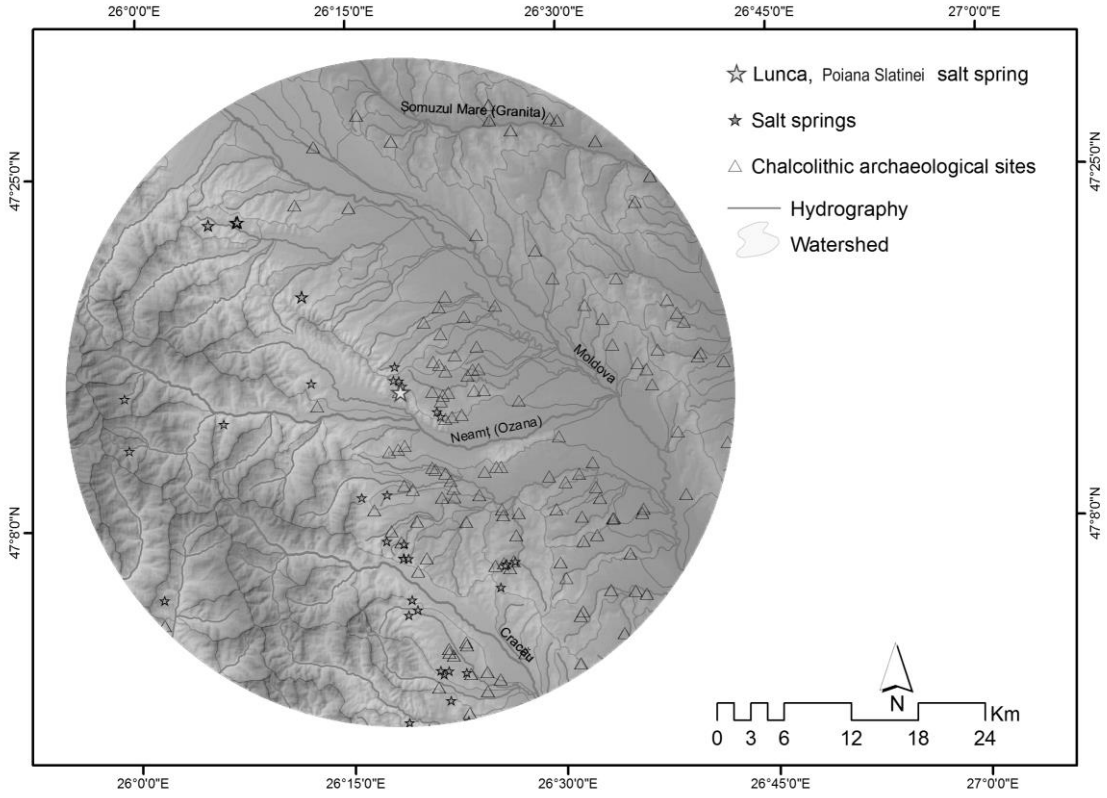

Figure 6. Chalcolithic settlements in relation to the hydrography.

