Long-term Social Processes and Demographic Dynamics of the Early Bronze Age (2800–1700 BC) in the Northern Banat Region of Serbia

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Submitted to the Graduate Faculty of the

Dietrich School of Arts and Sciences in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy

University of Pittsburgh

2022

UNIVERSITY OF PITTSBURGH

DIETRICH SCHOOL OF ARTS AND SCIENCES

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This doctoral dissertation examines long term social and economic transitions in the Northern Banat Region of present-day Serbia during the Bronze Age (2800–1700 BC). At this time, it appears that egalitarian communities gave way to completely new forms of hierarchical social organization by the early second millennium BC. These developments have been characterized through conventional social typologies based on the discovery of well-furnished graves in which unequal access to prestige goods is apparent. Bronze Age cemeteries have drawn the most interest with much less comparable research being undertaken on regional settlement patterning, household organization, and scale and location of craft production activities. Dissertation field research was undertaken in the Banat region of Northern Serbia, located in the Carpathian Basin of Europe, and was funded by a National Science Foundation Doctoral Dissertation Research Improvement Grant (# 1834491) in cooperation of the Intermunicipal Institute for Protection of Cultural Monuments of Subotica and the Ministry of Culture and Media of the Republic of Serbia. Research was comprised of the development of methods using a regional scale pedestrian survey of 200 square kilometers, surface collection of artifacts and statistical analysis, targeted near surface geophysical surveys and spatial analysis of topographic, environmental and survey data. Assessment of the data collected revealed exceptionally significant regional scale changes regarding demographic densities, socio-economic practices, and settlement patterns with regional integration and population centralization on a supra-local level during Early

and Middle Bronze Age Early (2200-1500BCE). Results also indicate the presence of economic intensification and interdependence with considerable potential for long distance trade and exchange. Subsequently the Late Bronze Age period (1500-800BCE) bring about a significant depopulation of the region and disintegrations of the previously established socio-political systems.

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Preface

While there are more than a few people I would like to thank for helping me finish this project, there are plenty whom were doing the opposite.

Ergo I will say nothing.

1.0 Anthropological Study of Social Hierarchy in Prehistoric Societies

Demographic trends found in the archaeological record around the world suggest that over time societies of only a few hundred people transformed beyond the local scale into much larger and more cohesive communities. These larger social formations grew and became organized in a variety of ways. In many cases, novel forms of social organization were associated with an increase in demographic demands that also created a new social and political environment where active individuals and leaders pursued opportunities at the supra-local scale that often led to a greater centralization of economic wealth and power. Scholars have sought to examine these changes through the study of ideology, warfare, and political economy (Mann 1986; Earle 1996).

Two broad modes of social organization, network and corporate, have been used frequently in archaeological literature for the comparative study of social complexity in early societies (Earle 1996; Blanton 1996; Feinman 2000). The accumulation of wealth, competition and prestige (Clark & Blake 1994; Renfrew 1986) has been established as a hallmark of network modes, while corporate modes of social organization have been associated with more inclusionary interactions such as integration, management and cooperation (Earle 1997). While these two modes have been highly useful in comparative studies, their premise assumes only two axes, vertical and horizontal. If we move beyond these two dichotomies, we are left with a greater range of variability present within these early societies and the myriad ways that social power and processes of centralization manifested. Importantly, these dimensions of social variability can be empirically investigated and ranked. Correlation between different dimensions of variability can create patterns and it is these patterns specifically that we can use to interpret hypotheses related to social change in the past (Drennan and Fox 2010).

The study of the processes that led to these different pathways offers an important opportunity for expanding our understanding of the various social, economic and political forces that drive long-term change in human societies. Rigorous comparative research on early societies has created substantial evidence to support the idea that social change is expressed through forces that are not random but usually operate in a finite number of consistent ways that can be identified through archaeological research (Drennan et al. 2011). Investigating and comparing the variations in such trajectories of social complexity offers a better opportunity for understanding social transformation only if we apply adequate conceptual tools for characterizing these variations. By delineating several important scalar dimensions of variation, it is possible to provide data that is accessible to quantitative comparison by examining and comparing the same types of datasets related to different trajectories. Drennan and Peterson (2012) have identified these as 'data threads,' which are not constrained to, but may be represented by, demography (demographic density, local community structure, supra local community scale and centralization), economy (long distance exchange, landscape-subsistence relation, wealth differentiation) and warfare (fortification, inter-site visibility and buffer zones). A comprehensive and comparative archaeological analysis of eleven regional trajectories has proven to be a highly successful tool to both investigate and interpret trajectories of social change in these early communities (Peterson & Drennan 2012). The study and analysis of these early social transformations in a global comparative manner offers important new opportunities for better understanding the genesis of new institutions and patterns of social organization that continue to be the bedrock of social life today.

1.1 Social Inequality and Sources of Power

Economic power is the control over the exchange and production of subsistence (staple finance) and luxuries (wealth finance) (d'Altroy et al. 1985) and this has been found to be a substantial foundation for political power. Elites can control the means of subsistence through control of prime agricultural land or intensified economic production (Earle 1997, 7). Another way is by monopolizing specialized manufacture and the distribution of prestige goods (Friedman & Rowlands 1977). These are primary elements that are fused within the corporate and networks modes of social organization (Blanton et al. 1996), which are not mutually exclusive (Earle & Kristiansen 2010, 244) but alternate between periods in which one is more pronounced than the other (Peterson & Drennan 2012). Control of exchange requires control over significant regions, which is not an easy task. Centralized exchange can be easily circumvented. This would imply that the significance of the flow of material goods through political economy structures is related to the elites` ability to use this material flow as a supportive mechanism for other facets of social power: military might, to circumscribe the resource, and ideology, as a means of instituting social inequality (Earle 1997).

Wealth accumulation and economic control, hallmarks of stratified societies and early states, developed out of the social inequalities of chiefly societies based on the accumulation of prestige goods according to Frieds (1967) and Service`s (1968) classic evolutionary models. “Big-man societies”, “tribes” and “rank” societies often have been described as social systems where prestige plays a fundamental role with regards to power.

At the lowest level of social interactions, the family, power relations are established, maintained, and extended to larger family units. This is an environment where kin structures and interactions provided the foundation for politics. Eventually, kinship bonds became secondary to a source of power which is more controllable. Scalar stress has frequently been referenced in archaeology as a significant and quantifiable tipping point in such social developments. It is a demographic characteristic of early social groups or settlements that occurs when communities reach populations of roughly 150 individuals. Johnson's (1982) theory describes the relationship that occurs between an increase in a group's size and the frequency of internal conflict.

Foundations of his theory rely on data observed from cognitive psychology studies and small group dynamics. Alberti (2013), through combining Johnson's theory, Dunbar's model of cognitive group size limits, , and ethnographic data, was able to predict the number of people required for change to occur through a process of fissioning. It has been observed archaeologically that when societies reach this demographic pressure point increased settlement processes occur in subsequent chronological phases (Bandy 2007). In some cases, when fissioning is not possible or beneficial, alternatives emerge through new social structures. These new formations can be viewed as a response to new population dynamics created in order to alleviate some of the conflictual interactions. Such formations might be manifested through ideological or religious practices, political and judicial or regulatory changes, formation of militias and use of force.

The processes outlined above can generate a system where people are positioned in unequal social positions that mediate social and political advantages. In these systems of institutionalized inequality, social interactions are manipulated via sources of power such as economy, military and ideology (Earle 1997, 5). Leaders can represent a focal point in the redistributive system wherein the exchange of goods occurs through ceremonies, gifting, and feasting. This is a socio-economic mechanism that gives leaders prestige by providing goods to the larger population (Fried 1967; Sahlins 1963; Service et al. 1968).

All these social processes provide leaders with the opportunity to amass goods that can be used for elite`s enterprises. More recent authors believe that social inequalities is caused by the control of economic resources (Earle 1997; Gilman 2001; Haas et al. 2004) and personal competition for political power (Clark & Blake 1994; Hayden & Gargett 1990). Social interactions can change through trajectories that are shaped by elites depending on the sources of power they are able draw upon and implement. However, in most case studies, economic power has very strong developmental potential (Earle & Kristiansen 2010, 244; Earle 1997; Peterson & Drennan, 2012, 65).

1.2 Social Complexity in European Late Prehistory

Few scholars would disagree that the European Bronze Age represents an important period in which new forms of hierarchical social organization emerged. Over the course of the twentieth century, archaeologists associated these changes with the rise of chiefdoms and related increasing degrees of social inequality and institutionalized leadership (Anthony 2010; Childe 1957; Earle & Kristiansen 2010; Gilman 2001; Harding 2000; Parkinson & Galaty 2007). Disagreements became more prominent when researchers set out to explain how these new social forms came into existence and what specific social, economic and political processes were associated with them (Harding, 2000; 2007; Jaeger 2014; O'Shea 2011; Vander Linden 2007). Discussions connected with these issues can be characterized broadly into two major areas: (i) Pan-European Bronze Age systems and (ii) variable trajectories of social change at local and regional scales.

1.2.1 Pan-European Bronze Age Systems

At the start of the second millennium BCE, the archaeological record of Europe suggests that new institutions and higher degrees of social stratification developed. A significant amount of resources and energy were used to create great burial mounds and fortifications, unlike the previous periods, when such undertakings were carried out by communities for the benefit of the entire group, such as the famous megaliths that were largely abandoned in the Bronze Age. At this time, focus shifted to individuals who were investing in their long-term status (Renfrew et al. 1974) and this represents some of the first major shifts towards more complex societies with varied social roles and inequalities (Earle & Kristiansen 2010; Kristiansen & Larsson 2005). The formation of supra-regional interactions, such as long-distance trade, exchange and warfare, reshaped social, political and economic institutions by re-forging the types and scales of interaction. Enterprising chiefs were envisioned as powerful enough to reorganize and utilize local social and natural environments and resources largely for their own benefit shifting the local pattern of interaction to bigger, supra local social formations (Earle & Kristiansen 2010; Kristiansen & Larsson 2005; Shennan 1986). These new social transformations also were associated with the introduction of metal-based economies. This form of political economy, which mostly emphasizes a type of wealth finance (Earle 1997), created alterations in demographic patterns because of the reorganization and, in some cases, enhancement of craft production. It has been argued that this novel system provided the means for a new class of elites to emerge through new social institutions that were based on a network mode of organization (Blanton et al. 1996). To establish their legitimacy, new elites used prestige goods acquired over long distance interactions with state-like formations that had already emerged elsewhere (Kristian Kristiansen & Larsson 2005).

Trade and exchange, however, did exist before the introduction of metals such as bronze tin, copper and gold. However, transport technology apparently did not allow for large scale long distance ventures. With the implementation of new transportation equipment, such as boats and animal driven carts/chariots/wagons, metals and other valuable commodities moved over longer distances (Kristiansen & Larsson 2005). Rivers became amplified conduits for long distance trade and connected central Europe with the developed states of the central Mediterranean via the Carpathian Basin and the Balkans. Luxury goods were not only traded for raw metals but also for other subsistence materials. At this point in time, subsistence strategies shifted from strongly relaying on cultivation to a much greater emphasis on pastoralism (Earle & Kristiansen 2010). Herd animals could have been easily implemented in patterns of longer distance trade since animals are inherently easier to move than agricultural staples (Earle & Kristiansen 2010). This new metal based economy spanned Europe and involved luxury goods that constituted the source of economic and ritual power (Earle 1997), which was used for crafting political alliances among enterprising elites. This can be viewed as a centripetal force that aggregated interactions by stimulating the production of mobile goods (herding of livestock) that were exchanged in this new value system while also leaving a mark on local and regional settlement organization and subsistence patterns.

1.2.2 Variable Trajectories of Social Change at Local and Regional Scales

In more recent years, a focus has shifted to defining and characterizing local regional dynamics in the context of social hierarchy and institutionalized inequality. The Bronze Age of Europe take different form across the continent. In mainland Greece and Crete this period is dated at 3100 BCE and in Mesopotamia by this same time city states are already expanding (Parkinson & Galaty, 2007). At the start of the third millennium BCE, the Early Bronze Age of Greece is represented by early signs of the emergence of social complexity and hierarchy reflected in mortuary practices, variation of house size, and settlement nucleation (Earle 1997; Galaty 2005). At the same time, the Copper Age in Bulgaria is indicative of similar developments. Inhabitants of preexisting tell settlements began burying some of their dead with rich gold and copper burials (Chapman et al. 2012; Galaty 2005).

The Iberian Peninsula, during the Copper Age, experienced the emergence of the earliest examples of social complexity related to warfare and warriors (Gilman 2001). As some have argued, all the "tools" for elite aggrandizement were present long before the onset of the second half of the second century BCE and the Bronze Age (Chapman et al. 2012). Late Neolithic Europe was already familiar with early forms of metal extraction and production (Radivojevic et al. 2015; Roberts et al. 2009) as well as evidence for craft specialization (Bailey 2005) and circulation of these potentially valuable commodities (Kovács et al., 2013). Some scholars (Kienlin 2012) believe that there is just too much variability in the organization of intra-site (tells) space and daily interaction to designate these settlements under one model of social and political organization.

Some evidence suggests that craft specialization (pottery making, metalworking, etc.) was present in Late Neolithic and Early Bronze Age communities but there is very little evidence of centralized control that would be reflected in spatial separation and concentration (Kienlin 2012). Distinct political domains, such as those identified in Mediterranean examples (Kristiansen 2005), where there is evidence of palaces, administration, large-scale storage, and distinctly larger more elaborate buildings, have no parallels in most regions of Europe (Kienlin 2012). This represents a more extended diachronic view for conceptualizing the emergence of institutions of inequality that largely exhibit variable dynamics and vast regional differences. Such a perspective introduces more uncertainty into the idea that the Bronze Age functioned as a "world system" in terms of elite networks and exchange systems and that the emergence of elites happened through a rather restricted set of social, environmental and material conditions (Brück & Fontijn 2013; Harding 2006; 2013).

The development of emerging social hierarchy, leadership, and inequality is present in all parts of Europe but not before the Middle Bronze Age (2000-1500 BCE). Variability in construction and distribution of settlement enclosures and fortification declines considerably only after 1000 BCE. Communal construction was a part of communities of autonomous agricultural villages that persisted for a long time before the emergence of institutionalized and hereditary social ranking (Parkinson 2007). This leaves the World Systems model for the Bronze Age without concrete answers to the social changes of the Late Copper Age (~2800 BCE) and Early Bronze Age (2200 - 2000 BCE) making it a particularly important and intriguing period of study for examining the emergence of new institutions of social complexity.

At present, it is still not clear in what ways the emergence of metallurgy had affected such social changes. Some parts of Europe see a rise in social complexity at the time of introduction of metals, such as Greece, Bulgaria and Spain. In other places, such as the Carpathian basin, the effects are reversed. Similar social changes that happened in Northern Europe, despite the introduction of metals, happened much later.

1.3 Social Organization in The Late Prehistoric Carpathian Basin (4500BC-1500BC)

Distinct changes that led to the emergence of new forms of economic and political complexity among early village societies in the Carpathian Basin have received less study than other regions of Europe. This area was colonized by farming communities during 6000-5500 BCE by settlers who possessed a seemingly full “package” of animal and plant domesticates (Boric 2009; Duffy 2010; Tasic 2005). Throughout history, the study of tell settlements drew researchers to important sites such as Karanovo and Obre I in southern Europe. In contrast, most settlements dating to this period in the Carpathian Basin are “flat,” thin-layered sites that reveal short spans of occupation (Chapman 2013; Greenfield 2014; Whittle 1996). Actual site size and organization of settlements is not well understood and there appears to be a broad range (Whittle 1996).

1.3.1 The Late Neolithic (5000-4500 BCE)

This period is represented in the Pannonian Basin by the Tisza pottery type and in the Balkans region by the Vinča culture complex. Settlements of this type in the lower Koros and lower Tisa regions are fortified, and their sizes range from 1 to 4 ha. Most of the smaller flat sites are thought to be seasonal occupations (Parkinson & Duffy 2007; Parkinson & Galaty 2007; Sherratt 1997) while large sites (up to 11h) are viewed as focal points with similar functions to tells. Burial practices at this time are still intramural with very modest grave goods (Whittle 1996). Some researchers believe that there is a strong association between grave goods and gender differentiation (Chapman 2013,155), as well as kin group clustering (Whittle 1996, 111), and there is little evidence of conflict and warfare.

A particularly interesting period, which early on attracted the attention of scholars, is the Late Vinča cultural complex that ends around 4600 BCE (Boric 2009). It spreads within a zone of 90,000 Km2 and encompassed central parts of the Balkans and southern Carpathian Basin. The basic substance economy of Vinča populations consisted of mixed cereal agriculture and animal husbandry. Characteristic material culture includes wattle and daub constructed houses, dark burnished pottery, and distinctive clay figurines. The term Vinča is based on technological and material similarities of the archeological record and should not be understood as representative of political, lingual or ethnic unity (Porčić, 2012). This homogenous material culture transformed by the end of the Neolithic period into increasingly regionalized areas across the Carpathian Basin with more emphases on nucleation at the local level. Some scholars believe that social boundaries that were not present at the beginning of the agricultural period became more prominent dividing the social landscapes in a few regions into distinct cultural patterns (Parkinson & Gyucha 2012a).

1.3.2 The Copper Age (4500-2800 BCE)

The next chronological phase represents an important shift in demographic patterns. This period is often divided into three (Sherratt 1997), or even four, parts (Parkinson, 2006a) with the hypothesis that Tisapolgar and the next phase Bodrogkesrsture present a cultural continuity of sorts (Chapman 2013). The number of settlement sites is far greater but their overall size would appear to be significantly smaller. Material culture that appeared to be undergoing a regionalization process in the Late Neolithic reverted to a more homogenous form (Parkinson 2006b; Parkinson & Gyucha 2012a) known as the Tisapolgar-Bodrogkerestur cultural complex. The distinguishing boundaries associated with heterogeneous material culture appear to have given way to societies in which such demarcations were of less importance (Duffy 2010; Parkinson & Gyucha 2012b). Burial practices also became increasingly different during this period. Cemeteries were situated away from settlements in locations that might be considered remote. Graves were assembled in rows, which may have represented different local communities (Chapman 2013), and were typically undisturbed by later interments (Parkinson 2006b). Grave goods appeared in far superior numbers then burials of the Neolithic period. Gender and age were important in the context of grave goods variation (Chapman 2013; Whittle 1996) but specific social stratifications, or statuses, are not easily discerned from the mortuary record (Parkinson 2006b). What seems to be the biggest focus for most of the authors specializing in this period is the introduction of kurgans (tumuli) (Chapman 2013; Mallory 1992; Parkinson 2006b; Sherratt 1983; Whittle, 1996) and connections with Indo-European languages and their diffusion. With the disappearance of the large settlements, the dominant feature of the landscape shifted to large cemeteries where interments were accompanied by grave goods associated with the "secondary products revolution" (Sherratt 1983), i.e. cattle burials and fired clay cart models (Chapman 2013). Valuable grave goods are rare (Whittle 1996) but burial patterning indicates a subtle diversity of groups (Chapman 2013).

1.4 The Bronze Age of The Carpathian Basin (2800-800 BCE)

This period within the Carpathian Basin appears to represent a time of emerging technological innovation and new cultural traditions that transformed societies. This coincides with the appearance of unique hierarchical social systems that are defined by many variations in regional and micro-regional trajectories. These systems have been detected in the archeological record primarily through funerary practices.

What transpires with the beginning of the Bronze Age is a return to a tendency of settlement nucleation and fortification. Tell sites reappear to dominate (to a limited degree, Kienlin 2009) the landscape as an important part of the society where regionalization and dynamic maintenance of borders is reinstated. This was a fruitful context in which social inequality became institutionalized in some parts of the Carpathian basin by the Middle Bronze Age and especially by the Late Bronze Age. The Danube floodplain and other major rivers in the area became social landscapes where large hierarchical tell based systems (Százhalombatta, Feudvar, Pecica) developed a dependence on trade and exchange (Earle & Kristiansen 2010; Falkenstein et al. 2016; O'Shea 2011).

1.4.1 The Northern Banat Region

During the Bronze Age, the Maros region was dominated by tell sites such as Pecica. This community utilized its specific position near major riverMaros to establish a flourishing economy in horse husbandry and became integrated in wider trade within the region (O'Shea 1996; O'Shea et al. 2011). The Maros cultural complex followed the traditions of the previous earliest Copper Age assemblages (Tiszapolgár-Bodrogkeresztúr), which occupied a much larger area. After the onset of the Early Bronze age, the transitional group Mako-Kosihy-Caka did not affect the broader homogeneity of the region. Between 2800 and 2400 BCE (Gogaltan 2015, O`Shea et al. 2018), the local assemblages begin to take a distinct form associated with the Moros assemblages. Most of the distinctions in material culture are associated with pottery assemblages recovered from funerary contexts where highly structural and differentiated funeral practices were detected at large cemeteries of the Banat region – most prominently in the territory of Serbia at Ostoicevo and Mokrin (Giric 1971; O'Shea 1996). Most tangible evidence connected with longer term trajectories of social hierarchy stem directly from funerary contexts. Through symbolism and value, material goods played a major role in forming and maintaining new social institutions. These symbols appear infrequently and are related to major levels of social power that was shared across the Maros territory and represented through non-local produced goods such as gold and copper objects. Acquisition of these goods was an important endeavor that would suggest that enterprising individuals could use their geographic positions strategically making themselves and their local communities active participants in supra local sociopolitical developments. Recent research has found similar evidence during long term tell based excavations. Research at the Pecica settlement indicates clear evidence of elite activity during the Middle Bronze Age period (1820-1680 BCE) through feasting and dietary practices as well as specialized craft production and population aggregation (O`Shea and Nicodemus 2018).

1.5 Objectives

Since valuable resources and commodities existed in the Carpathian Basin well before the use of copper alloy metals (Kovács et al. 2013), and metals were identified in rich burials before the Bronze Age, (Chapman et al. 2012), several questions remain to be answered for late prehistory, especially for the Bronze Age. In particular, the sources of social power associated with elites, and how these may have been different from structures of authority and inequality in communities prior to this period, must be identified and better understood. To understand how elites used specific forms of material objects and associated symbolism we must look at the trajectory of development of local populations and how communities may have become reorganized and integrated into new systems of economic and political control (Van der Linden 2006). These important gaps in knowledge realign the focus on Bronze Age social complexity away from burials and objects to look more intently at shifting settlement organization and demographic trends that may index important new patterns of control and centralization of resources and broader social interactions. Regional settlement patterns, therefore, have the potential to add an important new dimension to our understanding of social, economic and political processes and the actual effect they may have had on the reorganization of local and broader scale regional communities (Boric et al 2018; Drennan et al. 2015). To pursue these important questions, my dissertation research utilized data threads to identify and analyze patterns of social, economic and political organization that may be discernable in the archaeological record. When considering late prehistoric eastern and southeastern Europe two general models have emerged, as discussed above, that may be more actively examined:

1.5.1 Model 1 (Pan-European modes of social organization)

Some researchers have demonstrated (Sherratt 1997) that successive qualitative changes between Neolithic, Copper and Bronze Age societies related to emerging political economies that enhanced trade and craft specialization. Dramatic shifts in political leadership and economic organization resulted from supra local prestige goods and commodity exchanges, especially in metals, which required significant institutional restructuring to facilitate. This produced a very different political economy and spatial and demographic organization of societies (Kristiansen and Earle. 2015). If the Northern Banat Region underwent a similar trajectory we would expect to see larger supra-local communities with a steady trajectory of development through the Early Bronze Age. We expect Rabe, where recent research has been undertaken, to take a position of a centralized demographic center (Nicodemus 2017; Hanks 2018). A similar pattern may be observed in the bordering region at the settlements of Százhalombatta, Pecica and Uivar. One would expect these demographic centers to be focused points in the landscape where trade routes can be easily controlled and monitored (T. K. Earle 1997). Also, that these centers were not only well connected supra locally but controlled local resources by integrating hinterland communities into commodity goods production and exchange, such as organization and control of specialized craft production. If this is the case, we expect representative distribution of specific craft activities among settlements in relation to demographic centers. Spatial distribution of craft production related artifacts should follow centralization principles accordingly. If artifacts such as metal smelting and shell debris, stone chisels, ceramic wasters, axes, grinding stones and net weights are found to be concentrated in demographic centers at sites where trade is important then it could be argued that this pattern represents political economy based on interactions transcending local and regional patterns (T. K. Earle 1997; Krisitiansen and Earle 2015).

1.5.2 Model 2 (Local and regional trajectories of social organization)

Some scholars have argued that population estimates suggest that there is no indication that Bronze Age tells represent a clear increase in numbers beyond the thresholds of Late Neolithic sites (Gogâltan 2010, 35–36; Earle & Kristiansen 2010a; Duffy 2010). Fortification of significant size and orderly aggregated houses at Bronze Age tell sites, as well as metalworking evidence usually associated with political leadership and horizontal differentiation, are often challenged as not being significantly different when compared to Neolithic tells or other non-tell contemporary sites (Kienlin 2009). Considerable regional chronological variability in settlement patterns (Duffy 2010) and small-scale metalworking (Kienlin 2009) may indicate that Bronze Age settlements were not associated with increasing centralization and demographic aggregation. If this is the case in Northern Banat Region, then one can expect settlement patterning to be less centralized and more dispersed. This might appear as multiple smaller communities with no obvious centralized pattern of interaction or supra local communities with weak levels of regional interaction and buffer zones. The political economy and subsistence practices are expected to be of a more focused nature on local resources such as agriculture. Finally, if there is very little evidence for centralized craft specialization, or if the distribution of such products is low, it is likely that this was not an important factor in the local economy or long-distance commodity exchange networks.

1.5.3 Dissertation Research Questions

In order to examine these two models through the dissertation research, the following question sets were employed to structure my field research and collection of datasets focusing on settlement pattern variability and related social organization within the Northern Banat region:

Question Set 1. What is the spatial and demographic scale of late prehistoric communities in the Northern Banat region? How does this change diachronically from the Neolithic to Bronze Age?

Question Set 2. Can settlements be identified by the Bronze Age with evidence of centralization of resources, craft production, and supra local exchange? Do these settlements exhibit substantial demographic growth or are populations still dispersed in smaller farmsteads at the local and regional scales? Is there evidence of settlement enclosure and fortification and how does this co-vary with more centralized sites?

Question Set 3. Does regional scale settlement patterning indicate settlement proximity to important natural resources (productive soils, grazing, etc.) and regional river waterways that could be associated with long-distance exchange? If such evidence exists, is this more closely associated with Bronze Age archaeological patterning?

1.6 Field Research Methods and Expected Outcomes

In the following sections, I describe the specific research methods that were utilized for the dissertation research for each of the question sets outlined above and discuss the expected outcomes of the research. In the concluding chapter of the dissertation I return to the questions and expected outcomes to review synthesize and discuss the data collected and whether they support or refute one of the two models noted above.

1.6.1 Research Question Set 1

To understand the scale and character of demographic changes it is necessary to quantify the dimensions of communities by analyzing regional scale settlement patterns (Renfrew & Cherry 1986; Drennan et al. 2015). A previous general field survey was completed in the Northern Banat region between 2004 and 2014 with the goal of creating an archeological map of the entire country of Serbia(Trifunovic 2012). Unfortunately, the data collected by this survey did not provide a clear understanding of the types of settlements in terms of overall size, density of artifacts, and artifact patterning across the settlements or areas between them. Without these important data, it is not possible to more accurately identify settlement pattern hierarchy or density index relationships required for demographic estimates. The research presented here in this dissertation utilized a more comprehensive systematic full coverage pedestrian survey of approximately 80 km2 that is based on a methodology developed for research projects in other regions of the world (Balkansky et al. 2013; Kowalewski 2008; Drennan 2015).

The unique landscape setting and previous research in the Northern Banat region allowed for primary surveys and collection units to be placed in areas that exceed 80m above sea level – linking to previous work undertaken through the Banat Survey Project that indicated that prehistoric sites are only found at this elevation and above (prehistoric regional water levels). Vast areas of the Maros fan were drained in the past 200 years for agricultural activity using artificial drainage channel construction. Archaeological remains have not been previously identified in lower elevation areas that were "drained" through this program. Rather, archaeological sites are typically identified within "island" areas above 80m sea level. These higher elevation areas were targeted through the Banat Survey Project. Every area was walked with transects of 3 people walking 5-10 meters apart. Artifacts lying on the surface were collected without discretion and polygons were created around finds areas (Trifunovic 2012).

Units larger than 1ha were divided into areas of approximately 0.25 ha and sampling collections were collected in each of the units. Spatial coordinates were recorded by handheld GPS, and their spatial limits were drawn later on satellite and google map images. Every unit, and sub unit, was systematically sampled with 10m2 "dog-leash" circles (Drennan 2015). The targeted number of artefacts per collection unit was 40 and the number of sampling circles was increased until that number was reached. If the circles provided less than 10 sherds, or 1 sherd/m2, artifacts were collected for the entire 1 ha unit until the minimum number 40 was reached (Drennan 2015). Every team member was provided with a staff and 1.8m rope. The staff was placed in the center of the circle and artifact collection was done in one pass. The amount of time required to create one “dog-leash” circle was between 5-10 min. For areas covered by dense vegetation, where surface visibility of artifacts was limited, for every 100m a single shovel probe of 40 by 40 cm was excavated and sieved on site with 5mm mesh screen. Shovel probes were taken in accordance with collection units and subunits. Fortunately, during the survey no areas of limited surface visibility was encountered due to most survey regions occurring within agricultural fields during the fall period after the crops were harvested and the fields had been tilled. The procedure employed has been utilized and tested before with consistent success in other regions of the world (Berry 2014; Drennan 2015). The spatial statistical analysis of collected artifacts was done utilizing Surfer 12 software, including both regional and local scale demographic estimations (Drennan 2015).

1.6.2 Research Question Set 2

Unequal social relations based on the accumulation of wealth have been associated with the creation of expanding social formations by inducing progressively entangled webs of social interactions (Earle 1997; Gilman 2001). For late prehistoric southeastern Europe, it remains to be tested whether some individuals were just ambitious traders who liked to display wealth and were thus buried with luxury goods or where social elites that possessed high level socio-economic power that shaped demographic patterns and local and supra-local political economies.

These important issues were examined through the spatial analysis of surface artifacts and their density and variability generated through the regional scale pedestrian survey. Centralized organization of craft production, for example, can be recognized through specific artifacts relating to these activities and their distribution across identified settlement zones. Such artifacts include: ceramic wasters, loom weights and spindle whorls, lithic materials, slags and other metallurgical debris. These specific types of artifacts are less lily to be found on the surface or during excavation compared to general household items (potsherd). That being so, these find will be analyzed in term of presence and absence , and will not influence the understanding of the demographic trends. High variability in spatial distributions of artifacts, related to craft activities within a settlement or a local community, represents the importance of such specializations within a society. In this case, certain levels of interdependency pool different social actors that are interested in creating commodities and developing trans-regional interaction patterns. If one finds little variability in the spatial distribution of these types of artifacts this suggests that local economies were not well connected with other polities, agents, or consumers outside the local region.

In addition to the pedestrian survey and spatial analysis of artifacts and sites outlined above, near surface geophysical survey was undertaken to identify subsurface features linked to household size and spatial distribution, pit and hearth or furnace features, and settlement enclosures and fortification systems. Surveys were completed by Bryan Hanks (University of Pittsburgh) utilizing fluxgate gradiometry (Bartington 601-2) at the site of Rabe, a settlement located in the Northern Banat region that is within the dissertation regional survey zone. These surveys (2017 & 2018) revealed subsurface magnetic anomalies that are interpreted as residential structure foundation lines, enclosure ditches, and pit and hearth features (Hanks et al. 2017 & 2018; Nicodemus 2017). Further fluxgate gradiometer surveys were completed during the spring of 2019 at several locations identified through the dissertation field survey and these results are fully presented in Chapter 6 (Dakovic & Hanks 2019).

1.6.3 Research Question Set 3

By the Late Neolithic period, people of southeastern Europe lived in relatively large settlements that became more specialized in animal herding supplemented by wild and domestic plant exploitation (Boric 2015; Kienlin 2009). The Copper Age transition appears to reflect local groups with relatively increased mobility due to the growing importance of a cattle and a pastoral subsistence economy (Bokonyi 1974; Parkinson 2006b: 53–54; Siklodi 1983 Parkinson 2012; Orton 2012). With the beginning of the Bronze Age, relatively small surrounding areas of highly populated places, such as the Százhalombatta tell, suggest that political economies common for the Late Neolithic period, which relied almost exclusively on the exploitation of local resources, were no longer a common pattern (Sherratt 1997, Fig 4.4).

Most Late Neolithic tells seem to be part of the smaller and inward focused local clusters (Duffy et al. 2014) in lowland zones while Bronze Age settlements appear along rivers to facilitate regional and inter-regional communication and participation and/or control in the flow of commodities and prestige goods (Duffy et al. 2014; Gyucha 2019). Although Neolithic long-distance connections might have had short term importance at places such as Varna (Chapman 2013), those that developed during the Bronze Age appear to be strikingly different (Kristiansen and Earle 2015). What demographic, economic, environmental and social factors led to these changes? Local dynamics can only be understood by looking at the correlation of proper variables that examine regional scale settlement patterns with regional and local-scale natural resources. The natural environment can determine subsistence economies in many ways. Subsistence practices change occasionally with new social developments and the development of the political economy has long been cited as pivotal in shaping the utilization of the natural environment and local resources in complex societies (Earle et al. 2015). By assessing the quality of natural resources (available land and soil quality for agriculture, grazing land area and proximity to water and winter fodder), the dissertation research examined whether shifts in settlement patterns within supra-local communities were closely linked to changes in the prioritization of specific resources. To examine these important issues, settlement patterning data discussed above was examined in relation to the distribution of regional environmental resources. To evaluate access to economic resources by identified settlement, soil maps were used in combination with DEM models. Local and regional hydrology were modeled by using Austro-Hungarian military maps that include historical conditions before the use of modern canal systems for drainage (Gyucha et al. 2011). To understand the importance of rivers and other paths of long distance trade this research produced a network analysis using ArcGIS modeling tools to examine landscape use models outlined above. If settlement patterns indicates that bigger sites (communities) were positioned where the best soils were available this would indicate that circumscriptions of local resources was a prominent means of political economy. If this was not the case and settlements such as Rabe were actually strategically positioned near the corridors where circulation of commodities via river and land routes were possible (pathways between the areas of heavy swamps) then this supports the model that long distance exchange economy was a source of political power.

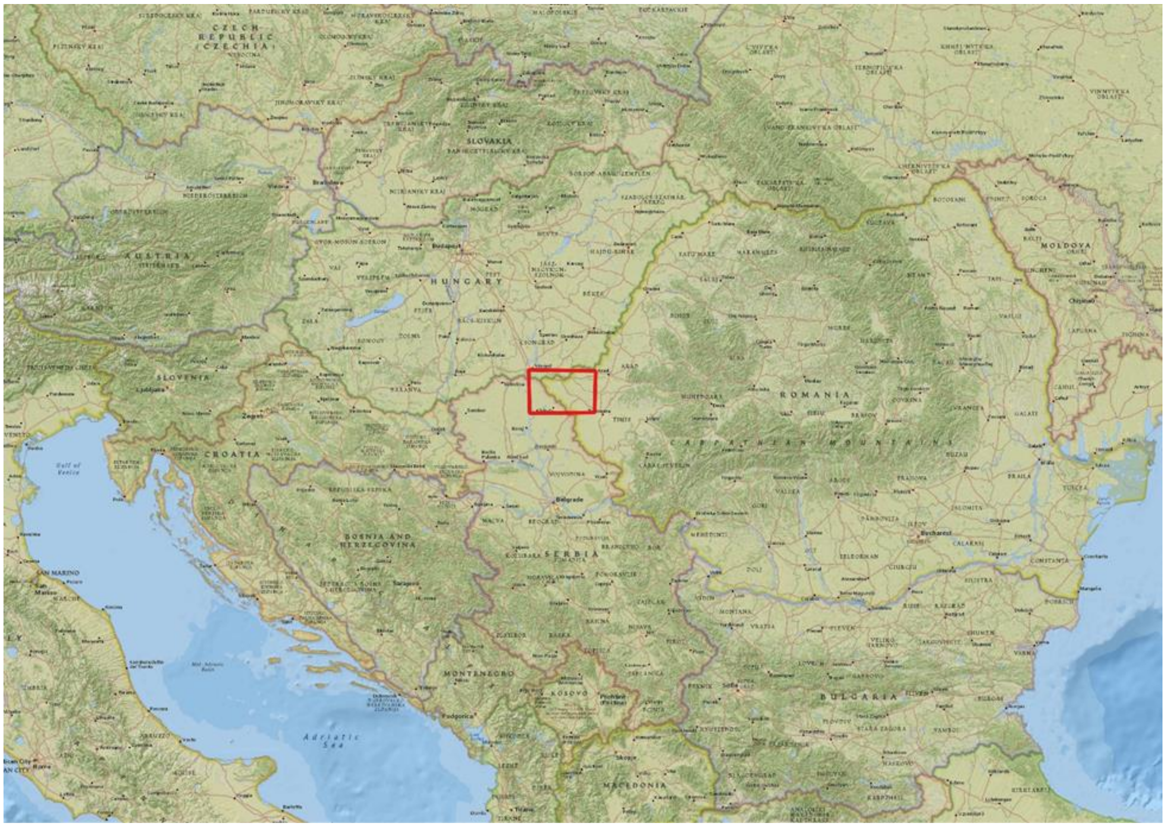


Figure 1 Southeastern Europe geographical features. Marked zone present the area of study.

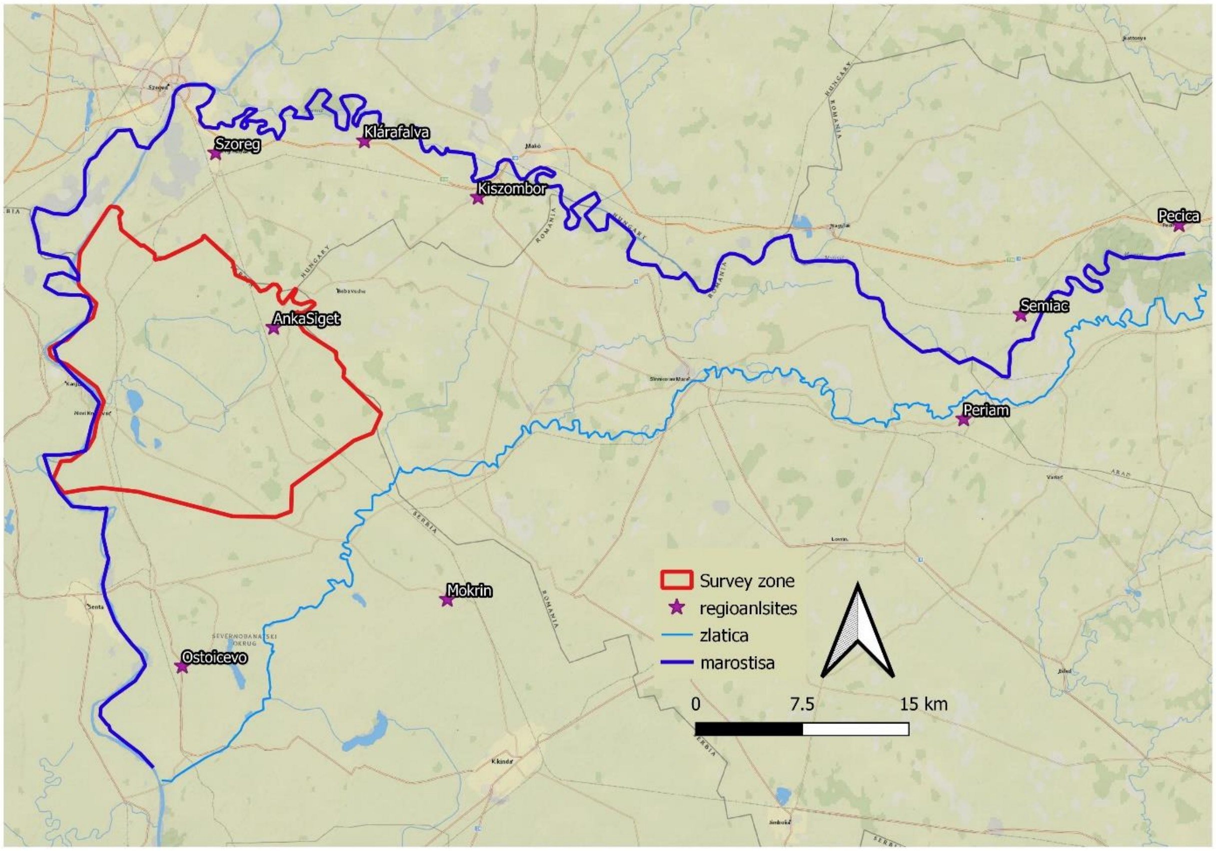
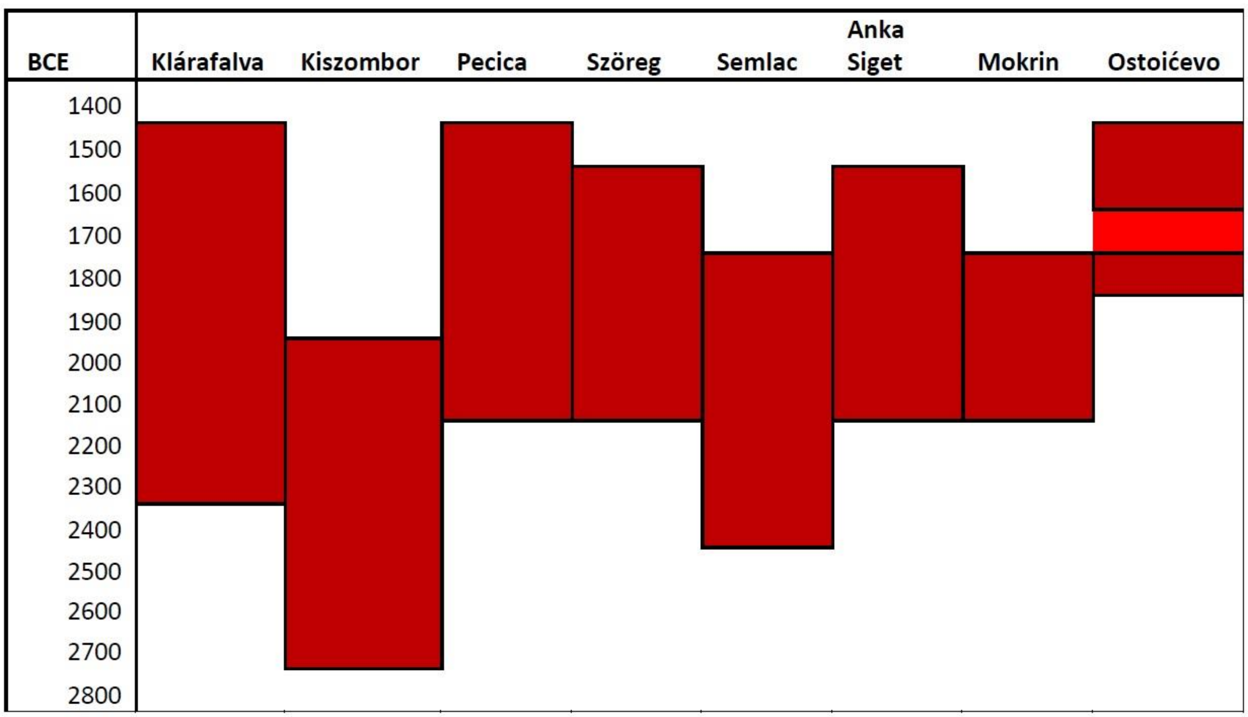


Figure 2 Survey zone and Maros sites in the region

Table 1 Simplified chronology and characteristic of culture periods (futures are focusing on group in the region of study)

Chronological Period	Major culture groups	Settlements	Demographic organization	Burials	Economy
The Late Neolithic (5000-4500 BCE)	Tisa/ Vinča	Smaller – seasonal; Large sites - fortified	Autonomous villages	Intramural, very modest grave goods	mixed cereal agriculture and animal husbandry
The Copper Age (4500-2800 BCE)	Tisapolgar-Bodrogkerestur	Smaller and more dispersed		Formal cemeteries, Subtle diversity of groups	
The Bronze Age (2800-800 BCE)	Mako-Kosihy-Caka	Multi-tiered fortified tells	Centralized hierarchical	slow increase in grave goods	Intensified animal husbandry and metallurgy
	Maros/Nagyrev/ Vatin				
	Cruceni-Belegiš-Gava				

Table 2 Chronology of Maros sites after O'Shea et al 2019



2.0 Archaeology Of the Banat Region Of The Republic Of Serbia

This chapter provides a brief overview of the Banat region of the Republic of Serbia and specifically the most northern part of this area. The first part explains the general settings and briefed introduction to the archeological institutions of this area. Following is a description of the geography of the region and an introduction of its influence on the modern settlements and workings of archaeology. What follows is an introduction to a history of the archeological work in the area. Specific focused is given to the local perspective, by paying special attention to the archeologist who were mayor contributors to the work done in this region; Miroslav Girić and Stanko Trifunović. These and other archeologist have provided foundational information which made it was possible to conduct the kind of survey that was executed by this dissertation research. Lastly what follows is a summary of the archeology and the cultural history of the Northern Banat with specific focus on the three time periods of the late prehistory that are best suited for studies of changes in social complexity of the past.

2.1 The Northern Banat Region

This area of Serbia, sometimes referred to as northern Serbia or northern Vojvodina, is part of the district of the Banat, one of three districts of Northern Serbia (Vojvodina). The Serbian part of Banat is often divided in the north and the south due to geographical differences. For example, the phrase, “flat like the Northern Banat (Ма све ми је равно ко северни Банат),” is an expression immortalized in the song of the most famous local artist Đorđe Balaševic, which describes the main difference between these two areas artistically and empirically. While the south is comparatively flat the north is incredibly more so. What is vastly different is that the Northern Banat is a vast depression where the elevation varies only between 40 and 90 meters above sea level. This makes the local water tables relatively high, a fact that is considered as a problem today, but in the past made the region very abundant in terms of the availability of water resources.

Importantly, regarding the organization and responsibility of cultural heritage, Northern Banat is divided between four municipalities, Novi Kneževac, Čoka, Kikinda and Novi Bečej. Only Kikinda and Novi Bečej have regional museums and Novi Kneževac and Čoka fall under the jurisdiction of the Intermunicipal Institute for Protection of Cultural Monuments of Subotica (Међуопштински завод за заштиту споменика културе Суботица). The survey that forms the basis of this doctoral dissertation was conducted within the municipality of Novi Kneževac, within the townships of Majdan, Banatsko Arađelovo and Novi Kneževac.

2.1.1 Geography

Today, the Northern Banat region looks very different to what it was like during the late prehistoric period. The most notable change in the physical landscape relates to the substantial drainage systems (discussed in detail later in this chapter) that were undertaken in the 18th and 19th century. However, the land still retains many of its "hydromorphic" characteristics (see chapter 5) As a native of this region, I can testify to the unique qualities of the soils (The detail of the local soils are described in Chapter 5 in more details)and to their intense "stickiness" during periods of intense rain. I was very fortunate during the fall and winter of 2018-2019, during the months that I carried out the pedestrian survey research for my dissertation, that is was such an unusually dry year. Pedestrian survey is particularly challenging during the late spring and through summer due to the crop growing season in the reason and it is typically after the harvest season in the fall, or over the winter and before planting season in the spring, that the fields are uncultivated and available for pedestrian survey. However, during this time, foul weather can be a serious hinderance. At the time of my pedestrian survey, it seemed to be a small “miracle” that I had such favorable, dry weather, however, I personally chose to believe that instead this was an act of the region itself, finally, welcoming me back and into its open arms.

More specific details on the local soils, and their use in agriculture, are described in Chapter 5, but here it is important to note that this region is very agreeable to pedestrian survey following the fall harvests. This is primarily because much of this region has been under agriculture for a significant period of time. Due to tilling and cultivation processes in the fields many archaeological artifacts have been turned up to the surface. While there are several major roads in the region today many are in poor condition and for the dissertation survey most of the access relied on dirt roads of variable condition.

Several areas within the region are not cultivated and are left as meadows for grazing. In these areas it is not unusual to see domestic herd animals, especially sheep. These flocks are tended by shepherds who are generally quite friendly - however the disposition of their dogs is another matter. There are generally no fences used in the region, such as is common in the United States or in neighboring countries such as Hungary. This is most likely due to a lack of interest in managing large herds, such as cattle, or may be related to the Socialist past of the region and people’s attitudes towards land use. In any case, it allows for an interesting opportunity to view contemporary grazing patterns, some of which might not be that much different than those used in prehistory.

What is noticeable about this region is the relatively low presence of trees and forests. This is the product of the last 1,000 years of human habitation and widespread deforestation. Today, the region resembles something of a steppe biome. Riverbanks are somewhat different in this sense because this is where comparatively larger quantities of wood can be found. River banks, estuaries, and marshes are rich areas of vegetation and there are fish and fowl as well as wild came such as boars and deer. These provided important subsistence resources especially during harsh winters.

2.1.2 History

Historically this region was at the very fringes of the Roman empire and it is thought that Atilla the Hun died and was buried within the area. The Ottoman conquest of the Balkans initiated the Great Exoduses of the Serbs from 1683-1699 and 1737-1739. During these periods of migration significant numbers of the Serbian population moved into the Banat and neighboring regions. Eventually the Banat region became a battleground between the Austro-Hungarian and the Ottoman empires. With the reestablishment of the Kingdom of Serbia in the 19th century (1804–1876) this territory was eventually incorporated into the kingdom and later the Social Federal Republic of Yugoslavia. As the region transformed politically over the past 50 years, Northern Banat was vastly depopulated as a result of several economic crises in the 1990s. As a result, the municipality of Novi Kneževac has only a fraction of the population as compared to the 1960’s and 1970’s.

2.2 Milorad Giric – the beginnings of the Serbian (Yugoslavian) perspective

Archaeological research on the “Mokrin People”, from the Serbian/Yugoslavian perspective, started with the important studies of Milorad Girić. While this region and these archeological assemblages were known prior to Girić’s work, he completed the first important synthesis (from a Northern Banat perspective) and was most notably involved with the excavation of the famous Mokrin cemetery (Girić 1971). This project was an important, international collaboration with the Smithsonian Institution, whose representatives were most likely under the impression that they were in the unique position of peeking inside “The Iron Curtain” during the Cold War of the 1970’s and the 1980’s. Unlike Soviet Period archaeology, the archaeological institutions of the Social Federal Republic of Yugoslavia were under little to no influence from state ideology, leaving the Smithsonian researchers relatively deprived of authoritarian hospitality. The work pioneered at the Mokrin cemetery by Girić, and his collaborators, produced important insights into the social organization of the Maros culture. Research has continued in more recent times through Serbian scholarship and these efforts have been supported through European Research Council funding. However, the Mokrin cemetery was not the first instance that Girić had the opportunity to work with mortuary remains of the Maros culture. In 1959 he published the first report of the excavation at Ostojićevo, some 12 years before the publication of the research at Mokrin. The exposure to mortuary assemblages did not entice Girić to forget the importance of settlement study and in 1987 he published Settlement of the Maros Culture (Насеља моришке културе) in which he briefly addressed the importance of understanding settlement patterns and how they relate to social organization as a whole.

2.2.1 Our good neighbors – Research in Southeastern Hungary and Southwest Romania

The Pannonian plain or the Carpathian basin have been a significant part of the archeological scholarship early on (Child 1957) and continue to be (Kristiansen & Larsson 2005; Earle & Kristiansen 2010; Girić 1971; Jankovich et al. 1989; Gyucha et al. 2013) a very important aspects of understanding the past developments of our societies. Chronological desputs in archeology are at this point in time very common the Early Bronze Age to middle Bronze Age transition is no exception. For the purposes of this research I will focus on chronologies established in southwestern Romania and Hungary (O'Shea 1991; Gogâltan 1997; Gyucha 2010; Parkinson and Gyucha 2012). This substantial body of work puts the beginning of the Early and Middle Bronze Age at around 2200-2000 BCE, with the conclusion of this chronological phase at 1600-1400BCE. Beginnings of the Early Bronze Age continue on the traditions of the Late Copper Age represented by very large regional groupings (Parkinson 2012). During this chronological phase initial appearance of the Maros culture to c. 2700 cal. BCE are represented by absolute dates from Kiszombor (O'Shea 1991). Changes in social complexity begin to appear in the Carpathian Basin slowly at this time. Division of relatively less homogeneous regionalized culture groups beginning to be the norm again with more pronounced settlement hierarchies and settlement patterns focusing on tell sites (Gogâltan 1997; Nicodemus 2014).

The marshy confluence region, also referred to as Lower Maros (O'Shea 1991; Nicodemus 2014) is famously know for research done at cemetery of Szőreg, Dészk, Mokrin, Oszentivan, Pitvaros and Obeba (Banner 1931; Giric 1984; O'Shea 1991) and systematically researched settlement of Klárafalva, Kiszombor and Anka Siget (Nicodemus 2012; O'Shea, et al. 2012). Area future upstream of the Maros river, the middle Maros is mostly known from the research done on the prominent tell site such as Pecica, Periam and Semlac. These sites are larger than those of the

Lower Maros, have more prominent fortifications, deeper stratigraphy and habitation are that are spread beyon the enlusures systems. Pecica have found preliminary evidence for functional differentiation, including unique public/social architecture, ritual activities, and economic intensification and/or specialization (Nicodemus 2012; O'Shea, et al. 2012;). At the site of Pecica there are significant evidence for economic intensification, public architecture and ritual activities (O'Shea, et al. 2019).

2.3 Stnako Trifunovic and The Introduction of Modern Archaeological Survey Methods In Serbian Archaeology

The Banat Survey Project (Археолошка топографиај Баната) was initiated by Stanko Trifunović, considered by many to be one of the most dedicated archeologists in Serbia at the turn of the 21st century. The main goal of the project was to create a robust data collection through surface survey followed by the creation of archaeological maps of the Banat region. This important project was conceived in 2004, with support from the Museum of Vojvodina, Novi Sad, and the Regional Institute for Cultural Heritage Protection, and has been a great success to date. Survey results from two of the most northern municipalities of the Serbian Banat have been published and results from the municipality of the town of Kikinda is forthcoming. Similar projects have been done in other regions of the world and, most notably and in close proximity to the Banat region, the Hungarian Archaeological Topography project (Magyarország Régészeti Topográfiája) was completed in the 1990s (Jankovich et al. 1989; Gyucha et al. 2013).

Trifunović's original objective was to map all the archaeological sites in the Banat region, not only for purposes relating to industrial and infrastructural development plans, but also to highlight the important cultural heritage of the region. These ambitions also include creating an archeological map of the entire northern area of Serbia and then expanding to cover other regions of the country.

The idea of creating a systematic archaeological map of Serbia is not new and much work had been started with this aim in mind several decades ago. A pioneering work in this case was Archaeological Sites in Serbia (Археолошка налазишта у Србији) (Garashanin and Garasanin 1951). Similar efforts also were put forward by the Serbian Academy of Sciences and Arts but unfortunately due to historical and political events of the recent past these efforts have not been fully published.