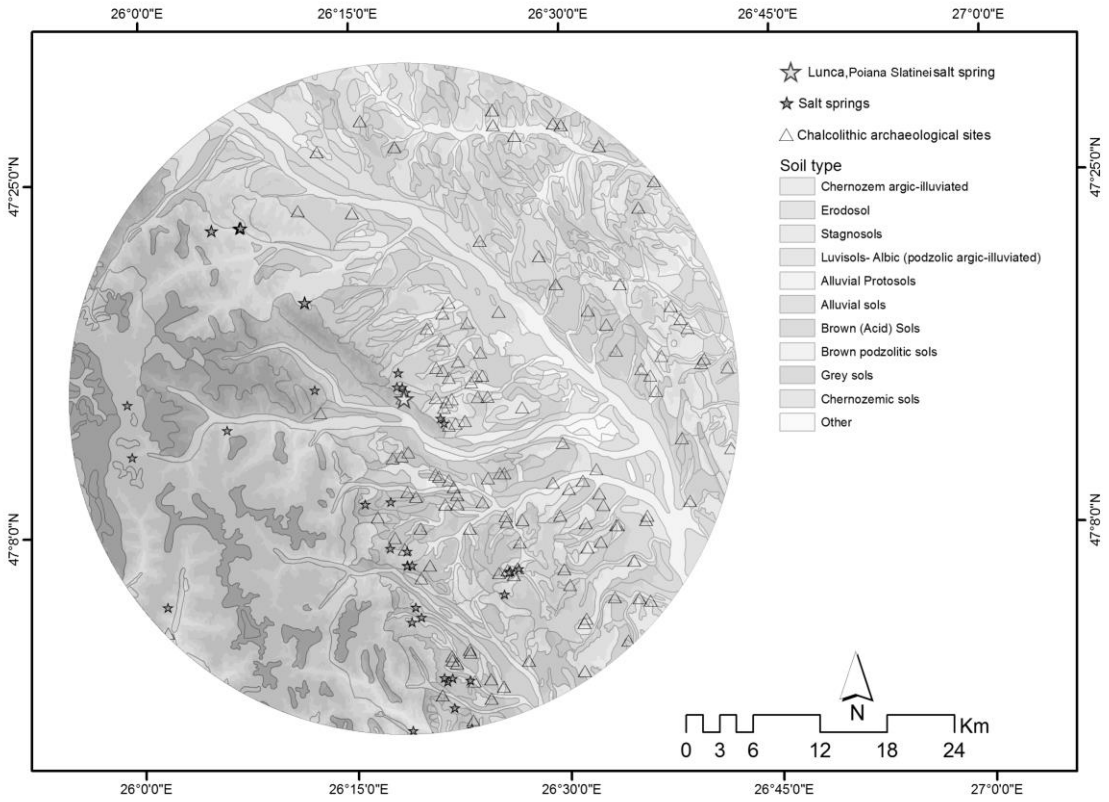

Figure 7. Chalcolithic settlements in relation to the soil type.

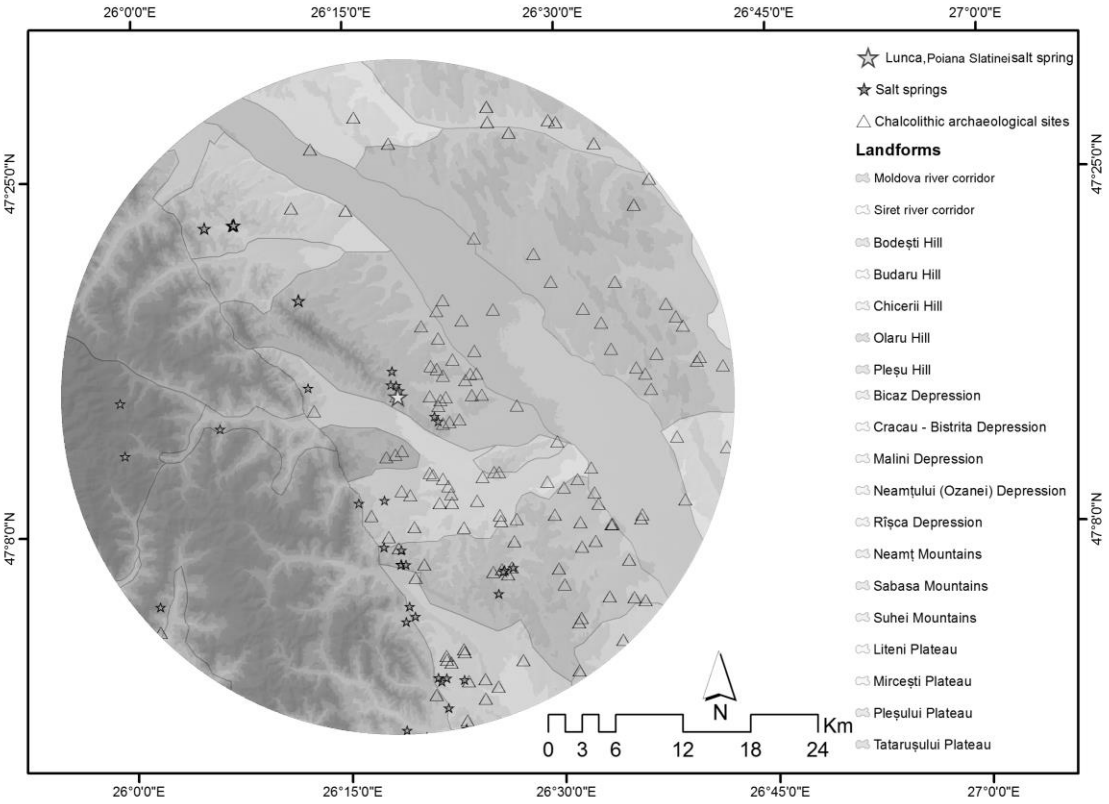

Figure 8. Chalcolithic settlements in relation to the landform units.

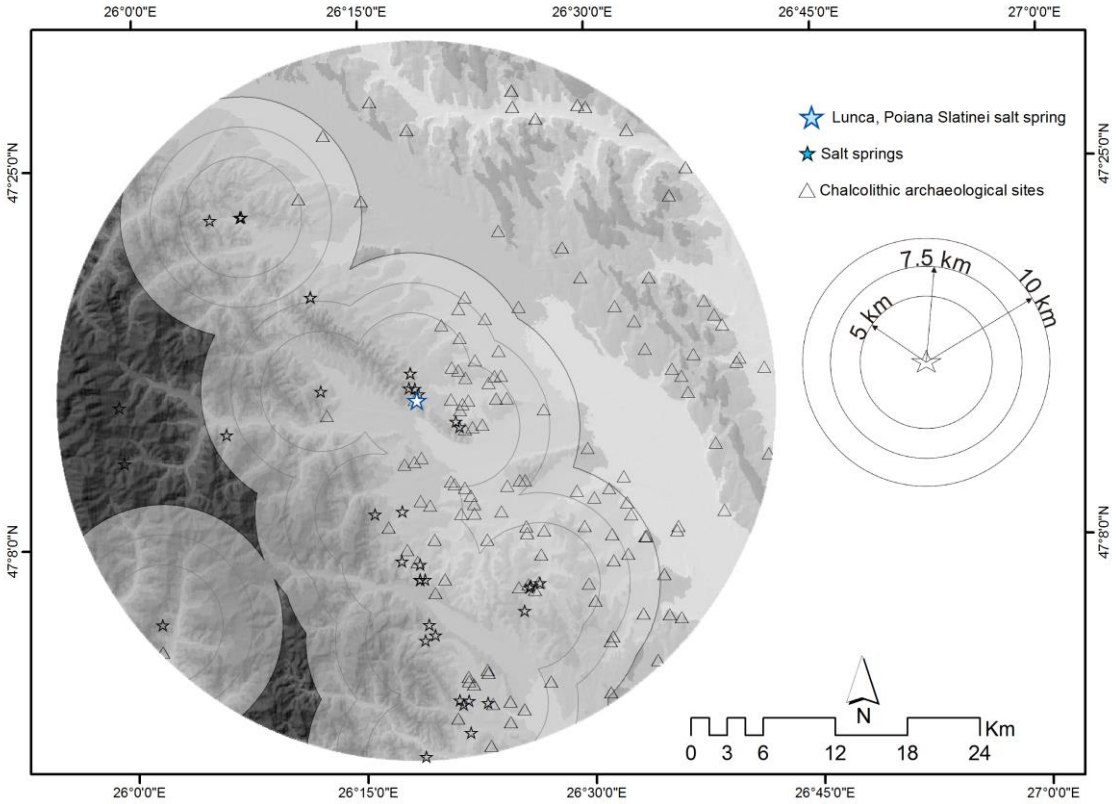

Figure 8. Multiple concentric limits around salt springs.

Table 1. Percentages of settlements in relation to the altitude.

Altitude (m)	**Number of sites**	**Percentage of sites**
200-300	10	7.75%
300-400	72	55.81%
400-500	35	27.13%
500-600	11	8.53%
600-700	1	0.78%
700-800	0	0%
>800	0	0%

Table 2. Percentages of settlements in relation to the slope.