An important foundation to my doctoral dissertation field research was the opportunity that I had to join Trifunović's Banat Archaeology Survey in 2013 as a student participant. At this point in time the survey crew, led by Stanko Trifunović himself, was working on the municipality of Kikinda`s northern area. During the campaign, I was fortunate to have the opportunity to learn a great deal about how "the archaeology of this region works" – to use a local phrase. The pedestrian survey methodology used on the project was straightforward and the objective was to survey all areas not covered in marshland during prehistory, i.e. ground with an elevation of 80 m above sea level. The Northern Banat region is a part of the Maros River alluvial fan in the Eastern Carpathian Basin. This is a flat area with a significant and relatively stable hydrological system (Gyucha et al. 2011). Vast areas of the Maros fan were drained in the past 200 years for agricultural activity using drainage channel construction. Archaeological remains have not been previously identified in lower elevation areas that were "drained" through this program. Rather, archaeological sites are typically identified within "island" areas above the 80m sea level point.

These higher elevation areas were targeted by the Banat Survey Project and every area was walked utilizing parallel transects of 3 to 5 people walking 3 to 10 meters apart.

Stanko Trifunović was also concerned with determining the surface area of artifact distributions to a relatively high degree. Identified surface artifacts were collected without discretion and polygons (Figure 2.2) were created around these areas. This, as a result, produced several topographic maps containing polygon-like areas of archeological artifact finds. A major component of the survey project took place in the labs through the sorting of the recovered archaeological materials. A wide range of material culture was collected during the surveys with the vast majority representing fragmented pottery. A major effort of the team was focused on classifying the chronological nature of the recovered pottery sherds. This offered me an important opportunity to better understand the key chronological sequences of the region through the prehistoric and historic periods.

2.4 New Approaches to Regional Survey

The Banat Survey Project was a great success in providing an abundance of data in terms of broader landscape use through time and archaeological artifact patterning and stylistic and technological change. By providing such data, the survey project created a considerable foundation for developing methods that would increase the accuracies of data collection in order to answer more specific questions about the past. One of the main questions, which strongly influenced the development of my dissertation research, was the need to better understand the trajectory of social complexity of late prehistoric communities in this region (see chapters 1 and 3). The main foundation for understanding this phenomenon relies, as stated above, on demography and landscape (more in chapter 3). While the previous surveys in this region, as well as all the important archaeological research carried out over the past 100 years, provided an important foundation for identifying the material culture correlates of these communities. While much has been gained through the large scale survey, a more comprehensive understanding of settlement patterning and demographic change through time is still needed.

Approaches to regional archaeological surveys vary significantly depending on national archaeological traditions. Even the term survey, or the word used in Serbian language Rekognosciranje (Рекогносцирање), has many interpretations both culturally and politically. Survey in Serbia traditionally has been understood as strictly a non-invasive reconnaissance of the archaeological potential of a specific location ("rekognosicaranje" and reconnaissance most likely do not stem from the same origins, however, their implications have quite similar meanings - personal communication with Dr. Steven L. Kuhn). This typically suggests that no shovel probes, test pits or auguring is included. Survey, in the Serbian archaeology formal permit system, is one of two ways to apply for authorization to conduct archeological field work. The other category is for stratigraphic excavation. As a consequence of this distinction, receiving permission to conduct a survey is more straightforward and requires far less supporting documentation.

While archaeological surveys have been used to answer important regional questions in many regions of the world, for example as indicated through well-known surveys conducted in the Viru Valley and Lower Santa Valley's of Peru, the Basin of Mexico, Valle de la Plata in Colombia, and many others, not all regional surveys are alike. The Banat Survey Project, as discussed above, had as an important priority the consideration of cultural resource management objectives for the Republic of Serbia. However, it would be improper and disrespectful to the people and institutions involved to over characterize the survey in this respect as significant results were achieved that have added importantly to our archaeological understanding of this region. Consequently, my objective in developing a strategy for dissertation field research was to further develop the previous results achieved in the region through survey and to intensify data collection and analysis for the purposes of better understanding settlement patterning and demographic change in late prehistory.

Since more intensive survey methods are necessary to produce finer grain data to address such questions, the conventional Serbian pedestrian survey approach was modified for the purposes of this dissertation project. These methods are detailed in Chapter 3. Here it is only necessary to state that as a result of the large scale Banat Survey Project, specific loci related to archeological sites were already known and identified on polygons on the regional survey may.

My dissertation research survey returned to these locations to conduct more intensive surface collection and subsequent data analysis. The spatial units identified and collected by the Banat Survey Project were represented by polygons denoting archaeological surface artifact scatters for all chronological periods. As a result, there is no correlation between a specific time period and the area denoted by the project's polygons. If one would simply use these identified areas, or the number of artifacts (more on this in chapter 3) collected within them, the resulting analysis would be limited and would not reflect important chronological changes connected to the use of the site, or area, through time. In any case, having access to the Banat Survey Project's results before initiating my own survey was extremely important and allowed me to increase the overall area I was able to cover in my own research from approximately 60km2 to more than 100km2. Similar approaches to already crated data from large project surveys, the Hungarian Archaeological Topography project (Magyarország Régészeti Topográfiája), have been done quiet scruffily for the archeology of the Körös region (Duffy 2010; Parkinson 1999)

2.5 Archaeology and Culture History of The Northern Banat Region

In this section, I provide a brief overview of the main archaeological culture phases in the Northern Banat Region beginning with the Late Neolithic. I do not focus on the earlier periods of prehistory as this has little relevance to the discussion of settlement patterning and demography that I focus on for the Bronze Age in the later chapters of the dissertation.

2.5.1 The Late Neolithic (5000-4500 BC)

While the Late Neolithic is certainly not the beginning of the late prehistoric period or of important changes in regional social organization, it is certainly a period that has garnered much attention from archaeological scholarship. As discussed above, the two major Neolithic culture historical complexes of this region are the Vinča and Tisa. Both archaeological culture types were identified during the dissertation survey through the collection and analysis of pottery sherds. Since the general condition of surface artifacts tends to be poor (due to cultivation damage and surface weathering and erosion processes, discussed in Chapter 3), it was not possible to distinguish and separate sites in great detail based on the pottery analysis itself. Social organization of the Late Neolithic in this region is a topic that has been heavily debated by scholars. While tell sites are well known, the presence of smaller sites points to the possibility of multiple tier hierarchies and relatively low levels of complexity often described as simple chiefdoms. Research in Hungary by Parkinson and Gyucha indicate that there is no clear evidence of economic differentiation within or between Neolithic tell communities, despite the potential of such sites playing a central role in the social and economic life of the region’s inhabitants during this period (Parkinson 1999; 2002; Parkinson and Gyucha 2012). Settlement nucleation does not necessarily point to social and economic centralization and development of hierarchical structures, even if such developments are often a part of this process (Earle 1997). No further discussion of these developments for the Neolithic are necessary at this point, rather, the artifacts related to the Late Neolithic will serve as a comparative counter point to the other time periods discussed below.

2.5.2 Early and Middle Bronze Age (2200-1500BCE)

This time period is often discussed as the Late Early and Middle Bronze Age by regional scholars, however, it will be addressed from this point on in the dissertation as the Early and Middle Bronze Age or BA. This period has been associated with marked change in both the demographic nature of prehistoric communities and settlement patterning and is conventionally understood (as discussed in Chapter 1) as a period of great social change and a new stage in the development of hierarchical societies in the Carpathian Basin. For the Northern Banat, and its surrounding region, this represents a new trajectory of social development for the Maros culture.

The Early Maros phase, which ends around 2000 BCE, has been geographically identified at the confluence of the Maros-Tisa rivers. This development continues with many different social characteristics that form and flourish in the next phase. In the beginning, the Maros development is between the Negyrev culture to the north and most likely the Vucedol to the South, the latter archaeological culture is still largely unknown today. In later phases to the south of the Maros is the Vatin culture (Tasic 2005). While understanding the exact relationship, or connections, between these two archaeological culture phenomena present an interesting challenge, thus far little research has been undertaken on better understanding these developments.

The Early Maros phase has been characterized by the relative increase in related aspects of social complexity. Tell sites slowly become a central place once again but are structured differently than their Neolithic period counterparts. Long houses, interpreted ad reflecting corporate group organization, are no longer utilized and instead evidence of smaller domestic structures likely related to nuclear family extended units become common within settlements (Parkinson and Gyucha 2012).

Mortuary remains also point to a slow increase in social inequality (O'Shea 1996). As discussed in Chapter 1, by the end of Middle Bronze Age tell like settlements such as Pecica show clear signs of elite activities and emerging socio-political complexity (O`Shea and Nicodemus 2018). This period is represented by fully developed tell central places across the region with clear evidence for feasting, craft specialization, and population aggregation (O’Shea et al. 2011; O`Shea and Nicodemus 2018; Earle & Kristiansen 2010; Falkenstein et al. 2016). However, some scholars argue that these tell are not very different form the Neolithic ones questioning their importance and specifically their role in the centralization of society (Kienlin 2009).

The end of the Middle Bronze Age is famously known as a time period for the abandonment of the tell sites around 1600 to 1400 BCE. While this is not connected with the collapse around 1200 BCE (Molloy et. al 2020), there may be some interesting parallels between these events related social, economic and political processes. Pecica and the other sites of the Maros, including Rabe Anka Siget within my dissertation research area, show clear signs of abandonment and population decrease, but this appears to be a widespread phenomenon across the Carpathian Basin (Earle & Kristiansen 2010; Falkenstein et al. 2016). As a result, it is evident that the Maros sequence is an excellent case study for the examination of the rise and decline of social complexity.

2.5.3 The Late Bronze Age (1500-800BCE)

This final stage of the Bronze Age is of interest to this dissertation research for several reasons. Most notably is that it occurs just after the decline of Maros culture but also it reflects a number of important differences from the Bronze Age developments in other parts of the lager region. While most, but not all, tell settlements are abandoned by this phase there is also a shift to a more homogeneous cultural area such as the Gava and Urnfield archaeological cultures (Earle & Kristiansen 2010; Falkenstein et al. 2016). Between the Danube, Maros and Tisa rivers and the Carpathian Mountains a significant number of Late Bronze Age sites have been discovered and excavated producing two major ceramics groups: Dubovac-Žuto Brdo in the south and Cruceni-Belegiš-Gava in the North, such as Corneşti-Iarcuri and Gradište Iđoš (Bulatović 2007; Gogâltan and Sava 2010; Harding 2017; Molloy et. al 2020). These mega fortification settlements present the successors of the tell communities of the Middle Bronze Age with very centralized control of the means of production and hierarchical political control. According to Molloy et. al 2020, there is a significant possibility for site codependence, signaling the potential for stratified hierarchical societies. The main source of political and economic power was through the control over the production of metal – achieved through restricting access to raw materials and centralizing metal smelting activities (Gogâltan and Sava 2010).

2.6 Conclusion

Confluence of the rivers Tisa and Maros and its integral part, northern Banat, present a special case where different intersections of physical landscape, anthropo-scape and archei-scape present an opportunity for understanding how these different scapes interacted and formed the societies of the past and present. Vast areas of mushy low land that have been cultivated for thousands of years present them self's as unique opportunities for archeological research, where late prehistoric artefacts and findings are somewhat more accessible with relatively minor interference from modern and historic occupations and developments. Combined with the presence of Late Neolithic cultures and the Maros complex, this area presents a unique space for investigating the earliest trajectories of the development of social organizations and the rise of social hierarchies and inequalities.

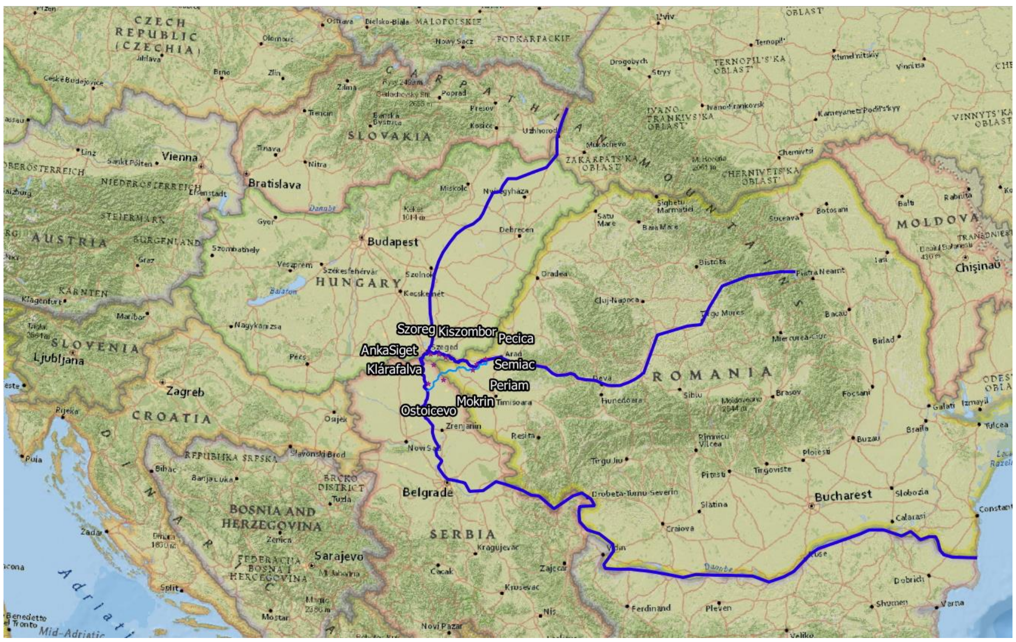


Figure 3 Geography of the Pannonian plain and the bordering regions. Also included are mayor rivers and relevant archeological sites.

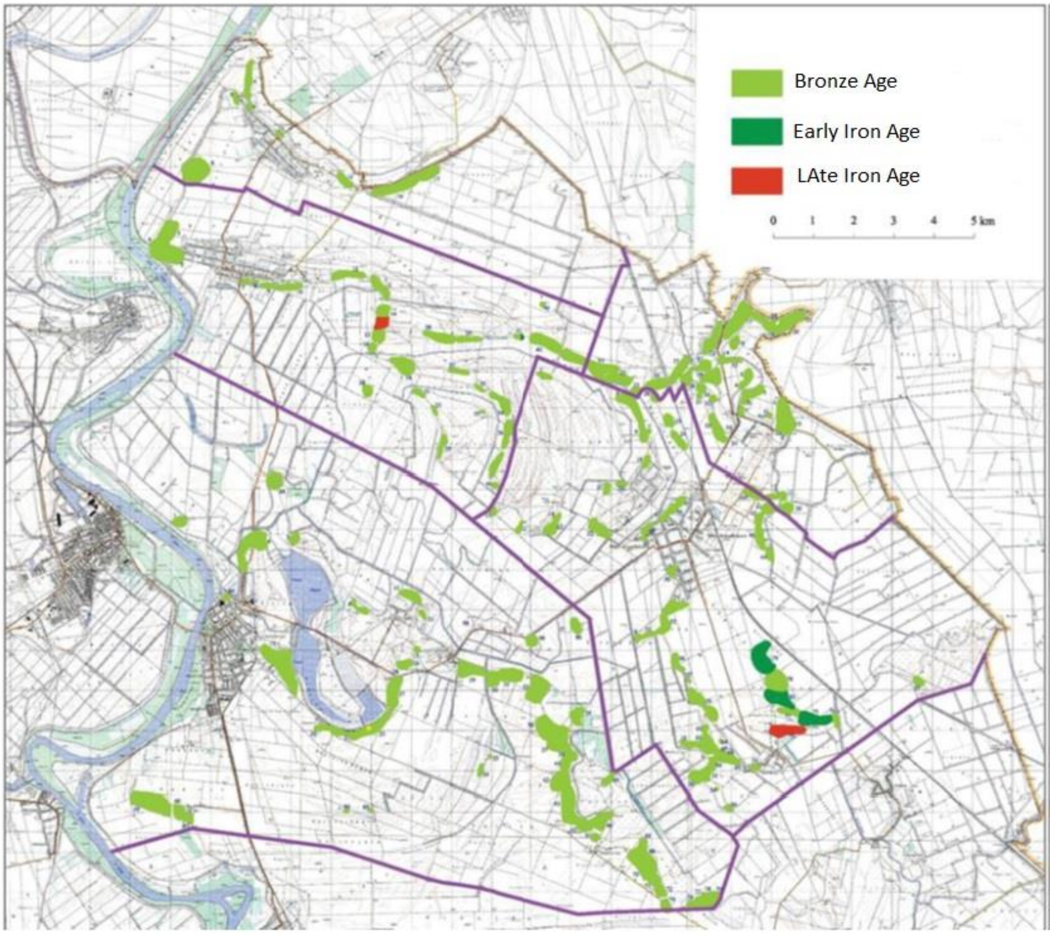


Figure 4 Map of The Banat Survey Project municipality of Novi Kneževac, from (Trifunovic 2012)

3.0 Regional settlement patterns

This chapter provides an overview of the methods employed for the regional pedestrian survey, laboratory methods for processing finds, and spatial analysis of this data. I will start by establishing the framework of the analysis by addressing how the identification and structuring of the archeological site was done in the past and for this particular analysis. What follows is explanation of the process of developing regional demographic by establishing residential densities. These are analyzed with the development of area density indexes which provide a way to focus on delineation and investigations of local communities. I conclude this section by presenting result of regional settlement patterns and population dynamics for the Late Neolithic, Early and Middle Bronze Age and Late Bronze age time periods.

3.1 Base unit of analysis

In any scientific inquiry where data must be collected it is of utmost importance to establish not only what form the data will take but also what the particular phenomenon in question comprises of. As a basic premise, in anthropological archaeological, this should be rather straightforward as humans in the past should be the base unit of our analysis. However, the subjects of our study have long since perished and this requires a shift in focus to the material patterns they have left behind. As such, to understand long term social processes, the base units would be artefacts of human interactions behavior in the past.

Humans interact in many ways, but more importantly such interactions occur on many different scales that may be represented by households, neighborhoods, communities, towns, cities, etc. Even though a significant number of archaeologists interested in socio-political organization of the past utilize households as a proxy for understanding change over time this research project has chosen regional scale local and supra local communities as a starting base unit for understanding changes in early social complexity.

3.1.1 Identifying and Defining an Archaeological Site

Archaeological artifacts have been the staple of the discipline since its inception. Conceptualizing the social, economic, and political forces that influence the character of settlement patterning came at a later stage of disciplinary development. The simple fact of the matter is that most archaeological materials are obtained from sites, which may be defined in various ways in connection with a wide range of human behavioral actions and adaptations. With the first systematic analysis of archaeological records the questions of site size came into focus as an important consideration (Parsons 1972). This aspect was sometimes overlooked simply because of the nature of the research. It is true that much can be understood about human behavior without knowing the specific size of an archaeological site. Furthermore, determining the exact spatial dimensions of a site can be a delicate enterprise depending on the survey methods and the exact nature of the behavioral patterns we are examining.

As discussed in Chapter 2, for the Northern Banat Region, a key consideration for the development of the archaeological survey was defining the possible locations and overall site size to develop appropriate protection strategies for the cultural heritage of the sites. This information can be a great starting point for the enhanced survey strategy undertaken by this dissertation.

Typically, archeologists determine the dimension of a site by the presence and absence of artifacts on the surface in question. However, it is important to examine changing spatial patterns of artifact distributions as they relate to different chronological phases. Once the location of artifacts in both time and space are determined more precisely it is possible to delineate meaningful associated demographic units. Following this notion, this dissertation research basic building blocks of the sites, in the classical sense, was a collection unit or a group of collection units adjacent to each other (more precise explanation of the method is in the next section). This is done to increase ethe resolution of understanding how much area is represented by artifact of specific chronological type.

3.2 Constructing Regional Demographics

3.2.1 Creating residential density

One of the first lines of inquiry in understanding demographic dynamics at the regional scale has been the examination of the number of archaeological sites identified. In the case of this research project, delineated local communities (discussed further below) are counted for all the prehistoric periods in question. The dissertation research in the Northern Banat region identified a total of 30 Neolithic, 33 Early to Middle Bronze Age, and 28 Late Bronze age “communities” within a survey zone that was 250km2. According to these site counts it would appear there was little variation in the number of sites over time by chronological phase within the defined region. Problems like these are not uncommon and questions relating site distributions and population density, have been pondered for some time and have addressed a platter of complicating theoretical issues (Wilson 1988; Kowalewski 2003; Chamberlain 2009; Zimmermann et al. 2009). While similar number of sites might be a reflection of limited areas viable for settlement within the region (O`Shea 2019), an argument could be made, since the spatial pattern for all tree time periods are different, that there is enough space for clustering not to be determined by geography. More discussion on the topic of using space as a variable can be found in chapter 4. That being said, these counts of local communities on their own offer limited opportunity for further interpretation and more reliable population proxies are required that are based on site size and estimated residential densities

As mentioned above, the area of a site was calculated by measuring the total area where surface scatters of artifacts were recovered. A combination of GPS data from a handheld device and satellite images were used to generate these occupation area calculations. Even though calculating overall site area can aid in increasing the accuracy of population proxies some lingering questions remain. For example, the correlation between settlement area and population size is unknown for specific time periods and attention must be paid to the potential residential density. The way populations are organized within specific physical spaces may take many different forms. Modern examples of residential density can range from a single cabin to a crowded skyscraper. Even though this kind of range is not expected in late prehistory it is still necessary to find a way to create a number that can signify number of occupants per hectare within an occupied area.

3.2.2 Area Density

The saying that, "one person's garbage is another person's treasure", has a special relevance for the field of archaeology. All things being equal, the more people the more waste that is produced, and in the prehistoric past, where transporting waste was significantly difficult, waste tended to be deposited near where it was originally generated. As a result, it is not uncommon for regional demographic studies to draw on observed densities of archaeological artifacts to represent variation in human demography.

Human occupation debris in the past is represented in many forms but often the best preserved and most frequently encountered are ceramics and lithics. Even ethnographic observations have indicated that during a year a considerable amount of sherds can be produced, used, and disposed of as waste (Drennan et al. 2015: 28). All things being equal, larger quantities of artifacts per hectare will be accumulated if the number of people pre/hectare is equally significant. In order to collect the variable density of surface artifacts – the locations where artifacts were recovered during my field survey were systematically separated into 50 X 50 meter units or smaller (Fig3.13 This combination of area and density is a useful way to create a quantifiable index of artifacts (waste) in the landscape. The density of artifacts is measured in sherds per hectare and the area of occupation is measured in hectares.

This area-density index will be high in cases where there was a large area of occupation and/or a significantly high density of artifacts recoverable from the ground surface. What this means in terms of settlement use is that a high area-density index represents more intense occupation of the settlement during the period, or phase, represented by the ceramic types. In a specific cultural context, the consumption of ceramic vessels and their inevitable destruction as well as disposal is relatively constant. Every index is also a representative of occupation during a specific time periods. This is also taken into account and all the values are divided by the representative time units (900 for Late Neolithic, 700 for Early and Middle Bronze Age, and 700 for Late Bronze Age). The area-density index provides an approximate indication of the amount of occupation for a certain time period in term of person per year at a location. However, it does not address what precisely happened during this time. For example, did a 100 people live on a 1 ha for 100 years or did 50 people live in 1 ha for 200 years. The values would be the same, but it does not affect the population estimation on a local or supra local level (Drennan et al. 2015: 46). This makes area-density a relative indicator of how much waste was produced during the period represented by the recovered sherds. More waste, more people, all things being equal.

3.2.3 Local communities

Humans, more often than not, live in communities. These social formations emerge from the complex interactions of "simple" family units, extended ones, and other people within their neighborhood. In the past, most often these social entities have been referred to as villages or towns and these are frequently identified as archaeological "sites" during survey. The term archeological site can, at times, be highly ambiguous and may potentially generate some challenges when one tries to better understand community structure and demographic scale.

Daily face to face interactions (Murdock, 1949) are usually associated with local communities, which are social entities typically associated with such terms as hamlets and villages. This pattern rests on the idea that people in one local community interact more, on average, with their own community then with people of other communities. This is a specific form of a distance interaction principle, which emphasizes the relative space between people since such forms of interaction decreases with distance. This is an important socio-economic factor in the modern world where people can transverse great distances in many ways. However, with late prehistoric technologies and transportation this principle is even more strongly influential in terms of social interaction patterns.

Following this principle provides insight into the importance of spatial patterning of local communities, represented by archaeological correlates such as overall site area, residential density (surface artifact density) and the combination of both (Drennan et al. 2015), and enables the construction of the term local community as a descriptive and analytical unit based on meaningful social factors. As Drennan et al. note, “A meaningful delineation of local communities in an archaeological record leads simply and directly to description of their sizes, location, and distribution and how these change throughout time. These variables are central elements in human social change, and they are vitally important as well for the consideration of how people envision their places in their social communities and in the world” (2015: 60).

3.2.4 Delineating local communities

Spatial clustering can be used as a more formal and automated task for delineating local communities. Density surfaces crated from residential densities are used to present distribution of the populations in space. Collection units with z values of the density of the surface finds (sherds/ha) were created first as a vector using Auto CAD 2022 software. This is the necessary step because the collection data, with regards to the number of sherds, is recorded in a table, while spatial data comes as a vector information. These two avenues of information come together through an SQL query by using Auto CAD 2022. The next step was the conversion of this data into an IDRISI raster where the visual data was reprocessed into grid data for Surfer software 17 , with which surface interpolations were created.

The interpolation method used to produce the surfaces is inverse distance weighing by using distance raised to the power of 4. This process generated surfaces where different peaks represent separate areas of occupation. A contour map serves in this instance as useful means to indicate the way the bases of the occupation peaks are distributed outwards. The objective here is to identify the variations in the nearly flat surfaces that surround the peaks. All collection units that are within this contour are associated with the same local community or, in a more traditional sense, represent one site. Even though the selection of the correct contour is a subjective task it is always uniform, and this clustering reflects both the impact of distance and size of the population in creating a community. For all three periods (Neolithic, Early and Middle Bronze Age, and Late Bronze Age) different surfaces were used based on the chronological separation of the collected material.

3.2.5 Population dynamics

Demographic diachronic oscillations in the archeological record usually begin with the simple number of sites identified on an archaeological map. Some maps are comprehensive enough to show different chronologies making it possible to ascertain the number of sites per period (Sanders 1979). Often this is used to reveal fluctuations in the number of people in the region at specific times, which may produce a nicely plotted curve that can be compared to other anthropogenic oscillations (Manning & Timpson 2014) This often led to theories about population dynamics with regard to natural landscapes and other social phenomena such as migration and warfare. Regional survey may be approached in several different ways but to understand population growth and/or decline it is necessary to survey the whole region. Complete coverage surveys have been created specifically for this purpose (Parsons 1972).

To understand the dynamics of various interlinked units of a system it is important to be aware of the properties of all the units in that system. When examining the character of human interaction in the past with regards to settlement patterns, this means that there must be data collected from all parts of the landscape and the various ways in which people have occupied it. If the density of occupation is only measured on what is typically identified as archaeological sites, or tell sites, and then it is established that in the later periods there was a decline or no occupation of these sites then a fuller understanding of demographic changes will be substantially limited. Ethnographic examples have indicated that the distance that populations can relocate or migrate from previous settlement locations can vary substantially from quite distant to nearby locations within the same region. Therefore, archaeologically, potential interpretations of demographic decline can in fact just be indicative of a slight reshuffling of population on a regional scale if a fuller measure of demographic trends across the region are not produced through broader survey and analysis.

3.2.6 Population estimates

Estimating the number of people for a particular unit of occupation in time and space is a challenging task, especially when one is considering the ancient past. Nevertheless, it remains one of the most common objectives in archaeological demographic reconstruction. These estimates are not fundamental for all of the demographic analysis in this study but because they can be an important part of characterizing both local and supra-local communities, and because American Archeological Anthropology chooses to do these things not because they are easy but because they are hard a strong effort has been made to make the most of this data in generating diachronic population estimates and densities for the survey region. For the Neolithic period in the Balkans, the best-known population studies to date come from Vinča sites in Serbia (Porčić 2012; 2018) and the site of Okolište from Central Bosnia (Müller et al,2013) For Bronze Age settlement, population estimates are available from the Benta region in Hungary (Kristiansen 2012) (Table

3.1). These published examples from previous scholarship provided a reference point for proportions between the density of occupation and settlement area and this was utilized in creating a conversion rate for the estimated populations for the local communities that were identified within research survey zone in the Northern Banat region. As demonstrated in Table 3.1, the idea is to look for settlement with similar area and crate a conversion index which will be used to multiply the are index in order to get population estimates. This is done for all three time periods since there are three different data sets. For the Late Neolithic time period this index is 53, for the Early Middle Bronze Age is 9 and for the Late Bronze Age the index is 4.

3.3 Regional Settlement Patterns

One of the important parts of understanding long term social processes and population dynamics in late prehistory is to determine the spatial and demographic scale of these communities. These processes are traced through data threads related to population nucleation and centralization or spatial and demographic manifestation of political economies. These threads form the basic components of regional settlement patterns.

3.3.1 Neolithic (5500-4400BCE)

The chronologically earliest artifacts recovered were predominantly pottery sherds and date to the Neolithic period and are related to the Tisa (Tisza) and Vinča (5500-4400 BCE) cultural complexes. According to the data collected during the survey, it is possible to delineate 30 local communities for the Neolithic (Fig 3.3). The total area of occupation that was calculated, based on

106 individual collection units, was 24.6 hectares. This would represent approximately between 1,600-6.400 (3,200) people or a regional population density of 12.8 people /km2(based on the survey area of 250 km2, and regardless of the elevation). The population estimates for individual local communities ranged from 3-12 to 350-1400 people with the vast majority of the communities (21) falling between 6 (possible farmsteads) to 100 people.

There also were two additional populations estimate ranges for the Neolithic local comunities - four of which ranged from 100 to 250 and another four, ranging from 480 to 700 people (Fig 3.3) Most of these communities, were located within the eastern part of the survey zone with only four exceptions. This is not surprising since this area is a plateau with an elevation that would have been above the lower lying areas that would have been inundated by water and marshes during this period. In this part of the survey area, based on area densities (inverse distance to the power of 4), local communities were quite evenly distributed. By increasing the smoothing function of the residential density surface (inverse distance to the power of 0.001) a clustering of local communities on a supra local scale (discussed further in chapter 4) begins to take shape. There appear to be three different demographic centers where centripetal forces are more pronounced for the Neolithic period. In terms of the regional settlement patterning one can therefore delineate three separated supra-local communities (more on this in chapter 4).

3.3.2 Early to Middle Bronze Age (2200-1500 BCE)

For this period, it was possible to delineate 33 local communities using the same principle. There were 190 collection units which translate into a total area of occupation of 45 ha. Even though the number of local communities is increasing only slightly the residential area is almost doubled in size compared to the previous period. Population estimates for the entire region during this period are approximate between 2500-7500 (5000) people or 20.2 people per km2. As for the residential density of the communities, there is a very wide range from a basic family unit size, or what might be considered farmsteads (2-5 people), all the way to a community of 1,000-3,000 people. Populations estimate ranges would suggest more variations with regards to the settlement size then in the previous period (Table 3.3). Again, using a surface density map to plot demographic variation across the survey zone, one can see significant changes from the previous period (Fig3.5;3.6). The majority of these Early and Middle Bronze Age sites also are in the eastern part of the survey zone, just as during the Neolithic period, however, the occupation in the northern sector is much higher. In the smoothed residential surface map (inverse distance to the power of 0.001), the majority of the demographic focus is concentrated in one location. The identified demographic community that incorporates the tell site of Rabe Anka Siget clearly stands out as the only supra local community in the survey area with only two other loci, which did not generate a comparable demographic potential.

So far, it would appear that this region resembles a temporal pattern not so dissimilar to the one constituted in other parts of Carpathian basin (Duffy et al. 2014) (Gyucha 2019). Not unlike in the Korosh and the rest of the Maros regions, what seem to be smaller depressed communities of the Late Neolithic and most likely during the early phases of the Copper Age and Bronze Age transitions, come together in a more aggregated communities, the likes of with are demonstrated with the surface contours for the Early to Middle Bronze Age. Large settlement of Anka Siget is creating a demographic pull for all the local communities within the survey area (and most likely beyond) witch are now also significantly bigger than in the previous period.

3.3.3 The Late Bronze Age (1500-800BCE)

The analysis for this final chronological stage delineated a total of 28 local communities (Table 3.4). The total area of occupation was 23.6 ha as represented by the artifacts recovered from 107 collection units. Related demographic estimates suggest the population for this period was 400-1600 (800) and the regional population density was 3.3 people per km2 (Table 3.4). Communities range in size from 2-8 to 70-250 people, with very little evidence for significant outliers. This represents a significant decrease when compared to the previous Bronze Age phase in terms of demographic potential. Again, most of the identified communities are concentrated in the eastern part of the region but this time most of the demographic aggregation would appear to be in the southern part of the survey area (Fig 3.9). Based on an inverse distance to the power of 0.001 residential surface map it is possible to delineate two supra local communities, where the one in the south is significantly larger.

3.4 Conclusion

The overall trend in the survey zone, when it comes to the period from 5500 to 800 BCE seems to be of population increase during the Maros period(Early and Middle Bronze Age), and a significant subsequent decline in the Late Bronze Age. The total number of local communities does not represent this change very clearly. The total area of occupation is the first indicator of this change and the residential densities, calculated from the surface collections, are even clearer indicators of substantial demographic shifts in the region. As for residential aggregation tendencies, according to the residential surface maps, clear change is also apparent (Fig

3.3;.3.6;3.9).From the Neolithic period, where it is possible to see three different centers of demographic aggregation, the Early and Middle Bronze Age phase suggests a shift towards one significantly bigger supra local formation

Table 3 Regional population estimation references

	Site size (ha)	Population estimate	
Okoliste phase 1	4.6	900	
Phase 2	5.6	2000	
Phase 3	1.2	200	
Gomolava	2	70	
Alsónyék–Bátaszék	1.5	168	
Uivar	2.5	200	
Divostin	15	1900	
Stubline	15	875	

Table 4 Neolithic local communities

Local community	area (ha)	Density (sherds/m2)	Density (sherds/ha)	index	index/century	population estimate multiplied by 53
N1	0.1572	0.005725	57.25191	9	1	53
N10	2.6231	0.00305	30.49827	80	8.888889	471.2
N17	0.7446	0.001343	13.43003	10	1.111111	58.9
N11	0.2622	0.003051	30.51106	8	0.888889	47.2
N12	0.2399	0.002084	20.84202	5	0.555556	29.5
N13	0.1306	0.000766	7.656968	1	0.111111	5.9
N14	0.087	0.003448	34.48276	3	0.333333	17.7
N15	0.1004	0.003984	39.84064	4	0.444444	23.6
N16	0.3285	0.000304	3.04414	1	0.111111	5.9
N18	0.3798	0.000263	2.632965	1	0.111111	5.9
N19	0.2587	0.000773	7.730963	2	0.222222	11.8
N2	0.2495	0.001202	12.02405	3	0.333333	17.7
N20	0.4042	0.001979	19.79218	8	0.888889	47.2
N21	0.7065	0.002831	28.30856	20	2.222222	117.8
N22	0.303	0.0033	33.0033	10	1.111111	58.9
N23	1.6754	0.001492	14.92181	25	2.777778	147.3
N24	0.2153	0.000929	9.289364	2	0.222222	11.8
N25	1.2428	0.00177	17.70196	22	2.444444	129.6
N26	0.4712	0.003608	36.0781	17	1.888889	100.2
N27	0.7978	0.001379	13.78792	11	1.222222	64.8
N28	3.8273	0.003135	31.3537	120	13.33333	706.7
N29	0.4794	0.000626	6.257822	3	0.333333	17.7
N3	0.3176	0.000315	3.148615	1	0.111111	5.9
N30	0.0367	0.013624	136.2398	5	0.555556	29.5
N4	0.2263	0.002209	22.09456	5	0.555556	29.5
N5	0.3689	0.001898	18.97533	7	0.777778	41.3
N6	1.656	0.004831	48.30918	80	8.888889	471.2
N7	1.7516	0.00177	17.6981	31	3.444444	182.6
N8	3.8638	0.001113	11.12894	43	4.777778	253.3
N9	0.7709	0.001297	12.97185	10	1.111111	58.9

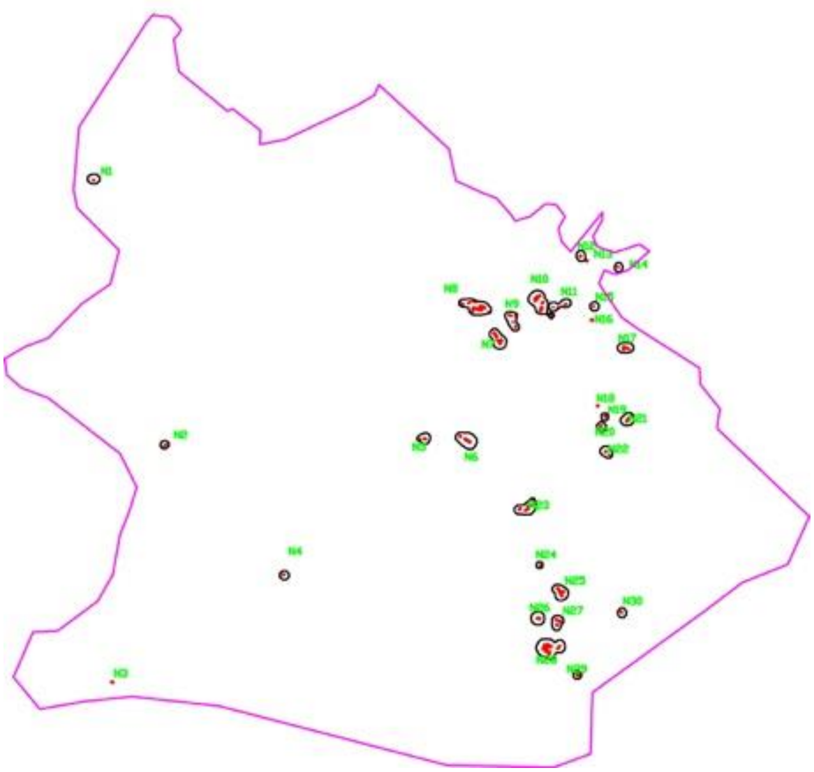


Figure 5 Neolithic local communities position within the survey zone

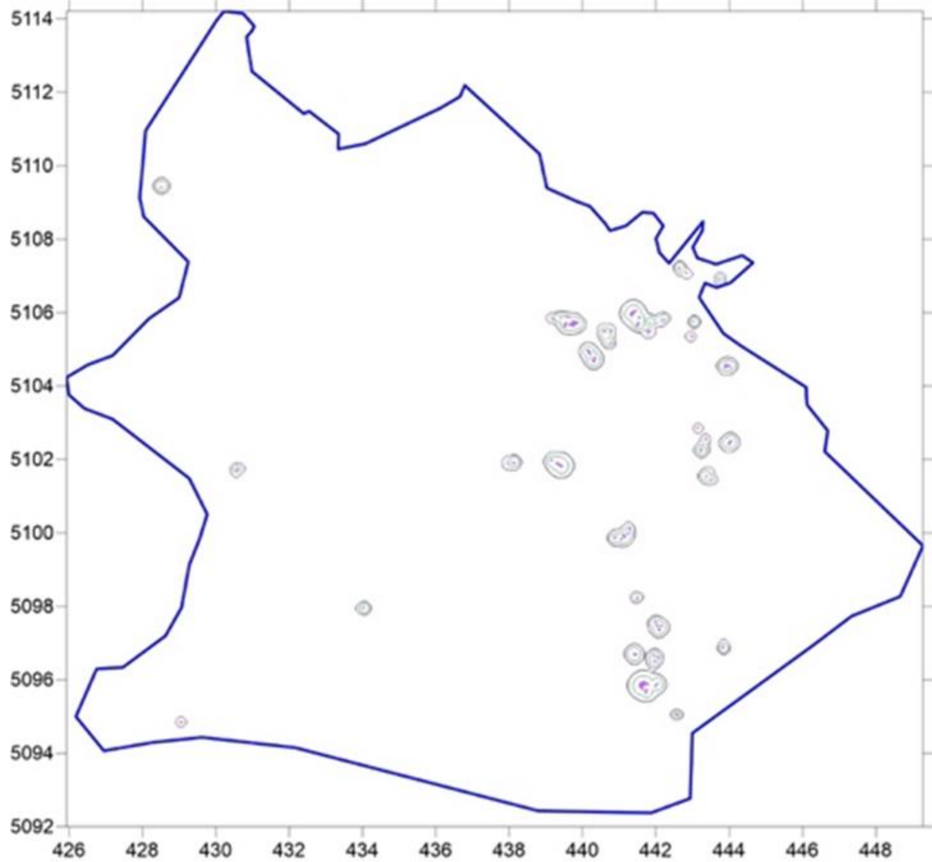


Figure 6 Late Neolithic population density surface with a most outer cut-off couture lave that systematically clusters noncontiguous patches of occupation (local communities, smoothing method of inverse distance powers of 4)

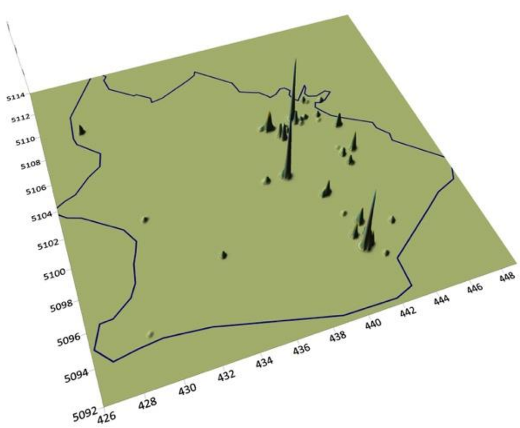


Figure 7 Late Neolithic population distribution represented as density 3D surface (smoothing method of inverse distance powers of 4)

Table 5 Early and Middle Bronze Age local comunities

Local community	area (ha)	Density (sherds/m2)	Densty (sherds/ha)	index	index/centuri	population estimate multiplied by 9
B1	0.2	0.001923	19.23077	4	0.6	5.4
B2	0.2495	0.006814	68.13627	17	2.5	22.5
B3	0.8566	0.001284	12.84147	11	1.6	14.4
B4	2.1314	0.003003	30.02721	64	9.2	82.8
B5	0.081	0.001235	12.34568	1	0.2	1.8
B6	0.5274	0.005119	51.19454	27	3.9	35.1
B7	3.7804	0.01029	102.8992	389	55.6	500.4
B8	6.3682	0.003784	37.84429	241	34.5	310.5
B9	0.5938	0.002021	20.20882	12	1.8	16.2
B10	8.1743	0.021543	215.4313	1761	251.6	2264.4
B11	1.7553	0.011565	115.6497	203	29	261
B12	0.7217	0.024248	242.483	175	25	225
B13	0.244	0.003279	32.78689	8	1.2	10.8
B14	1.7264	0.004228	42.28452	73	10.5	94.5
B15	0.0967	0.005171	51.70631	5	0.8	7.2
B16	2.662	0.003494	34.93614	93	13.3	119.7
B17	0.4792	0.000417	4.173623	2	0.3	2.7
B18	0.3798	0.002106	21.06372	8	1.2	10.8
B19	0.7501	0.0028	27.99627	21	3	27
B20	0.6686	0.007478	74.78313	50	7.2	64.8
B21	0.3594	0.0064	63.99555	23	3.3	29.7
B22	3.0633	0.005288	52.88414	162	23.2	208.8
B23	0.2473	0.000809	8.087343	2	0.3	2.7
B24	0.5896	0.005258	52.57802	31	4.5	40.5
B25	0.07	0.004286	42.85714	3	0.5	4.5
B26	0.96	0.003542	35.41667	34	4.9	44.1
B27	4.9072	0.006745	67.45191	331	47.3	425.7
B28	0.8876	0.008337	83.37089	74	10.6	95.4
B29	0.7519	0.001197	11.96968	9	1.3	11.7
B30	0.2957	0.013527	135.2722	40	5.8	52.2
B31	0.1623	0.017868	178.6815	29	4.2	37.8
B32	0.2417	0.005792	57.92305	14	2	18
B33	0.1	0.002	20	2	0.3	2.7

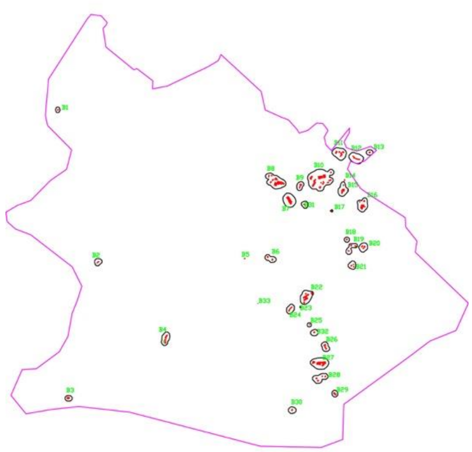


Figure 8 Early and Middle Bronze Age local communities position within the survey zone

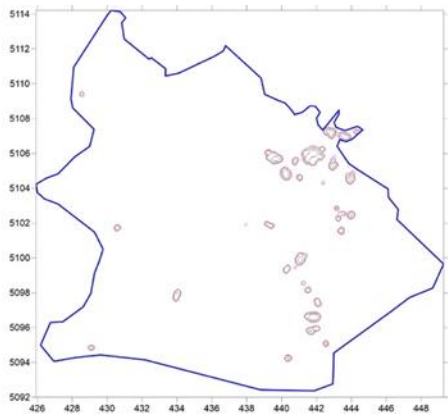


Figure 9 Early and Middle Bronze Age population density surface with a most outer cut-off couture lave that systematically clusters noncontiguous patches of occupation (local communities, smoothing method of inverse distance powers of 4)

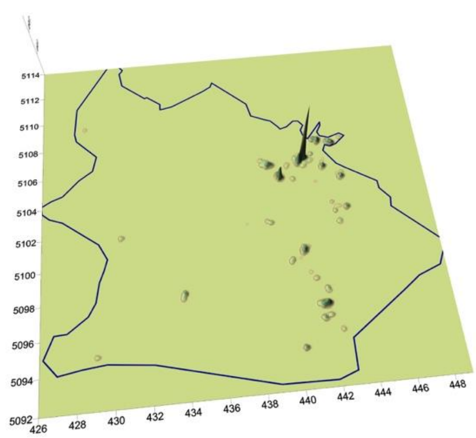


Figure 10 Early and Middle Bronze Age population distribution represented as density 3D surface (smoothing method of inverse distance powers of 4)

Table 6 Late Bronze Age local communities

Local community	area (ha)	Densty (sherds/ha)	index	index/centuri	population estimate multiplied by 4
L1	0.1572	31.80662	5	0.8	3.2
L10	0.1004	29.88048	3	0.5	2
L11	0.3363	23.78828	8	1.2	4.8
L12	2.9899	109.7027	328	46.9	187.6
L14	0.4902	53.03958	26	3.8	15.2
L13	0.213	117.3709	25	3.6	14.4
L15	0.5082	84.61236	43	6.2	24.8
L16	0.1436	6.963788	1	0.2	0.8
L17	0.2735	36.56307	10	1.5	6
L18	0.0515	19.41748	1	0.2	0.8
L22	0.1604	41.49763	6.65622	1	4
L19	3.2291	19.90118	64.2629	9.2	36.8
L20	0.2524	47.54358	12	1.8	7.2
L2	1.4572	90.08271	131.2685	18.8	75.2
L23	3.2573	43.6409	142.1515	20.4	81.6
L21	0.9379	88.72379	83.21404	11.9	47.6
L24	0.0367	326.9755	12	1.8	7.2
L25	0.3614	27.67017	10	1.5	6
L27	3.73	58.58445	218.52	31.3	125.2
L26	2.7311	68.09651	185.9784	26.6	106.4
L28	0.5616	14.24501	8	1.2	4.8
L3	0.0241	82.98755	2	0.3	1.2
L4	0.2474	72.75667	18	2.6	10.4
L5	0.1871	42.75788	8	1.2	4.8
L6	0.0969	30.95975	3	0.5	2
L7	0.8109	61.65988	50	7.2	28.8
L9	0.1625	129.2308	21	3	12
L8	0.1822	54.88474	10	1.5	6

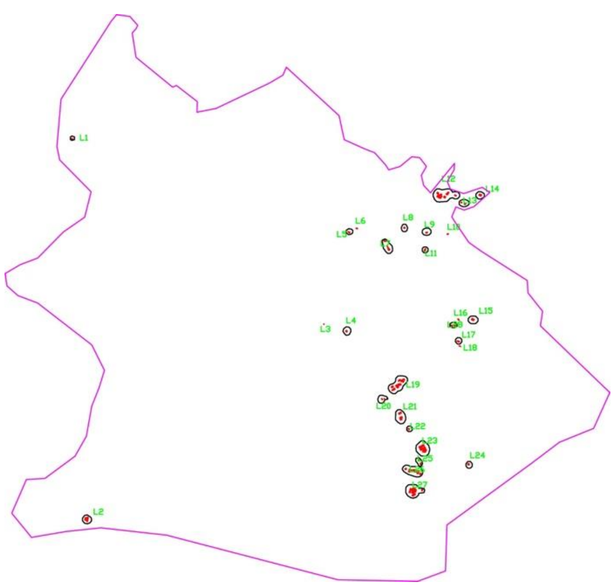


Figure 11 Late Bronze Age local communities position within the survey zone

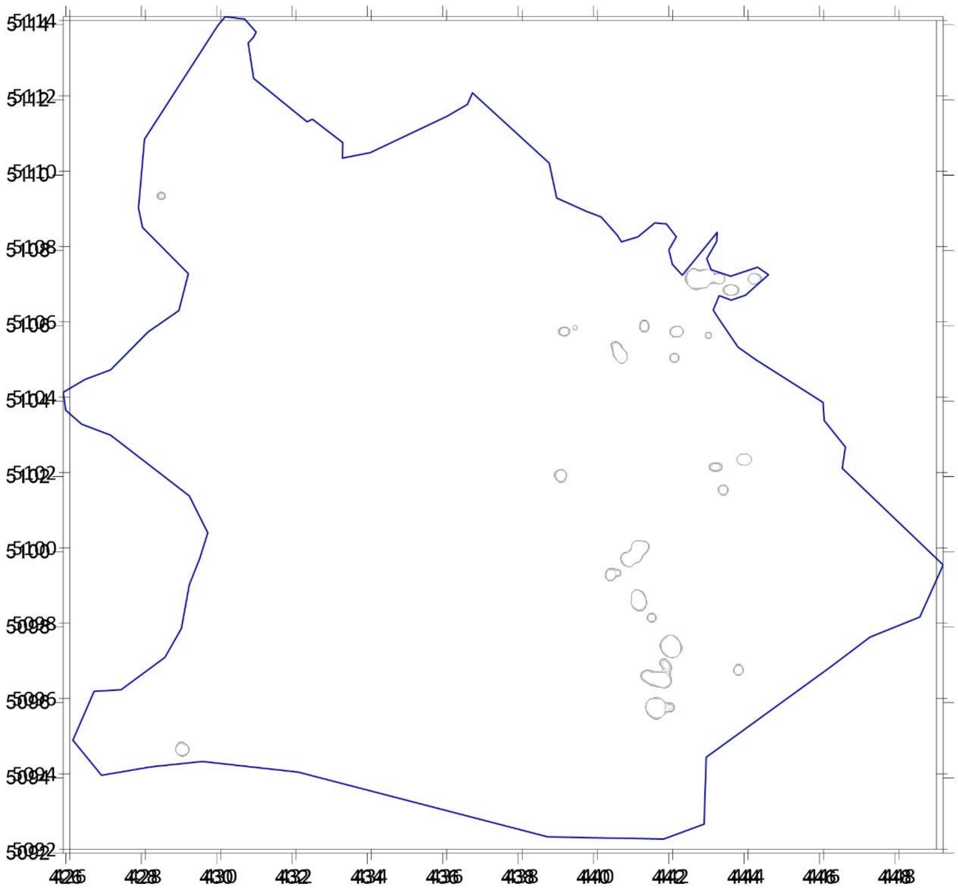


Figure 12 Late Bronze Age population density surface with a most outer cut-off couture lave that systematically clusters noncontiguous patches of occupation (local communities, smoothing method of inverse distance powers of 4)

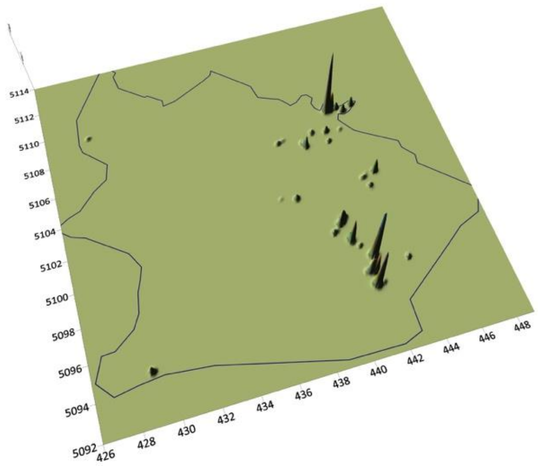


Figure 13 Late Bronze Age population distribution represented as density 3D surface (smoothing method of inverse distance powers of 4)

4.0 Interpreting Communities: Integration and Centralization Tendencies

This chapter provides an overview and discussion of the interpretation of social communities within the Northern Banat survey zone examined through the dissertation research. Survey data is analyzed and discussed in the context of important integration and centralization tendencies of populations within the region for all three time periods. I start by examining the supra local communities structures follow by the rank size analysis. What follows is the delineation of supra local communities using density surfaces for the Late Neolithic, Early and Middle Bronze Age and Late Bronze age time periods. Next is the examination of integration and centralization of the communities by using the B coefficient. The final part of this chapter focuses on analysis related to economy and production by analyzing artefact related to these activities.

4.1 Supra Local Communities

Patterns of interaction between people who lived in households, of various forms and dimensions, can be considered as the building blocks of communities. Daily, relatively mundane interaction patterns are easily conducted between members of a local community. Forms of interactions that are particularly related to political and economic organization or cosmology may require interactions that extend beyond local members. The integration of multiple local communities is a common dynamic allowing for the emergence of larger scale social, political and economic formations. Such supra-local communities often grow to spatial and demographic potentials that transcend personal scale interactions and this results in more complex social developments often referred to as “polities” (Renfrew & Cherry 1986), “chiefdoms” (Carneiro 1981; Earle 1997), or “districts” with “buffer zones” between them (Drennan & Peterson 2012).

4.2 Rank Size Plots

The method of ranking communities within a regional context first started with the work of geographers who were interested in variation in the distribution of settlements and certain patterns regarding this were observed early on (Zipf 1949). When settlements are ranked by their distribution, they appear to correspond to a log normal one and even though it has not been completely clear why this “power law” occurs it has been frequently observed empirically in modern societies and in earlier ones (Drennan & Peterson 2004; 2015).

To understand the relationship between the settlements of the past, archaeologists have used rank size graphing to see whether settlement patterns conform to the “power law”. Usually, three outcomes are observed. First, the most expected pattern is an integrated settlement system under the largest site observed in a rank size plot in the form of the straight, log normal line. Second, the firstly ranked site is so large that the area is integrated even more than expected in a log normal distribution and the rest of the settlement, with ranks lower than the first one, lie below the log normal pattern. Third, when the rank size pattern is displaying “convex” properties, and the values are above the straight line in an arc like shape, weak integration is to be expected.