Slope	**Slope of relief (degrees)**	**Number of sites**	**Percentage of sites**
Flat - Almost Flat	0-1	15	11.6%
Very gentle	1-3	42	32.6%
Gentle	3-5	40	31.0%
Modest	5-10	23	17.8%
Moderately steep	10-15	8	6.2%
	15-20	1	0.8%
Steep	20-30	0	0.0%
Very steep	30-40	0	0.0%
Extremely steep	>40	0	0.0%

Table 3. Percentages of settlements in relation to the aspect.

Aspect	Aspect of relief (degrees)	Number of sites	Percentage of sites
Flat	-1	0	0.0%
North	0-22.5	8	6.2%
Northeast	22.5-67.5	18	14.0%
East	67.5-112.5	30	23.3%
Southeast	112.5-157.5	31	24.0%
South	157.5-202.5	23	17.8%
Southwest	202.5-247.5	9	7.0%
West	247.5-292.5	5	3.9%
Northwest	292.5-337.5	2	1.6%
North	337.5-360	3	2.3%

Table 4. Percentages of settlements in relation to the soil type.

Soil type	Number of sites	Percentage of sites
Grey soils	44	34%
Brown podzolitic soils	34	26%
Luvisols-Albic (podzolic argic-illuviated)	13	10%
Erodosoil	11	9%
Alluvial protosoils	9	7%
Stagnosols	5	4%
Chernozemic soils	5	4%
Chernozem argic-illuviated	4	3%
Alluvial soils	2	2%
Brown (acidic) soils	2	2%

Table 5. Percentages of settlements in relation to the concentric limits.

Limit (km)	Number of sites	Percentage of sites
5	56	43%
7.5	75	58%
10	90	70%

The analysis of the generated imagery and the statistical data in the tables offer the first clues regarding the habitation model of the Chalcolithic communities from the study area. It reveals that the Precucutenian and Cucutenian communities preferred the elevation level between 300 m and 400 m (72 sites; 55.81%), gentle and very gentle slopes (82 sites in total; 63.6%) with eastern, south-eastern or southern exposure (83 sites in total; 65.1%).

Another conclusion is the preference for locations found near sources of water, with grey and brown soils (78 sites in total; 70%), and, most conspicuous, in hilly, depressionary or plateau areas (Bodești Hill, Pleșu Hill, Ozana Depression, or Tătăruș Basin). At the same time, the increased density of the settlements in the central and southern parts of the study area should be put directly into connection with the presence in the vicinity of some salt springs which, as evidenced by the archaeological excavations, were exploited intensively. The information from Figure 8, alongside the statistical elements from Table 5, supports this position. More exactly, on the basis of the ethnographic investigations [3] conducted during the last six years in this area, and of the information available in older works on the catchment areas of prehistoric

agrarian communities [10], three concentric limits (at 5 km, 7.5 km and 10 km) were defined around the salt springs and used as inputs for the statistical analyses of the inner Chalcolithic settlements. Within the 5 km limit there are 56 archaeological sites, representing 43% of the 129 sites considered for the analysis. As the limits extends to 7.5 km around the salt spring, the number of sites within the limits increases to 75, representing 58% of the total. The 10 km limit harbours 90 sites, or 70% of the total number of Chalcolithic sites located within the study area.

As a preliminary conclusion expressed in relative terms, it can be said that as closer as a site is to a major salt spring, the more the salt (brine) factor establishes itself as relevant for the settling selection process. As the distance from such a salt spring increases, other factors gradually take precedence. The results offer a sufficiently detailed image of the constant interactions between prehistoric human communities and their surrounding environment, underlying, alongside the other variables specified, the importance of the salt resources for the prehistoric human communities living in the piedmont areas of the Eastern Carpathians.

This methodological approach requires amendments (e.g., a digital elevation model with a higher resolution), additions and calibration, but it establishes itself as a starting point for future similar research in this area, and, moreover, can serve as the basis of a predictive model suitable to be applied to other chronological or geographical settings.

ACKNOWLEDGEMENT

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