After rank size graphs are established the interpretation of the possible deviation from the log normal distribution is often subjective. If an observation can be made that a change in the rank size pattern can be observed among different time periods it may be interpreted as an indicator of change in the socio economic or political centralization. However, these differences also can be due to the vagaries of sampling. To better understand these issues, and to provide a comparative context, Drennan and Peterson have created the A coefficient (2004). Simply put, this coefficient quantifies the degrees of deviation of the rank size plot from the log normal distribution. However, it should be noted that there is nothing “simple” when it comes to creation of these plots. The value of the A coefficient points to the degree of positive or negative deviation that the observed pattern has with regards to the log normal one. This coefficient also provides an error range for the necessary levels of statistical confidence in order to address the issues of possible vagaries of sampling.

Rank size plots have been around for a considerable length of time withing the scientific community including the discipline of archaeology. This suggests that this is a “tried and true” method for understanding regional settlement pattern integration and centralization. For all its mathematical elegance, one thing that this method does not account for is where settlements may occur within a region and how they relate to each other. The ranked sites, or communities, spatial relations are in no way included in the creation of rank sizes graphs, A coefficient or not. In a way it is like trying to understand physics without including the dimension of time. Meaning that in certain circumstances rank size plots may accurately depict regional demographic dynamics of the past. However, it is possible to imagine that it is of real importance to not only understand how many people inhabited the landscape but also where these populations chose to development networks of interactions.

4.2.1 Analysis and results

To create rank size plots with the A coefficient, the first step used was to produce area index values and add statistical significance. This was done by using the method of the bootstrap as developed by Drennan and Peterson (2004). This procedure was done for three separate samples according to the area index values for different time periods.

The results from the procedure involved with creating the rank size graph A coefficient show the value for the Neolithic of 0.054±0.413 (at 80% confidence) and a rank size graph where especially the first 6 ranks follow the log normal line (Fig 4.1). This would suggest, in the traditional manner, little divergence from the log-normal distribution making this an integrated settlement pattern. For the Early and Middle Bronze Age period, settlements below rank 25 were omitted from the analysis. This is because large numbers of very small communities possess a tendency to skew the results. The value for A coefficient is -0.518±1.020 at least an 80% confidence that the rans size analysis indicates little difference from the log normal distribution (Fig4.2). It is also worth noting that first 6 to 8 ranked communities fall relatively close to the log normal line. The result of the rank size analyses for the Late Bronze Age period appears to be of a similar manner to the first data set in their outcome (Fig 4.3). The A coefficient value is 0.012± (at 80% confidence), which places it the closest to the 0 values. The shape of the graph is also very close to the log normal line. Traditionally, most scholars would be in agreement that this settlement pattern can be considered as well integrated with at least 90% confidence, according to the rank size graph analysis.

4.2.2 Rank Size Challenges

Rank size graphs can be a very practical tool when attempting to understand socio-political formations that were of significant size. These entities are usually made up of significant numbers of settlements, very prominent capitals, and lower ranking centers. Unfortunately, or not, early complex societies are usually not structured in this way. Earlier complex communities, as examined by archaeologists, and those identified in this dissertation research, are considerably smaller in size and contain fewer settlements. Except for the period of the Early and Middle Bronze Age, there is more than one socio-political entity, and one could consider creating rank size graphs for each of them separately. However, this would quickly lower the resolution of the data further, and the picture of the demographic organizations of the region would be very crude. Rank size analyses are also purely mathematical, meaning there are no considerations of space. Where people dwell within a region can hardly be characterized as an aspect of no significance. When demographic centers are not located in central positions within their regions it has been shown that rank size graphs are ineffective in addressing the special properties of these population dynamics (Drennan & Peterson 2008).

4.3 Density Surface

The cosmos is vastly hugely mind-bogglingly big expanse where matter exists and interacts in time and space (Adams 1979). In not at all dissimilar fashion, the density of human interactions does not rely solely on space. Since more people allow for more interpersonal interactions, communities with many inhabitants will have a greater demographic “pull”. Meaning that a simple mathematical expectation suggests increased interactions when the number of people in the community is larger.

Space and people create communities, or rather patterns of interactions, in the past in a somewhat similar way as time and space are interlinked in the world of physics. How people occupied a landscape on a regional level can be presented or reconstructed as a surface (graphical representations) with elevations that are proportional to the population densities. All things being equal, these surfaces can serve as representations of regional demographic occupational distributions. Demographic peaks in the surface may be continuous occupied areas or clusters of separated collection units (Drennan & Peterson 2005).

4.3.1 Supra local communities and density surfaces

Larger interaction patterns that transcend daily face to face interactions are the next scale of our community model. Analytical surfaces generated with Surfer 13 with elevations proportional to local population density, represent demographic distribution across the landscape. These can be used to represent local communities and be mathematically modified to examine the next level of human interactions in the landscape. To allow communities close to each other to merge into more inclusive interaction groups it is necessary to “smooth” the surface that represents the demographic densities. This can be done mathematically by using the same principles, inverse distance weighted averages on density surfaces with a low power that will produce a smoother surface, thereby producing larger scale patterns (Drennan & Peterson 2005).

For the dissertation data analysis, raster data created in IDRISI were again converted to surfaces using Surfer 13. The interpolation method used was again inverse distance weighting by using distance raster, only this time a different power was utilized for different periods. The clearest regional trends obtained for the Neolithic period utilized a power of 0.5, for the Bronze Age it was 0.1, and for the Late Bronze Age I utilized the power of 0.001(Fig 4.4 -4.9). As seen in the figures (Fig 4.4 -4.9) , analysis of the Neolithic period yielded three supra local communities, one in the north, one in the central area, and one in the southern, all roughly of similar shape. For the Bronze Age, only one supra local community dominated the survey area. Lastly, only two (northern and southern) supra local communities are delineated for the Late Bronze Age time – and these analytical shapes vary from one another to a high degree.

4.4 Centralization and Integration

While regional integration patterns can focus our attention on the demography associated with central places, it is still important to understand the strength of centralization of the communities in the region. As stated above, regional community structure can be used with great success to understand how and why foundations of complex societies took shape. Living in aggregated communities, or as dispersed nonurban populations, influences the way space and land are used in terms of economic production. It reflects the economic use of land in agriculture and is highly dependent on the understanding of settlement patterning of the past (Renfrew & Poston 1979).

Examining the trajectory of development for early complex human societies, largely connected with early sedentary agricultural practices, has early roots within archaeological scholarship (Childe 1951). As these early societies emerged and developed certain organizational traits, such as hierarchical stratification, provided a springboard (Carniero 1981) for the development of well-integrated and intricate societies like we know them today. Centralization is an important component of this and is one of the most important variables of early integrated complex societies and this can be documented through measuring how people occupied the landscape in the past (Drennan and Peterson 2008).

4.4.1 Use of Centralization plots with B-coefficient

Even without the delineation of meaningful local communities it is still possible to analyze characteristics of demographic distribution. This is achieved by creating equal area circles around areas that population densities gravitate towards. To create a graphical representation of the population distribution, with regards to the center, the proportions of the population are calculated for each of the circles. In order to compare the three chronological periods that are the main focus of this dissertation research, it was necessary to create an index of cumulative proportions by converting the population proportions for every ring. Centralization is represented by a B coefficient that ranges from 1.000, for maximum centralization, to 0.000 for no centralization (Drennan & Peterson 2004,2015). This coefficient is an effective and graceful way of understanding the strength of demographic concentration in a specific community.

The first step in calculating the B coefficient is to establish the central places around which centralization will be measured. These loci will represent the focus of demographic "pull" where the interaction patterns are most focused. As discussed above, these focal points are based on the results of delineations of supra-local communities using density surfaces. The next step was to use IDRISI software, and the already generated raster values for each supra local community and divide it into twelve concentric circles of equal size and extract the values for every circle. After the demographic proportion of every circle was calculated it was represented by graphs (Fig. 4.10 -4.15). These graphs indicate 90% confidence zones created from the population estimates for each ring.

4.5 Analytical Results by Period

In this section, I provide results of my analyses for centralization within my survey zone and discuss their significance for each of the three periods evaluated in this dissertation. These results, and associated discussions, provide an important context for changing demographic as well as social, political, and economic organizational principles of these early communities.

4.5.1 The Neolithic Period

For the Late Neolithic period, the B values are 0.8444 for the south district, 0.6029 for the central district, and 0.4838 for the north (Fig. 4.10-4.12). Comparatively, this indicates that the southern district was the most centralized community of the three with the northern one being the least centralized. The southern district first ring indicates that 69% of the population lived within this community. The second ring represents 15% and rings 4,5 and 9 somewhat equally share the remaining percentage. At the center district 71% is represented in the first ring, rings 3 and 4 share 7%, and 9 and 10 approximately 23%. The northern district diverges the most from the other two with only 48% in the first two rings, with rings 4,5 and 6 sharing 38% and the rest equally diminish.

Just by focusing on the B coefficient analysis for the Neolithic period the diversity of the values is striking. According to the graphs, all three supra local communities have two or three components, depending on the point of view (Fig. 4.10-4.12). However, the shapes, sizes and patterns are all very different, pointing to demographic and, most likely, socio-political structures that are quite different in form. Since the B values drop from north to south it is not at all impossible that the central community might be the blend of the other two or may have acted as a buffer zone of sorts.

4.5.2 The Early and Middle Bronze Age

The Early and Middle Bronze Age is represented by only one supra local community that represents most of the survey zone and has a B coefficient value of 0.651(Fig. 4.13). The vast majority of the population, unsurprisingly, was located within the first two rings, 65% and 13% respectively. Rings 6,7 and 8 contained 6% of the population, while 10,11 and 12 held another 14%. With regards to the previous Neolithic period, the median centralization coefficient is only slightly increased. There is also at least some incentive to consider that the graph shows three or four different components and this is one more then that representing the Neolithic. With this in mind, the idea of “coming together"(Gyucha, A. (2019). is not only represented on a local level but also at a lager social scale. With the represented reginal data, of a relatively smaller regional, emerging tell site of Anka Siget, represent the emergence of regional polities. During this time period people not only build up a demographically substantial local community, but their centripetal forces are strong and visible on the landscape in the clustering of even more people in villages of modest size around them.

4.5.3 Late Bronze Age

The Late Bronze Age southern district value for the B coefficient is 0.8155 and the north one is 0.7086, which produces a mean value of 0.76. The northern district rings 1-4 contain 73% of the population while rings 5 and 6 have 4%, and 9,10,11 and 12 have 13% (Fig. 4.14 – 4.15). The southern district’s first three rings contained 92% of the population and rings 7,8 and 9 contained the rest. This period has the highest B value of all three, on average, and the southern Late Bronze Age district has the highest B coefficient of all the communities found through the dissertation research. The shape of the graph for the communities for this time period do not differ from one another significantly but it may be proposed that they are very different than those of the other periods. Most notably these graphs do not appear to have more than two components, making it one less than for the Neolithic period and two less than the Early and Middle Bronze Age results.

4.6 Social, Economic and Political Considerations Of The Data Patterning

Supra local communities tend to emerge as a central place for certain focused interactions. Special activities performed at these focal points can serve as the centripetal forces that pull the cluster together and create areas of higher occupation density in the immediate vicinity. For example, craft specialization often has been associated with larger, more hierarchical, and interdependent social formations (Brumfiel & Earle 1987; Drennan & Peterson 2012). By understanding how much variation there was in productive activities that were undertaken at different locations within a supra-local community it is possible to assess the role of craft specialization in broader trajectories of social development (Drennan & Peterson 2012).

To understand finer complexities of a social organization, and what role craft specialization and production played it regional developmental trajectories, it is important to assess the characteristics of associated artifacts with craft activities. For this purpose, it is important to assess the density and variability of artifacts such as: ceramic wasters, loom weights and spindle whorls, lithic materials, slags and other metallurgical debris (Brumfiel & Earle 1987; Drennan & Peterson 2012).

4.6.1 Problems with the collections

While collecting data during the dissertation survey, surface collection methods gathered artifacts in a random sampling manner. The majority of artifacts recovered were ceramic sherds. Unfortunately, the preservation of these artifacts generally was very poor to due cultivation practices and surface weathering. This is unfortunately a common problem with surface artifacts, in many regions of Europe, when they occur within cultivated fields. Recently, modern agricultural practices started abandoning deep plowing in favor of intensive discing. This new method is more affordable for farmers but has a devastating effect on the artifacts made from clay. These heavy rollers break soil into smaller grains which not only causes more erosion, a problem that is devastating numerous tell sites in the Pannonian plain, but is also fracturing potsherds into smaller pieces. An added effect of this agricultural practice is that it does not bring other unaffected artifacts to the surface from deeper stratigraphic levels, as deep bottom plowing typically does.

These agricultural practices may be the reason why no technological ceramics, associated with the Neolithic period and certain production activities, were recovered during the survey. Nevertheless, it was possible to distinguish between two types of pottery "coarse" and "fine" for all three time periods.

Commonly found prehistoric stone artifacts in the region, such as grinding stones and whetstones, can be more revealing in terms of production relating to cereal horticulture or agriculture, which is an important component for examining the relationships between the organization of economic production and demographic trends. In order to do this, The GIS tool ArchMap 10.6was utilized to overlay the demographic estimate maps with the locations where production artifacts were recovered during the regional survey.

4.6.2 Feasting Evidence

Anthropological scholarship has emphasized the importance of feasting practices among societies and the ways in which this can be intertwined within socio-political organization (Rosenswig 2007; Clark & Blake 1994). Some scholars have argued that this social activity should be considered as a way of understanding human agency in the past and provides a valuable insight into cultural ecology (Hayden 2001). The political importance of feasting has been demonstrated through analysis of food remains from archaeological sites through paleobotanical, faunal and isotopic analyzes (Rosenswig 2007).

Some scholars have argued that recognizing feasting events hosted by social elites can be identified in the spatial pattering of artifacts and ecofacts within prehistoric settlements. In conjunction with this, if an increase in food consumption practices occurred this also may be represented through the use of more elaborate serving vessels during the visual presentation and consumption of food and drink. These events may have led to the deposition of specific types of artifacts related to feasting in the archaeological record and the location and rate of these deposit may vary temporally (Turkon 2004, Rosenswig 2007). Different spatial and proportional distribution of serving wares within a local or supra local community may therefore be understood as a representation of activities engaged in by different strata within the population.

4.6.3 Serving Wares: Coarse vs Fine

The idea that the ratio between cooking and serving ware does have social significance is not new (Drennan 1975) and has been relegated to activities performed or patronaged by the elites in order to elevate their own social standing (Welch & Scarry 1995). For the late Neolithic and the

Bronze Age periods the associated pottery shows high levels of rough temper material, such as sand or grog, with minimal polishing or burnishing of the surface.

This kind of pottery is usually associated with cooking wear designed for everyday utilitarian use. What is usually designated as fine wear are potsherd of much finer and thinner walls, minimal temper, and evenly colored burnished or polished walls. These types of vessels are usually interpreted as serving wares. Food preparation items, cooking ware, and serving ware proportions often have been used as a good indicator of variation in social status differences within a settlement (Hirth 1993; Smith 1987 Welch & Scarry 1995). It is worth pointing out that creating such dichotomies inevitably lumps storage vessel into one of the two possibilities. However, by looking only at the surface treatment it is possible to include all sherds regardless of the specific vessel type (Welch & Scarry 1995).

Importantly, for ratios of serving to cooking ware types, it is necessary to make some assumptions. "A standard though usually implicit assumption of studies that compare serving-to-cooking ratios from different contexts is that within either ware category the relative frequencies of different vessel shapes remain constant. At the very least it is assumed that, if the relative frequencies of vessel types change, they should do so monotonically." (Welch & Scarry 1995; 412-413).

4.6.4 Analytical Results

The analysis of artifacts relating to craft production and/or feasting activities was carried out in two ways, mathematically and spatially. In order to understand to what extent ceramics can be related to feasting and/or required more specialized crafting, this was represented by generating a proportion with error ranges for each local community. This provides an opportunity to examine dynamic spatial relationships through the distribution of proportions and their clustering within super local communities and the broader region.

The results of these analyses are illustrated in Figures 4.16-4.18and corresponding Tables (4.1-4.3). The Figures represent all the local communities for a specific period. The second column of the tables represents the total number of artifacts in a local community followed by the percentages of course (CW) and fine (FW) potsherd with the standard error in last column (SE). The maps in the Figures 4.16 – 4.18 present a visual and spatial representation of the coarse-ware and fine-ware proportion distributions. The polygons on the maps represent the local communities and the colored polygons reflect the proportions of potsherds. The "hotter" the color the higher the proportion of the fine-ware pottery.

For the Late Neolithic all the fine-ware proportions are relatively low, the highest being N8 with 23% (not counting N2 because of its low total number of sherds). Only 13 out of 30 (45%) local communities have fine-ware ceramics. In terms of spatial dynamics, it seems probable that the highest proportion of fine pottery was associated closely with the demographic center in case of the central and southern supra local community for this period. The northern supra local community again stands out with its local community N8 (relatively far from the demographic center) having the highest proportion of fine pottery. It is notable that it is only half the size of N10, in demographic terms, which contains only 7% fine pottery.

The Early and Middle Bronze Age phase for this aspect of the study seems quite different. What is immediately noticeable from the table is the fact that 70% of the local communities have fine-ware pottery in their assemblages. The percentile range is also relatively higher and wider this time with the highest being 60% with a relatively mild drop off with the lowest number (6%). Spatially, what may come as little surprise, the local community with the highest proportion of fine-ware pottery is B10, which encompasses the tell of Rabe Anka Siget. Comparatively more interesting is the possibility of three more components within the supra local community. The first would be communities B19, B20 and B21, all with relatively high proportions of fine-ware pottery. The next component of interest is the B27 local community. This area has a comparatively high number of Early and Middle Bronze Age artifacts, more than 300 in total, and yet still almost 30% can be classified as fine-ware. Lastly, the local community B30, which has 32% of fine-ware pottery, is situated at the very southern edge of the supra local community for this time period.

For the Late Bronze Age, the analyzed data seem to be different from the two previous periods. In the first case, only 17 local communities have fine ware pottery representing 60%. In the case of the northern supra local community, three local communities stand out with their relatively high number of fine-ware proportions; L5 (25%), L7(100%) and L12(23%). In all actuality, local community L7 stands out markedly and is quite possibly an outlier of some sort, a situation that will be addressed more in Chapter 7. For the southern local community, the most notable standouts are L20 (25%) and L26 (26%). While it is tempting to say that Late Bronze Age is "reverting back" to Late Neolithic spatial variation of the fine and course-ware proportions, there are subtle differences between the two time periods. This will be discussed in more detail in Chapter 7.

4.7 Concerning Craft Production

For the purposes of the dissertation analysis, high concentrations or proportions of craft related artifacts (e.g. brasiers, chipped stone, grinding stone, loom weights, spindle whorls) indicate activities that might require specialized knowledge and related production characteristics.

While these concentrations are not necessarily representing specialized workshops, proportions of these artifacts can indicate an emphasis on the production or use of goods that require a significant amount of resources in terms of time and effort. While the actual presence of highly specialized crafts persons is not necessarily expected, these artifacts can still represent a product of the would-be elites occupying important regional centers and seeking these commodities and potentially their related production activities (Brumfiel et al.1987).

4.7.1 Analytical Results

Analysis of the collections documented four artifacts belonging to the categories mentioned above for the Late Neolithic time period (Fig. 4.19), 27 for the Early and Middle Bronze Age (Fig. 4.20) and 7 for the Late Bronze Age(Fig. 4.21) (Table 4.4). Unfortunately, these numbers are too low for a statistical proportional analysis. However, it is still possible to analyze the spatial component of these artifacts. Accordingly, maps were created in order to spatially situate these finds and potentially look for spatial correlation with other results of the survey and analysis.

What can be observed from the maps is the significant and more subtle variations in the spatial distribution of these production related artefacts between the three time periods. For the Neolithic period the northern supra local community seems to stand out, again because of the relative closeness to where craft artifacts were found relative to the demographic center of the community. The central supralocal community only has one grindstone fragment find at N23, which is a less populated local community.

For the Early to Middle Bronze Age, as expected, the vast majority of craft artifacts can be associated with the local community encompassing the tell of Rabe Anka Siget. The only exception to this is local community B23. Late Bronze Age artifact spatial pattering does not appear to reveal much. While it is possible to make an observation that most of the artifacts are found in local communities that are relatively sparsely populated, the total amount of finds is very low, similar to the pattern observed for the Neolithic period, and so any observation may be susceptible to the vagaries of sampling.

4.8 Discussion and Conclusion

In this chapter, the analysis was focused on supra local community structures and their relationship to demography and socio-economic practices. The delineation of the supra local communities has shown significant diachronic variations. The Late Neolithic pattern can be best described as small autonomous villages that were dispersed. The next period, the Early and Middle Bronze Age, reflects significant demographic and political aggregation and integration of the region followed by population dispersal during the Late Bronze Age.

The socio-economic dynamics appear to follow a very similar trend. Artifacts related to craft production seem to be the most numerous during the Early and Middle Bronze Age and are located mostly at the center of the supra local community. Analysis of artifacts related to feasting again suggests very different patterns for all three periods. Evidence from the Late Neolithic points to competing local centers that were replaced by a more centralized pattern during the Maros phase (discussed further in Chapter 7). All the lines of archaeological evidence presented in this chapter suggest a transition from stable Late Neolithic village life to more integrated and complex social organization of the Early and Middle Bronze Age that ended with disintegration at the beginning of the Late Bronze Age time period.

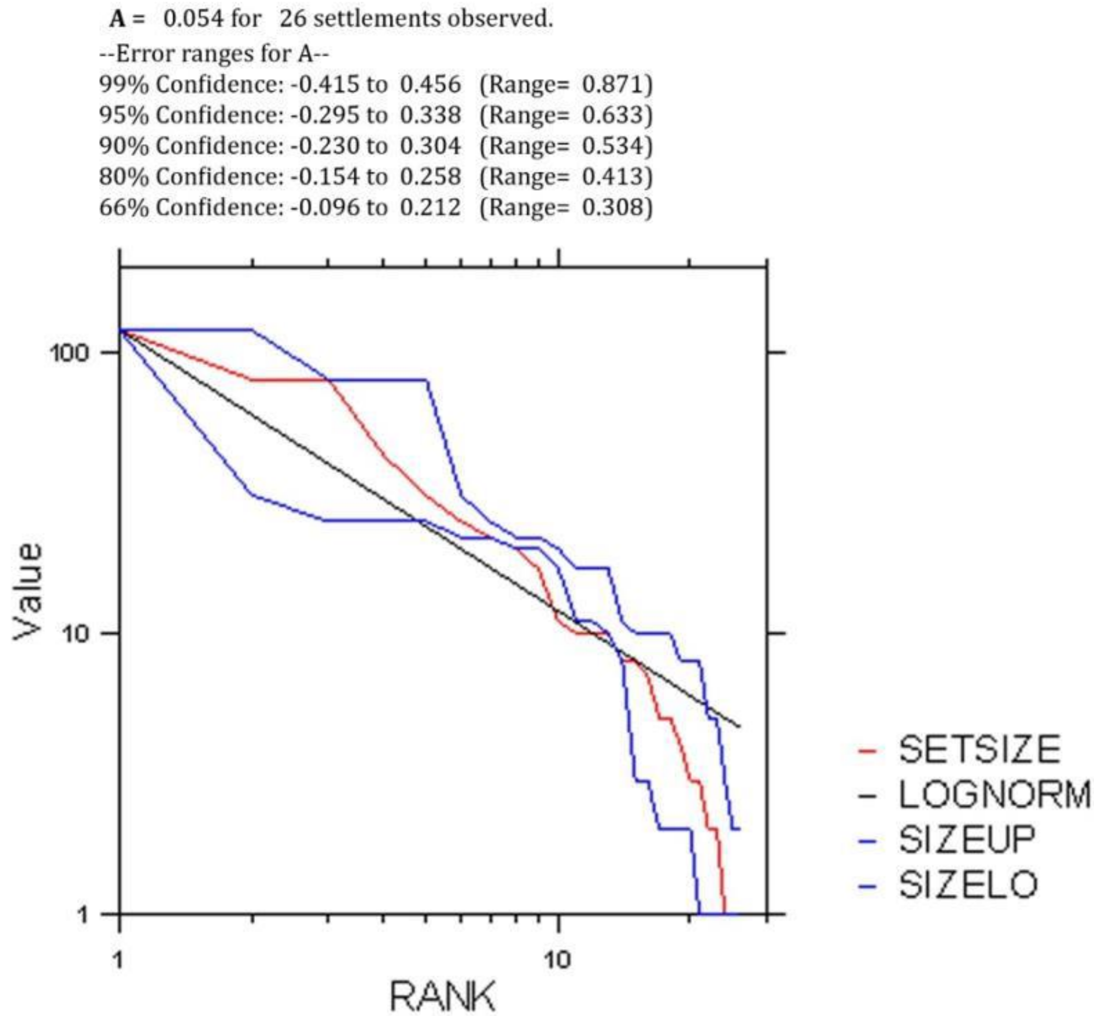


Figure 14 Neolithic A coefficient rank size graph.

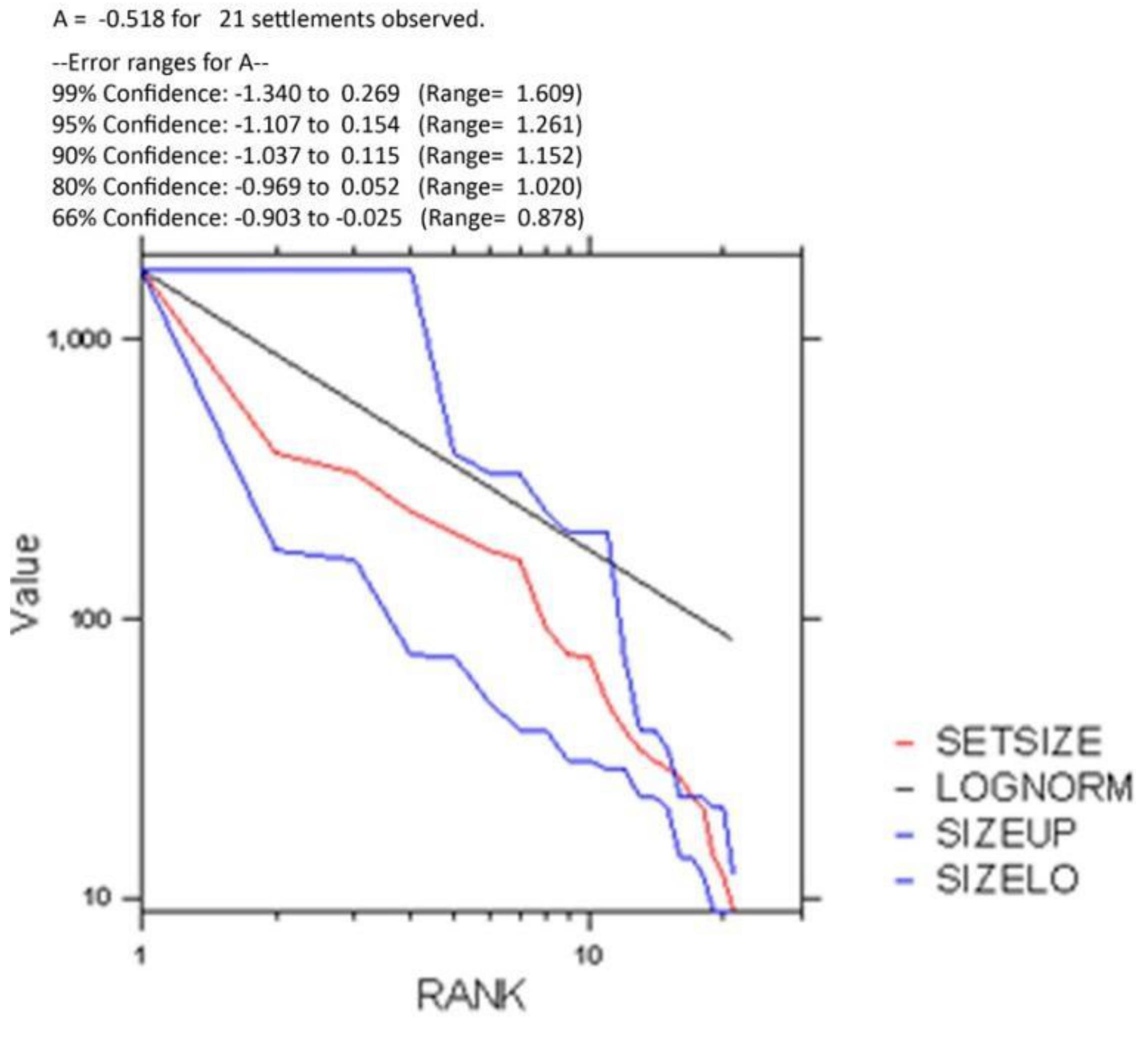


Figure 15 Early and Middle Bronze Age rank size graph.

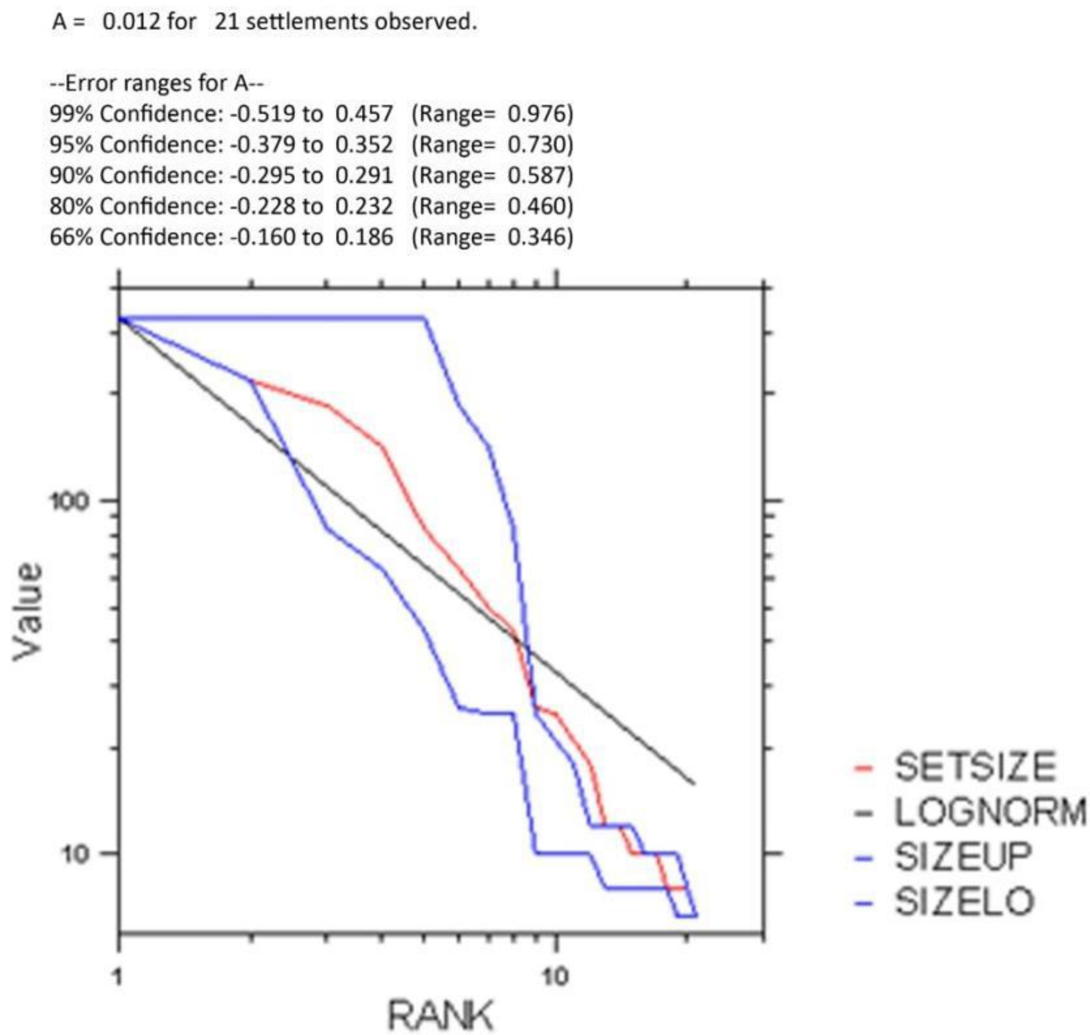


Figure 16 Late Bronze Age rank size graph.

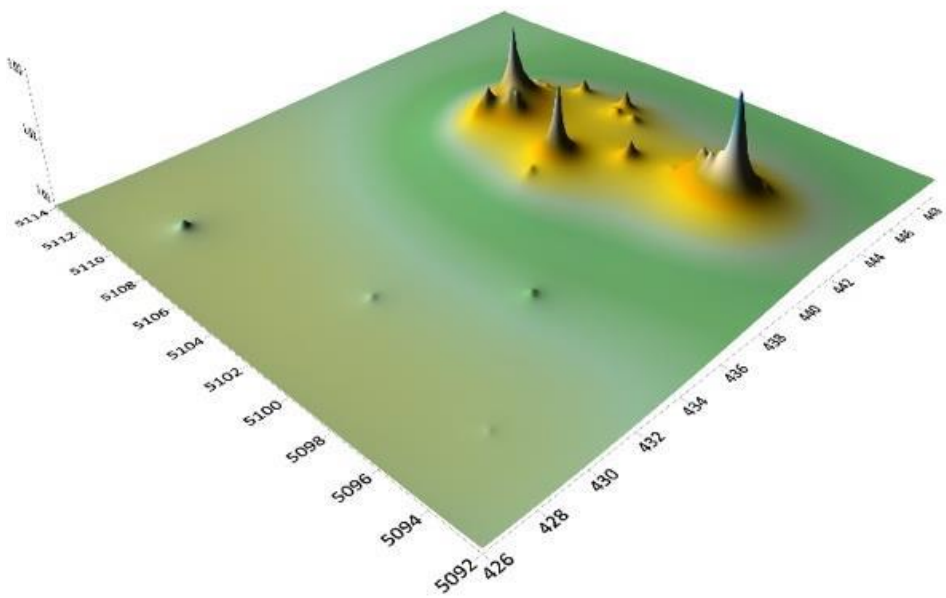


Figure 17 Neolithic density surface distribution inverse distance to the power of 0.5.

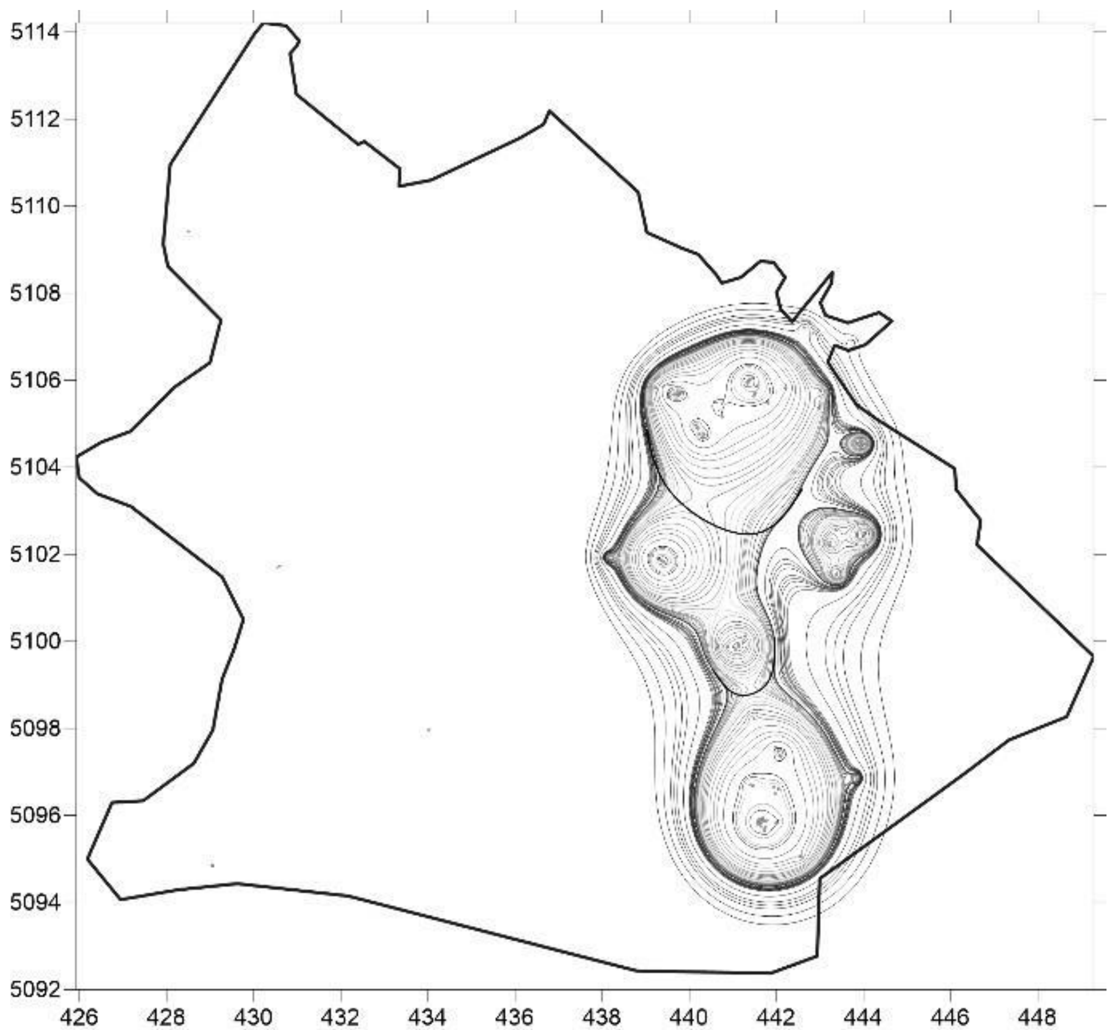


Figure 18 Neolithic density surface distribution inverse distance to the power of 0.5. The heavier weighted line represents the supra local community cut-off contour between supra local communities.

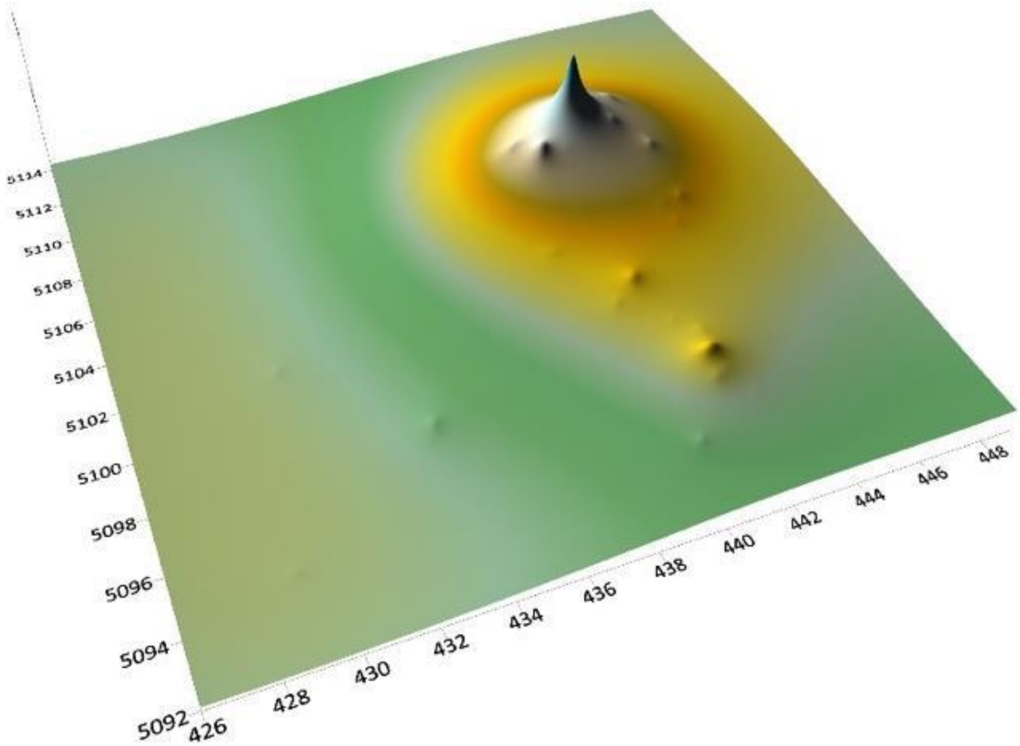


Figure 19 Early and Middle Bronze Age density surface distribution inverse distance to the power of 0.1.

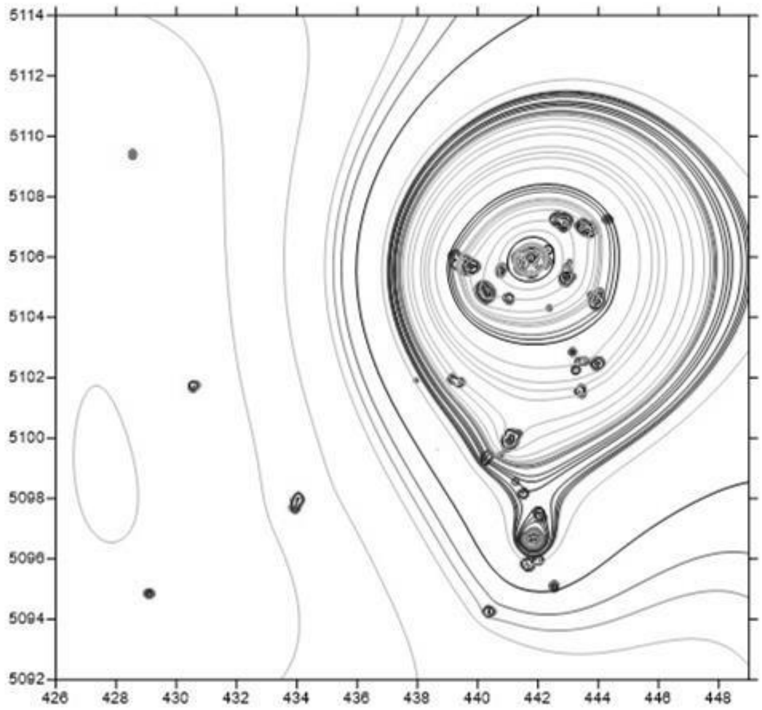


Figure 20 Early and Middle Bronze Age density surface distribution inverse distance to the power of 0.1. The heavier weighted line represents the supra local community.

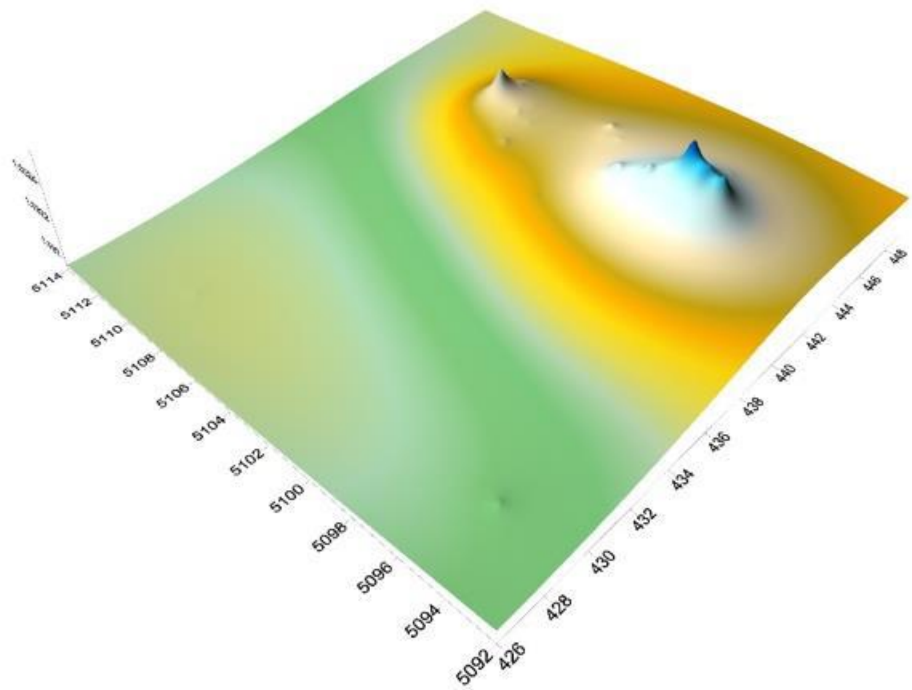


Figure 21 Late Bronze Age density surface distribution inverse distance to the power of 0.001.

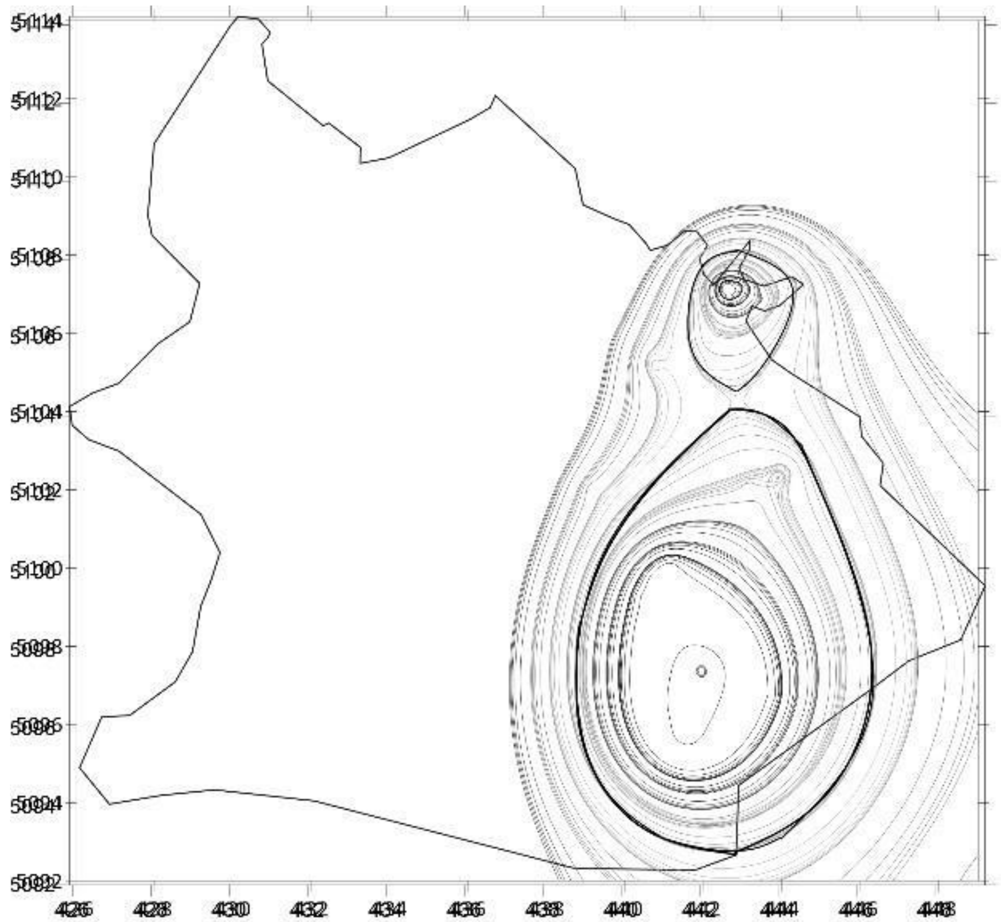


Figure 22 Late Bronze Age density surface distribution inverse distance to the power of 0.001. The heavier weighted line represents a cut-off contour between supra local communities.

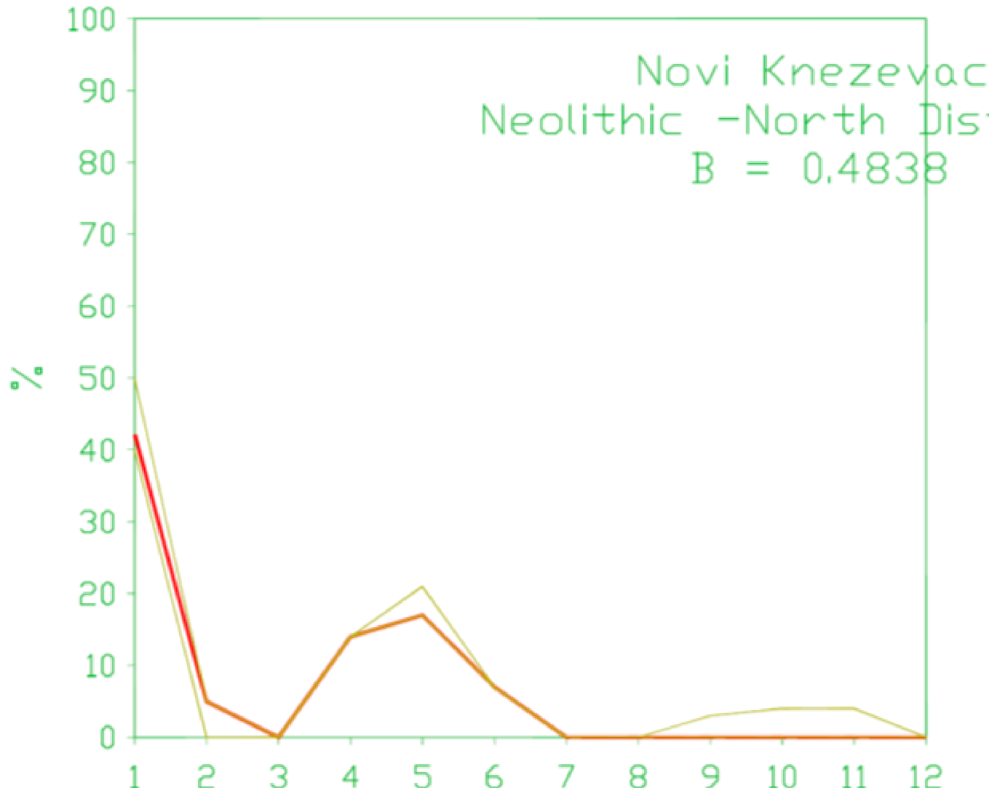


Figure 23 Graphed representation of the B coefficient for the Late Neolithic period North District.

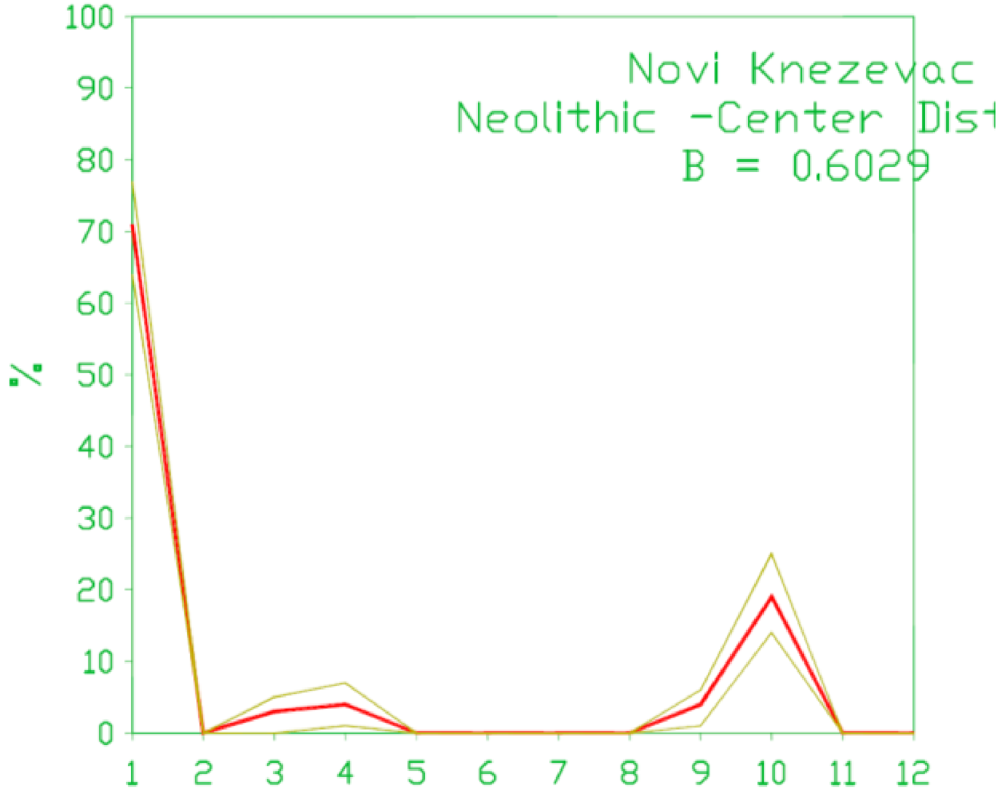


Figure 24 Graphed representation of the B coefficient for the Late Neolithic Central District.

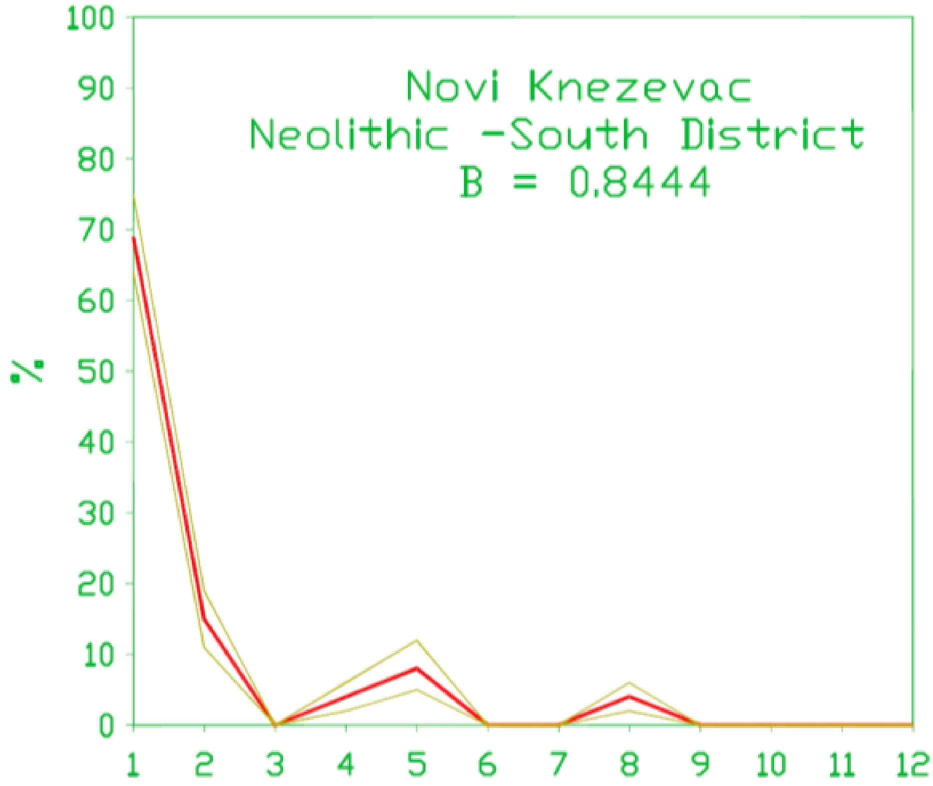


Figure 25 Graphed representation of the B coefficient for the Late Neolithic South District.

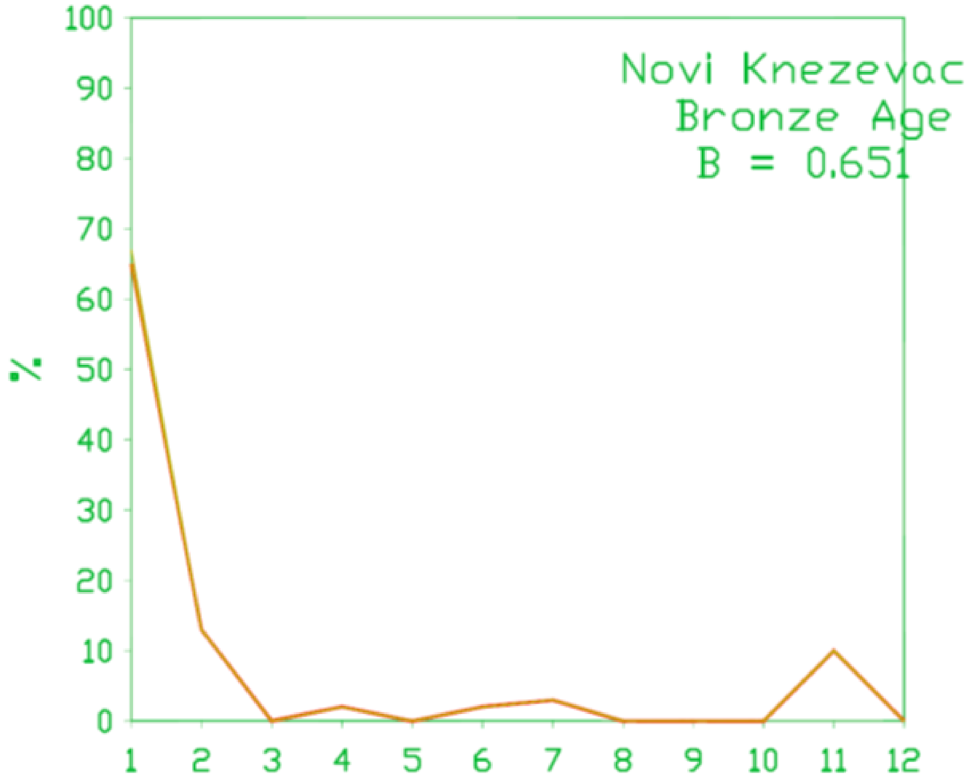


Figure 26 Graphed representation of the B coefficient for the Early and Middle Bronze Age.

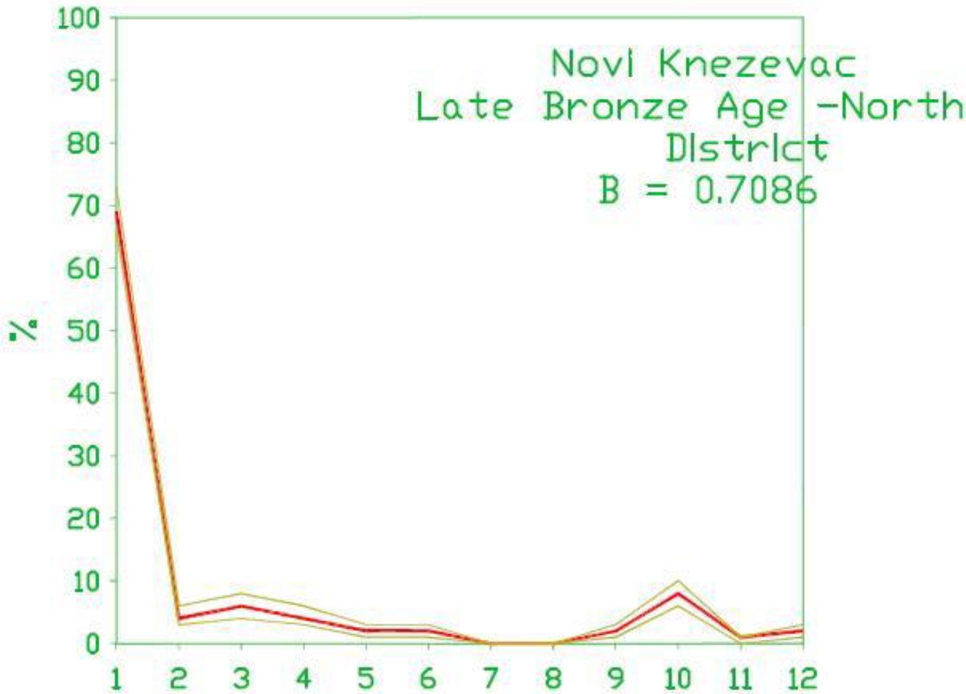


Figure 27 Graphed representation of the B coefficient for the Late Bronze Age North District.

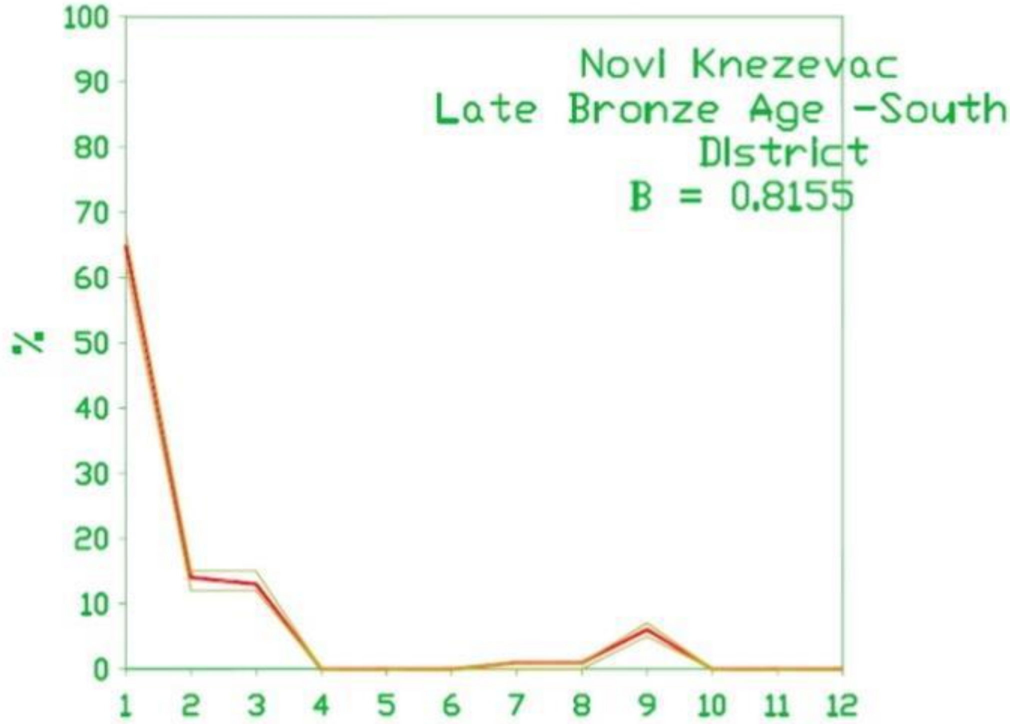


Figure 28 Graphed representation of the B coefficient for the Late Bronze Age South District.

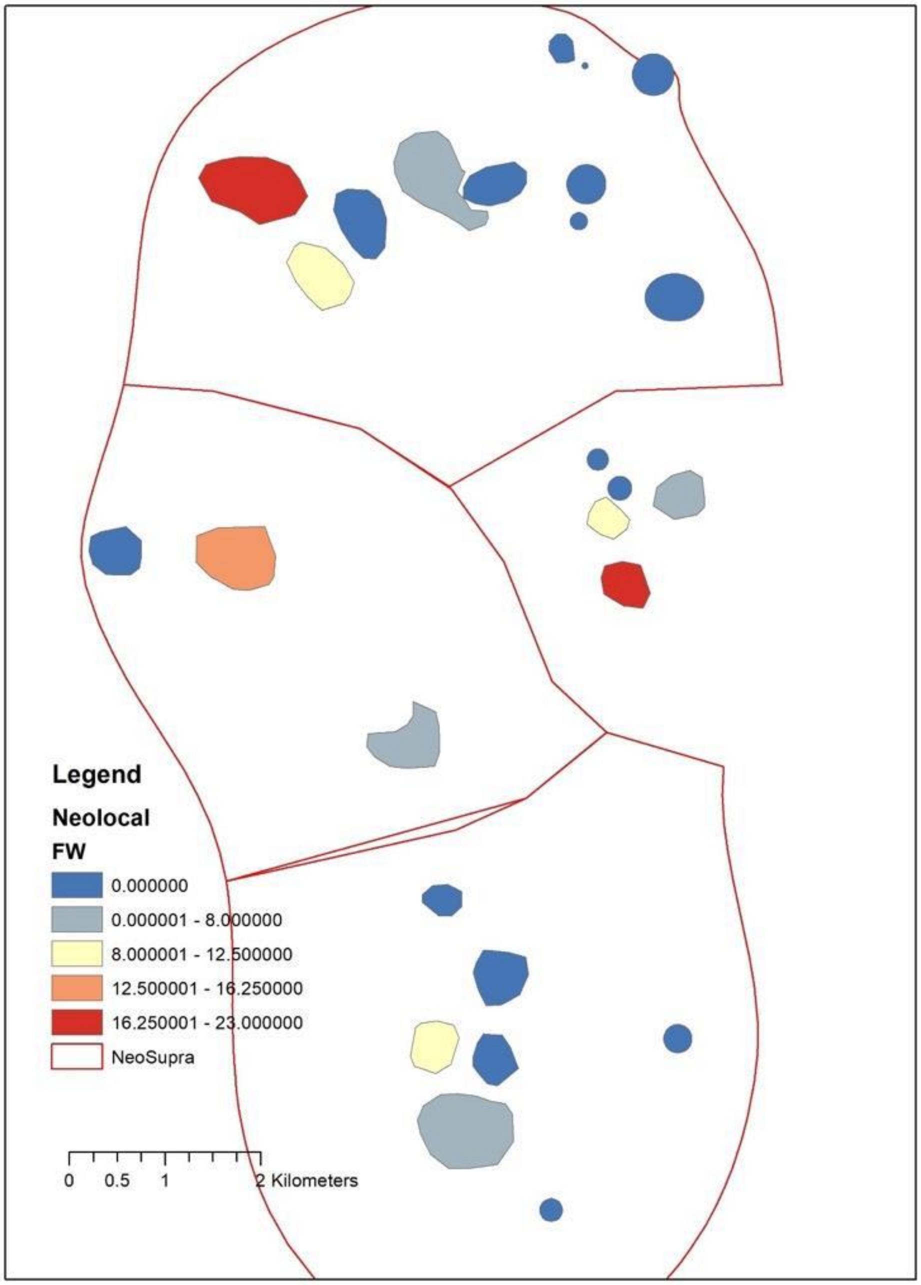


Figure 29 Map of the fine potsherd porportions for the Neolithic communities.

Table 7 Ceramic porportions for the Neolithic communities.

Neolithic local community	Neolithic total	cw%	fw%	SE
N1	9	100	0	0
N10	80	92.5	7.5	0.029448
N11	8	100	0	0
N12	5	100	0	0
N13	1	100	0	0
N14	3	100	0	0
N15	4	100	0	0
N16	1	100	0	0
N17	10	100	0	0
N18	1	100	0	0
N19	2	100	0	0
N2	3	66.66667	33.33333	0.272166
N20	8	87.5	12.5	0.116927
N21	20	95	5	0.048734
N22	10	80	20	0.126491
N23	25	92	8	0.054259
N24	2	100	0	0
N25	22	100	0	0
N26	17	88.23529	11.76471	0.078142
N27	11	100	0	0
N28	120	92.5	7.5	0.024044
N29	3	100	0	0
N3	1	100	0	0
N30	5	100	0	0
N4	5	80	20	0.178885
N5	7	100	0	0
N6	80	83.75	16.25	0.041245
N7	31	90.32258	9.677419	0.0531
N8	43	76.74419	23.25581	0.064425
N9	10	100	0	0

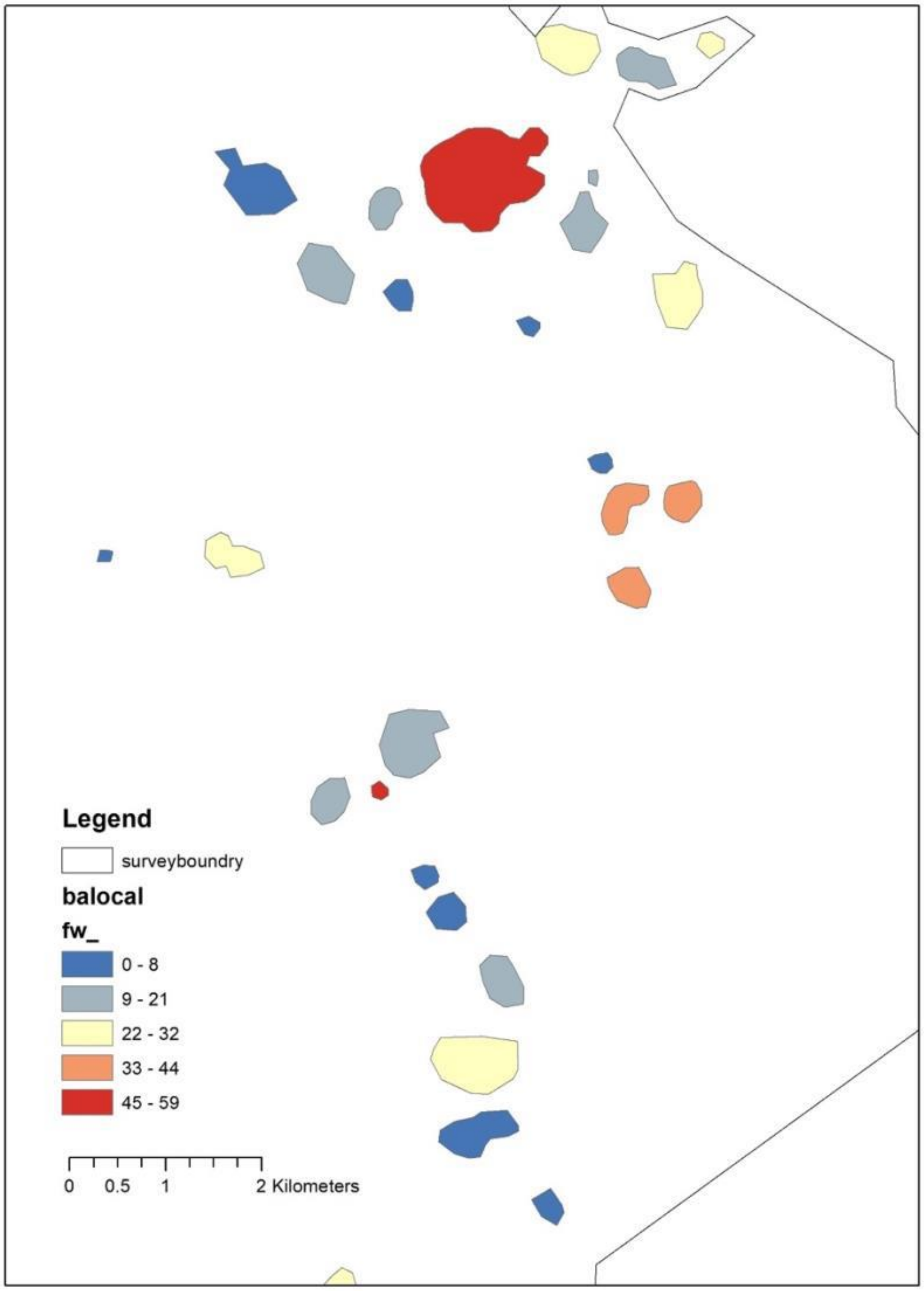


Figure 30 Map of the fine potsherd porportions for the Early and Middle Bronze Age communities.

Table 8 Ceramic porportions for the Early and Middle Bronze Age communities.

Early and Middle Bronze Age	total	cw%	fw%	SE
B1	4	100	0	0
B10	1760	40.51136	59.48864	0.011702
B11	203	73.39901	26.60099	0.031013
B12	175	81.71429	18.28571	0.02922
B13	8	75	25	0.153093
B14	68	82.35294	17.64706	0.04623
B15	5	80	20	0.178885
B16	93	74.19355	25.80645	0.045374
B17	2	100	0	0
B18	8	100	0	0
B19	21	57.14286	42.85714	0.10799
B2	17	76.47059	23.52941	0.102879
B20	50	62	38	0.068644
B21	23	56.52174	43.47826	0.103367
B22	162	83.95062	16.04938	0.028839
B23	2	50	50	0.353553
B24	31	90.32258	9.677419	0.0531
B25	3	100	0	0
B26	34	79.41176	20.58824	0.069345
B27	331	71.60121	28.39879	0.024785
B28	74	93.24324	6.756757	0.029178
B29	9	100	0	0
B3	11	63.63636	36.36364	0.145041
B30	40	67.5	32.5	0.074057
B31	15	93.33333	6.666667	0.064406
B32	14	100	0	0
B33	2	100	0	0
B4	64	73.4375	26.5625	0.055208
B5	1	100	0	0
B6	27	70.37037	29.62963	0.087877
B8	241	78.83817	21.16183	0.026311
B9	12	100	0	0
B7	389	85.34704	14.65296	0.01793

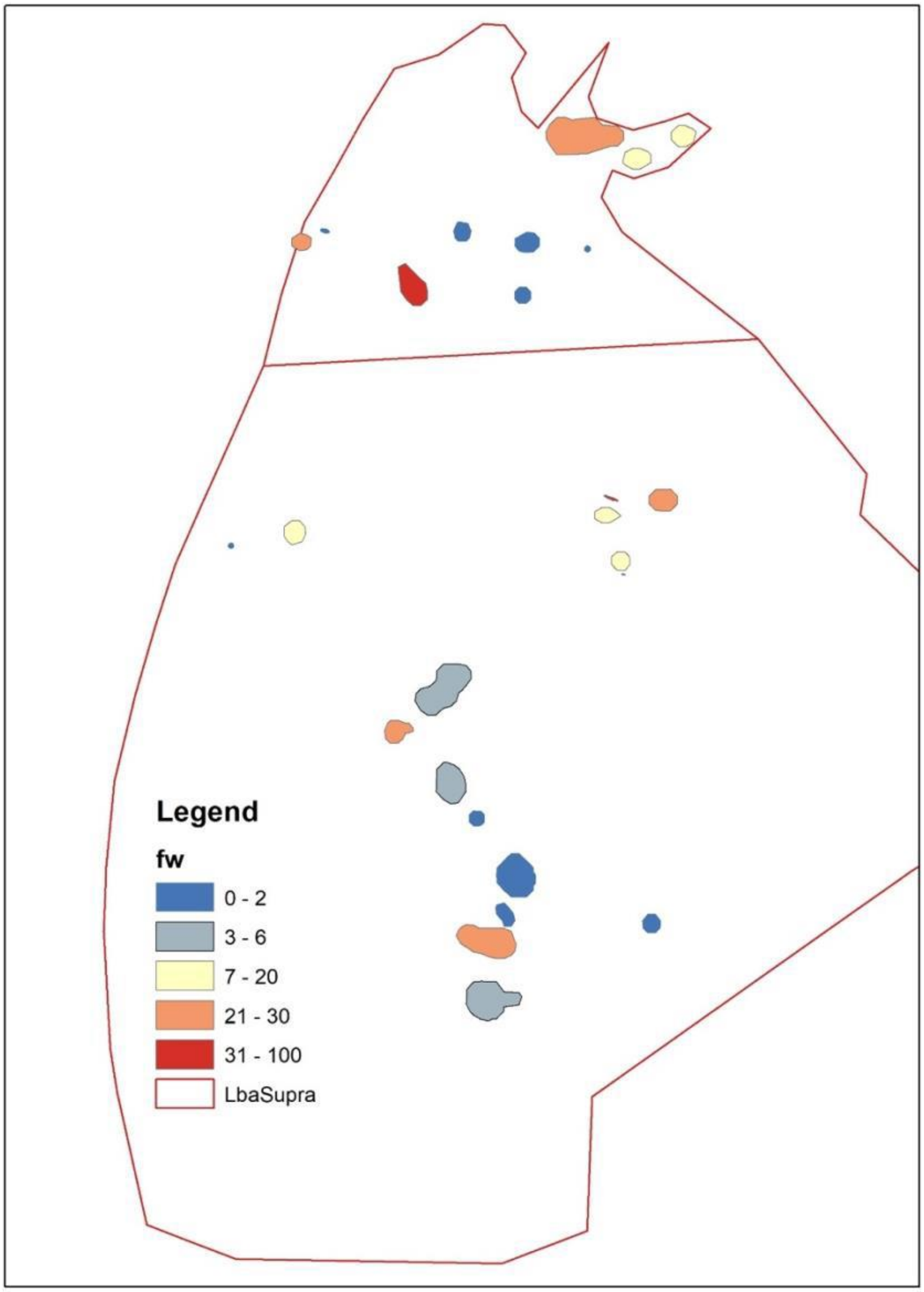


Figure 31 Map of the fine potsherd porportions for the Late Bronze Age communities.

Table 9 Ceramic porportions for the Late Bronze Age communities.

Late Bronza Age	total	cw%	fw%	SE
L1	5	100	0	0
L10	3	100	0	0
L11	8	100	0	0
L12	328	76.21951	23.78049	0.023508
L13	25	80	20	0.08
L14	26	88.46154	11.53846	0.062656
L15	43	69.76744	30.23256	0.070037
L16	1	0	100	0
L17	10	80	20	0.126491
L18	1	100	0	0
L19	134	94.02985	5.970149	0.020468
L2	29	86.2069	13.7931	0.064033
L20	12	75	25	0.125
L21	110	96.36364	3.636364	0.017848
L22	7	100	0	0
L23	289	98.2699	1.730104	0.00767
L24	12	100	0	0
L25	10	100	0	0
L26	160	73.75	26.25	0.034784
L27	254	94.48819	5.511811	0.014319
L28	8	87.5	12.5	0.116927
L5	8	75	25	0.153093
L6	3	100	0	0
L7	50	0	100	0
L8	10	100	0	0
L9	21	100	0	0
L3	2	100	0	0
L4	18	83.33333	16.66667	0.087841

Table 10 Craft related artifacts.

	brasiers	chipped stone	grinding stone	loom weights	stone tools
Late Neolithic		1	3		
Early and Middle Bronze Age	3	4	8	3	1
Late Bronze Age		1	2	1	

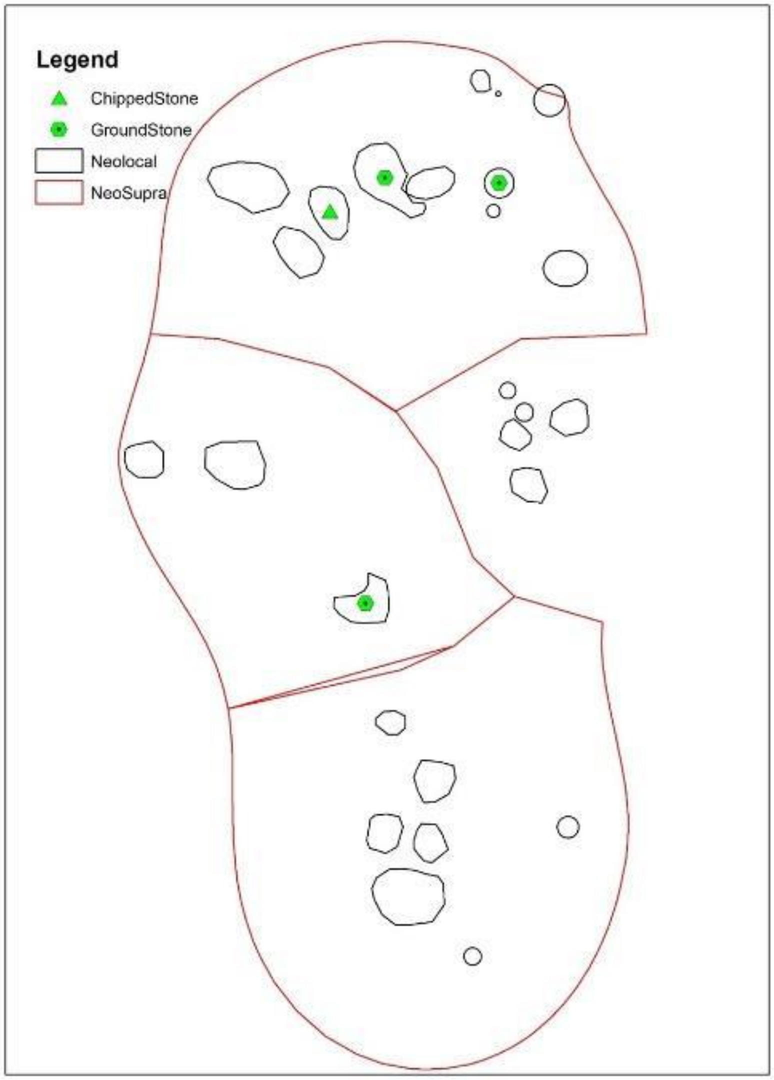


Figure 32 Spatial distribution of craft related artifacts for the Late Neolithic communities.

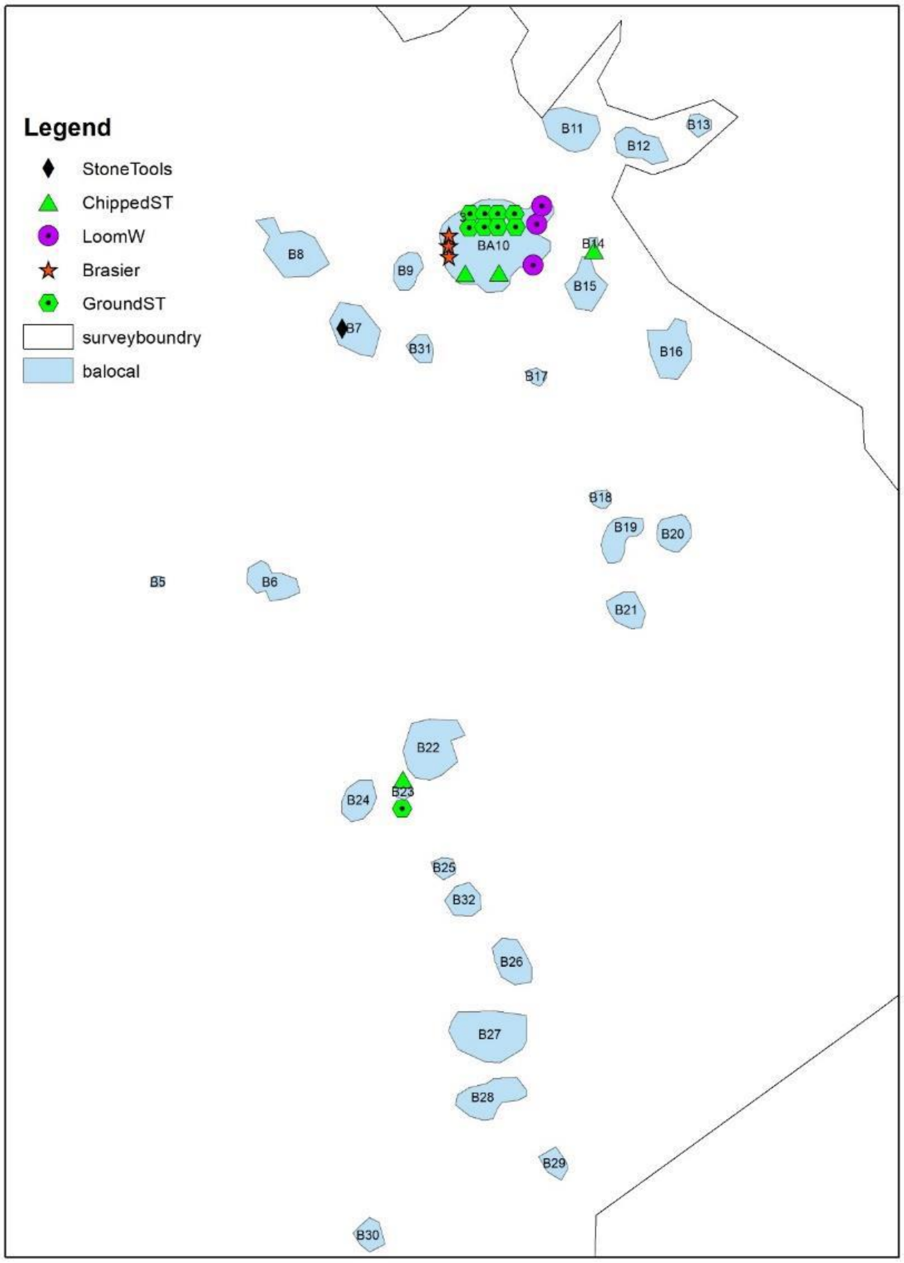


Figure 33 Spatial distribution of craft related artifacts for the Early and Middle Bronze Age communities.

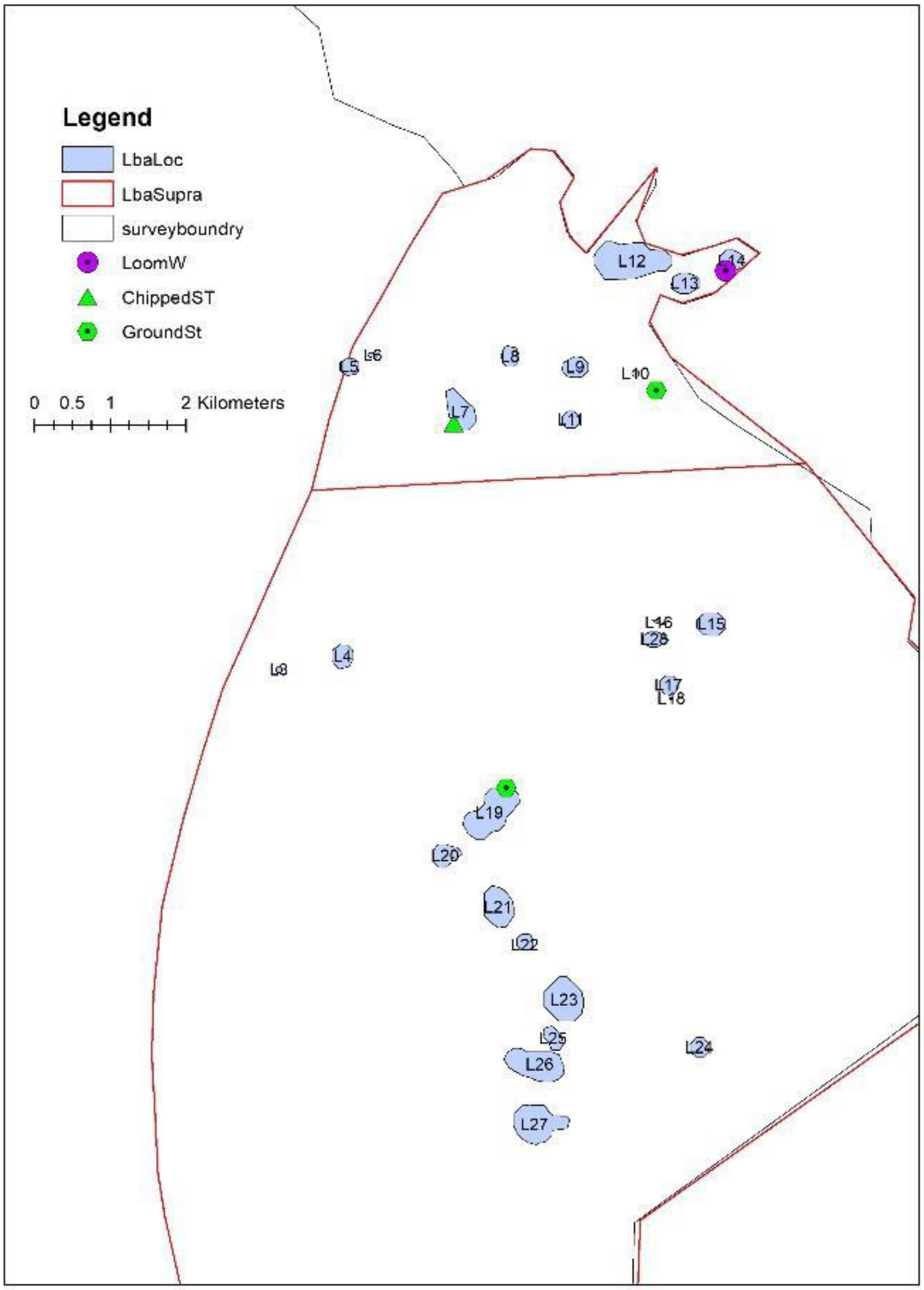


Figure 34 Spatial distribution of craft related artifacts for the Late Bronze Age communities.

5.0 Regional Soils Productivity and Hydrological Characteristics

5.1 People and Landscape

It is easy to imagine that without modern logistics and transportation prehistoric economies would have been highly influenced by natural environmental conditions and available resources. However, we should be cautious of being too deterministic in our views and robbing the people of the past of their agency. People whose ingenuity is the reason why we are here today. Nevertheless, undertaking a more detailed assessment of natural resources, and how they were utilized by prehistoric communities, is an extremely important component of better interpreting the part they played in the emergence of economic complexity and hierarchical social order.

As discussed earlier in the dissertation, social complexity and political economy are important threads, in combination with each other, in the comparative anthropological study of early societal developments. This being said, it is important in the study of fundamental changes in the nature of prehistoric societies to explore changes in the landscape relating to production activities and the potential control and centralization of them. Different productive modes, in terms of agriculture, will display different patterns of use of the landscape in which people live. This is where an understanding of regional demography, or how people occupied the landscape, has the potential to show changes at the regional and chronological scales, even if limited archaeological study has been undertaken there. The sustainability of human settlement in prehistory depends, at least to a fair degree, on the quality of the natural resources that are available in relatively close proximity. By looking at the specific productive properties of the landscape, and to what degree this corresponds to population dynamics, it is possible to create a firmer ground for understanding socio-economic development and organization and how their potential change through time.

5.2 Regional Soil Types

In the Serbian Northern Banat region, soils types fall into four relatively broad categories: Chernozem, Regosol on loess, Hydromorphic black soil, and Solonetz soil (In USDA soil taxonomy, Solonetz corresponds to sodium-rich Alfisols).

5.2.1 Chernozem Soils

Chernozem soil can further be divided into many categories but those that are dominating in the region of study are calcareous chernozems, chernozem with clay, alkalized chernozem and chernozem on sandy loess. Chernozem soils are one of the most productive fertile soil types in Europe and are frequently used in modern agricultural developments. Modern local Chernozem, however, suffers from low rates of phosphates, which can be somewhat mitigated by fertilization.. Calcareous chernozem is the most riches soil. It is very typical for this region and its distinctive features is the content of carbonates. Chernozem with clay. This type of soil is somewhat less fertile than the previous one because of the presence of clay in the structure with makes the soil retain more water. Alkalized Chernozem. The pH level of alkaline soil is above 7, and it usually contains a great deal of sodium, calcium, and magnesium. Since alkaline soil is less soluble than acidic or neutral soil, availability of nutrients is often limited. Chernozem on sandy loess. This kind of sediment are designated as the least fertile soils in the category of Chernozem for this region (Nejgebauer et al, 1971).

5.2.2 Regosols Soil

These types of soils have a weakly developed mineral horizon. Their matrix has a very low coherence and is prone to erosion. These soils are most commonly used for low volume grazing and were not generally productive for agricultural production (Nejgebauer et al. 1971).

5.2.3 Hydromorphic Black Soil

These soils are usually found on land that has been flooded along the large rivers in the region, such as the Tisa River. Water remains temporarily or permanently on the ground where the soil has been formed and this causes a process of waterlogging. While this type of soil can produce high agricultural yields, this is only possible after excessive moisture has been removed by means of drainage (Nejgebauer et al, 1958). Such intensive earthworks and systems of drainage are only known in the North Banat Region after the mid-18th century.

5.2.4 Solonetz soil

This type of soil contains high levels of salt. A very characteristic feature is the high percentage of absorbed sodium in the B horizon, often reaching up to 60%. These soils are considered deteriorated or damaged by modern agriculture and are often used as grazing areas of low yields (Nejgebauer et al, 1958).

5.3 Soil Classification and Ranking

The 4 main types of soils described above substantially vary in not only their productive potential but also in the surface area of their presence within the dissertation survey area. In terms of total area within the survey zone, the most dominant one is Hydromorphic black soil, but it is very likely that all of the area covered by this soil was underwater during late prehistory. In the Northern Banat Region Chernozem and/or Solonetz soils were those most likely to be utilized by ancient farmers. Finally, Regosols cover only a very small area of the Northern Banat Region. In terms of productivity, Chernozems are by far the most productive soils. Regosols are the least productive and Solonetz productivity is very limited. However, because of the high concentration of salt in these soils, it can be very useful in the diets of large herbivores such as cattle. Hydromorphic black soils were inaccessible to prehistoric farmers so they will not be taken into consideration any further. The order of ranking of soils from highest to lowest in productivity is: calcareous Chernozem (CC), Chernozem with clay (CWC), alkalized Chernozem (AC), Chernozem on sandy loess (CS), Solonetz (S) and Regosols (R).

5.4 Late Prehistoric Agricultural Practices of The Region

5.4.1 Neolithic

As discussed in a previous chapter, the basic subsistence practices of the Neolithic period represented a mixed agro-pastoral form. For the period of the Late Neolithic, and specifically Vinča settlements, new data over the past 10 – 15 years have revealed very diverse subsistence practices in conjunction with the natural resource potential of the areas in which the settlements were located. Both artifacts and ecofacts suggest that for most Vinča sites the immediate area around the settlements accommodated both animal husbandry and crop production. The Cattle (Bos taurus) and pig (Sus domesticus) were better suited to the wetter conditions found along the river valleys, marshes, and woodland areas. Sheep (Ovis aries) and goats (Capra hircus) were herded where grassland were available suitable. Cereal production was very common in this period including einkorn (Triticum monococcum) , emmer (Triticum dicoccum), wheat (Triticum durum/aestivum) and barley (Hordeum vulgare var. nudum). However there is also evidence for growing flax and pulses such as lentils (Lens cf. culinaris), peas (Pisum cf. sativum) and bitter vetch(Vicia ervilia) (Filipović & Tasić 2012)(Filipović et al. 2019).

While arable plots could have been located in the lowland alluvial zone, production yields in loamy alluvial soils are substantially lower and this type of land would have been better used for grazing livestock. The relatively elevated Chernozem soil areas would have yielded far better agricultural crops (Filipović, et al, 2019).

5.4.2 Bronze Age

Subsistence practices change through time with the onset of newly available species, colonization of new areas of the landscape, etc. However, sometimes it is very difficult to see these differences in the context of broader chronological and cultural developments. After the Late Neolithic, people still farmed crops and herded animals for a very long time. In fact, these practices remain an important part of local economies today within the region. Zooarchaeological research has indicated that by the time of the Middle Bronze Age (1900-1500BCE), Sheep (Ovis aries) and goats (Capra hircus) and horses were being herded, as they were an important part of the “secondary products revolution”. In terms of agriculture, most of the communities during the Early and Middle Bronze Age of the Carpathian basin relied on farming wheat (Triticum durum/aestivum) and barley (Hordeum vulgare var. nudum) with legumes such as lentils (Lens cf. culinaris), peas (Pisum cf. sativum), playing the auxiliary role in domestic production activities (Nicodemus 2014).

The best comparable data for the region has been obtained from two sites in Hungary some 15 and 20 km away from the survey zone. These settlements, Klárafalva and Kiszombor, both have different microregional environments, firmer being completely surrounded by wet floodplain with areas would have been flooded seasonally or carried permanent wetlands, and the latter only bounded by marshes and wet meadows on the north side while to the south there is wide strip of flood-free land. However, the Northern Banat Region dissertation survey indicated that the environments found associated with the identified Bronze Age settlements there were similar to the environments of the two settlements in Hungary. The general pattern associated with all of these sites suggests that the hinterland landscapes were used for agriculture. Fields were likely placed on elevated areas to avoid excessive alluvial flooding at certain times of the year. Evidence (Jones, et al. 1999) (Filipović, et al, 2019). for the abundance of grass land versus wetland taxa supports this argument and suggests that other ecological zones, such as marshes or floodplains, were not used for agriculture, at least not in an overly significant way. It is more likely, such as during the Neolithic period, that these zones were used for pasture. It is, however, worth noting that there has been evidence, recovered from the Maros sites (Nicodemus 2014; 380-392). of a high frequency of chaff (byproduct of end-stage cleaning/processed grain) (recovered from “central settlements”., It has been suggested that this can be seen as an indicator of craft specialization production such as pottery or metallurgy (Nicodemus 2014;392).

5.4.3 Fishing and animals

In terms of animal consumption, evidence from the two settlements in Hungary suggests a reliance on fishing, hunting, sheep/goat, and pig herding for Klárafalva. The community that occupied Kiszombor seem to have relied more on sheep/goats, while pigs and cattle take smaller (Nicodemus 2014).

Evidence indicates that it was not at all unusual for Bronze Age communities in these regions to rely on fishing and mollusk collection as important subsistence strategies as well. As is evident from the Klárafalva settlement, and other sites in the Carpathian basin, communities that had relatively small areas of land situated above flood zones may not have been able to specialize in cereal production and sheep/goat herding (Nicodemus 2014).

5.4.4 Overall

According to research done in the regions discussed above, it seems likely that agriculture practices, while adapted to specific ecological biomes, were not that different between the sites located in the Carpathian basin during the Bronze Age except when overall site size is taken into consideration. Traditionally, sites are divided between smaller settlements and tell sites. Apparently, while small sites tend to be more focused on the diversification and adaptation when it comes to subsistence practices tell sites, such as Pecica and Százhalombatta, appear to have had more emphasis on horses and cattle. These animals had the significant potential to be an important part of trade and exchange as well as being high value draft animals (O`Shea and Nicodemus 2018).

5.4.5 Discussion

Based on the discussion above, it may seem that larger settlement sites acted as central places during the Bronze Age and thus were the only ones exposed to trends of complexity and political economy. Since smaller settlements were relying on more diversified species for subsistence, one might argue that they were interested primarily in basic subsistence strategies and were not involved in regional scale politics (economics). If larger sites were focused more on specialized commodity production, they might have been under the influence of hierarchical systems and centralization. However, it is important to understand whether smaller settlements were part of the broader political landscape and therefore tied in some way to the larger settlements through processes of centralization of resources. If they were producing more subsistence goods, which became centralized at the larger settlements, then an argument can be made that they belong economically to the same supralocal community. If they seem to be more autonomous, and were not economically tied to the larger settlements, then there is potential for exposing these developments as being at the very early stages of a social hierarchical trajectory where the central players were not involving "periphery" populations into a strong supra local dynamic. It also suggests that the demographic stage was, at least in this case, the first to develop with a possible subsequent stage where aggrandizers where able to start manipulating social order for their own benefits.

5.5 Demography Vs Natural Landscape

Catchment zones are often used to assess the needs and potential of settlements in terms of agricultural production. To quantify catchment values, it is not uncommon to use a 5km buffer ratio, however, in the dissertation field research dataset, a 5km catchment would present a lot of overlap between the settlements considering the spatial proximity of the local communities to each other. Another possible solution would be to use Theisen polygons. This mathematical model of dividing spaces can produce “unnatural” patterns that probably do not represent, at least in a direct since, how people used the landscape. Since this case is not looking for individual behavior in regards to either people or settlements, but a whole region of 20-30 local communities with potentially a thousand to a few hundred individuals, Theisen polygons might have worked if not for the complicated pattern of the soil distribution.

As seen in Figure 5.1, potential catchment zones intersect with a wide range of soil types. Also, and perhaps more importantly, while these soils have a clear hierarchy in terms of productivity, quantifying the exact differences between the capabilities of each soil type goes well beyond this dissertation work.

5.5.1 Ranking soil productivity

The total area including the six soil types, within the Northern Banat Region survey zone, and excluding marsh wetlands, is calculated to be 4,488 ha. In order to understand the relationship between people and the landscape, in terms of agricultural production, it is necessary to consider the significance of living relatively close to these resources. The best approach to this problem is to better understand demographic trends in comparison to the soil patterns. Soils are ranked as seen in the Table 5.1 in 6 categories, with 6 being the highest productivity potential. Following this, a 1 km buffer zone was created in GIS software around all the local communities identified through the survey. Other values for buffer zones, such as 0.5 and 0.7km, have been taken into consideration and tested, but the results would be very similar. Any buffer zone larger than 1 km created the same problem with soil zone overlap as noted above.

As a population proxy, the previously developed area density index was used because it is more accurate than population estimates. The area density index value was added for each soil zone of the local community if the buffer zone cut through it significantly. Calculations for the observed population density for each soil zone in the region were done, as a whole. Next, the area of each soil zone in a catchment was used to determine the expected population in that soils zone in the catchment. This was done for all the other soils zones. Almost all local communities were counted multiple times for multiple soil zones. Since it is not productive to look for correlations between variables of different types (Drennan et al. 2015), the next step was to rank the occupation of each soil zone by establishing the density of occupation for each zone. This was done by dividing the area density index value of every soil zone by the total area of that zone thus creating a density of occupation for each soil zone. A statistical analysis was done, utilizing Spearman's rank correlation coefficient, to determine the strength and significance of the correlations between these two rank variables (Fig 5.2;Table 5.2).

5.5.2 Results

While at first glance the results seem to be ambiguous there is some interpretation required. For the Neolithic period the significance is far too low. This likely means that this data set cannot determine the correlation between the soils and the demographic dynamics for this time period.

For the other two periods, it does not appear that the correlation between where most people lived and the soil ranking were strong but weak. However, there is more to consider with these correlations.

In Table 5.5, the soil ranks have been color coded to match the soil quality represented in the soil map (Fig5.3-5.5). The numbers in the table represent the ranking of occupation. According to these numbers and how they correspond to the soil zones, all 3 columns for all periods are very different. . The Chernozem on sandy loess (CS) has been removed at the bottom part of the table because it is a very small area (1%) and is therefore somewhat misleading. When examining the lower color scheme, where the most populated zones are ranked by period, it would seem that during the Early and Middle Bronze age there is an increase in proximity to Regosols soil (R) compared to the Neolithic and Solonetz (S) compared to the Late Bronze Age. Both of these soil types are ranked lower but can be productive for grazing herds. Solonetz(S) soil zones seem to be more populated during the Neolithic, when it is ranked highest, then in any other time period. The most dramatic change can be seen with Alkalized Chernozem (AC) soils, which goes from moderately used during Late Neolithic, to mostly not in use during Early and Middle Bronze Age, to its highest ranking during the Late Bronze Age.

5.6 River Waterways and Long-Distance Exchange

Rivers present an incredible resource both in terms of resources for daily lives such as fish and other amphibious species. The area examined through the dissertation field research was not only inundated to a great degree by marshland but also was bounded by three major rivers. The largest river is the Tisa, to the west and it is approximately 10 to 15 km from the closest prehistoric settlements identified in the survey. This may be due to the propensity of rivers in this region to meanders and as a result create large swaths of marshland. The Maros River is smaller than the Tisa but it also contributes to the creation of associated marshlands and is situated to the north approximately 12-20 km from the closest identified prehistoric settlements. Lastly the Zlatica River is substantially smaller than the other two. Its waterways are much more stable and with far less associated marshlands. It is located some 6-9 km away to the south and east from the nearest prehistoric settlement identified in the survey zone. Understanding the relationship between demographic distributions within the region and waterways are just as important as understanding such trends an distribution to soil types. Waterways were not only important sources for subsistence but also for communication and long distance exchange (Duffy 2020). Archeological work in the Carpathian (Gyucha et. al 2013) basin has shown that settlement patterns and organization are often influenced by the environmental, social and cultural factors. Furthermore there seem to be strong indications pointing to the significant influences related to the hydrological features. However their power to influence the change in settlements patterns tents to taper away, especially on a micro reginal scale, where early complex societies tend to take shape. Based on the research done in the Körös Basin (Gyucha et. al 2013) a more dynamic socio-environmental interaction model is proposed for human-environmental relationships influencing the shift from small Neolithic sociates to more complex ones of the Bronze Age (Gyucha et. al 2013) (Duffy 2020).

5.6.1 Analysis of Hydrological Resources

In addition to the analysis of demographic patterns and soil types within the survey zone, I also sought to quantify the importance of rivers as a means of transportation and potential for the flow of commodities. To do this, buffer zones of 10 km were created around the three rivers in the region, the Tisa, Moris and Zlatica, utilizing GIS software. Following this, the calculated proportion of the population within the buffer zones was compared for the three chronological periods(Table 5.6).

As observed from this data, during the Neolithic period 62% of the population would have been situated within the 10km river buffer zones. During the Early and Middle Bronze Age, that percentage decreased to 37% and then climbed to 62% during the Late Bronze Age. It is worth noting that during the Neolithic period, of the three largest settlements identified, one is within the buffer zone of the Zlatica River, one within the Tisa River buffer zone, and the last one is outside all three of the buffer zones associated with the rivers. During the Early and Middle Bronze Age, of the largest three settlements, only the smallest is inside of the river buffer zone and is situated near the Zlatica River. Lastly, during the Late Bronze Age, of the 6 largest settlements, 5 fall within the Zlatica River buffer and this suggests that this river may have been an important resource and water corridor during the Late Bronze Age.

As for the Neolithic period, the data indicate that on average, in terms of proximity to the rivers, that there was no strong connection to using the waterways as means of long-distance communication. Lastly, since only 37% of the people lived in proximity to the rivers during the Early and Middle Bronze Age, this might suggest a lack of interest in long distance exchange using these waterways, and instead that terrestrial routes may have been of more importance for local exchanges networks.

5.7 Conclusion

This chapter focused on analysis related to the demography and how it relates to the natural environments in terms of agricultural production and soils as well as hydrological factors and their connection to long distance traps operations and trading. From the analysis of soil and demographic dynamics, I was able to show that there is no direct correlation between the quality of soils and the settlement patterns. This most likely mean that the population of all three time periods were not necessarily interested in maximizing their production by intensifying agriculture on the best possible soils. However, there are some indications for the desire to use soils that are better for grazing, in times of grater population increase. Suggesting the possibility of lucrative commodities and trend in times of grater social complexity. The analysis of the waterways seems to suggest an interpretation of increase interest in navigable waterway during these same times, again pointing out the possibility of the growth in intreat for commodity trade and production. In the next chapter I will present the result of the archeological geophysical survey and how it relates to the demographic patterns of the Northern Banat region.

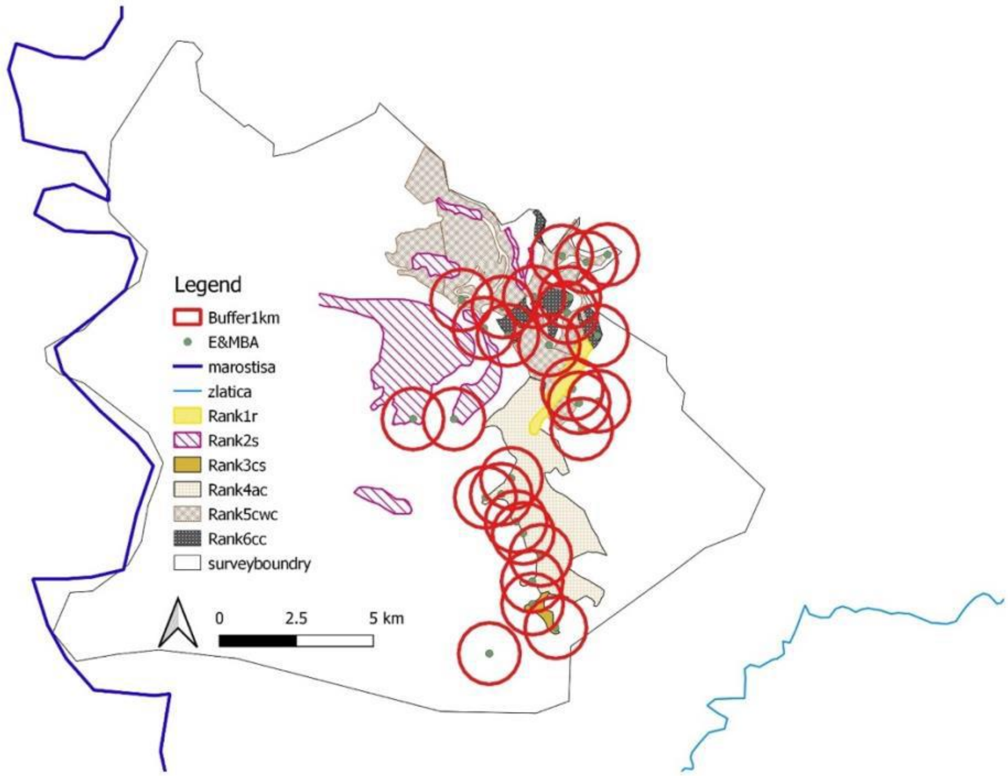


Figure 35 Early and Middle Bronze Age local communities with a 1km buffer ring.

Table 11 Soil rankings with #6 being the highest productivity potential.

Soil	Rank	Area in ha	%
Calcareous chernozem (CC)	6	251	5.5
Chernozem with clay (CWC)	5	1300	29
Alkalized Chernozem (AC)	4	1212	27
Chernozem on sandy loess (CS)	3	49	1
Solonetz(S)	3	1329	29.6
Regosols soil(R)	1	150	3.3

Table 12 Rank order correlation between soil ranks and population ranks for the Late Neolithic.

Neolithic Period				
Soil	Area in ha	%	index on or near 1km	density
Calcareous chernozem (CC)	251	5.5	140	0.557769
Chernozem with clay (CWC)	1300	29	215	0.165385
Alkalized Chernozem (AC)	1212	27	202	0.166667
Chernozem on sandy loess (CS)	49	1	123	2.510204
Solonetz(S)	1329	29.6	259	0.194883
Regosols soil(R)	150	3.3	21	0.14
				rs=0.31
				t=0.652

Table 13 Rank order correlation between soil ranks and population ranks for the Early and Middle Bronze Age.

Early and Middle Bronze Age				
Soil	Area in ha	%	index on or near 1km	density
Calcareous chernozem (CC)	251	5.5	2750	10.95618
Chernozem with clay (CWC)	1300	29	3093	2.379231
Alkalized Chernozem (AC)	1212	27	789	0.65099
Chernozem on sandy loess (CS)	49	1	414	8.44898
Solonetz(S)	1329	29.6	2263	1.702784
Regosols soil(R)	150	3.3	179	1.193333
				rs=0.55
				t=1.316

Table 14 Rank order correlation between soil ranks and population ranks for the Late Bronze Age.

Late Bronze Age				
Soil	Area in ha		index on or near 1km	density
Calcareous chernozem (CC)	251	%	91	0.36255
Chernozem with clay (CWC)	1300	5.5	535	0.411538
Alkalized Chernozem (AC)	1212	29	7354	6.067657
Chernozem on sandy loess (CS)	49	27	414	8.44898
Solonetz(S)	1329	1	112	0.084274
Regosols soil(R)	150	29.6	9	0.06
		3.3		rs= 0.42
				t=2.048

Table 15 Intensity of different soil types use for all periods.

Soil		NEO	BA	LBA
Calcareous chernozem (CC)		5	6	3
Chernozem with clay (CWC)		2	4	4
Alkalized Chernozem (AC)		3	1	5
Chernozem on sandy loess (CS)		6	5	6
Solonetz(S)		4	3	2
Regosols soil(R)		1	2	1
		NEO	BA	LBA
		5	5	5
		4	4	4
		3	3	3
		2	2	2
		1	1	1

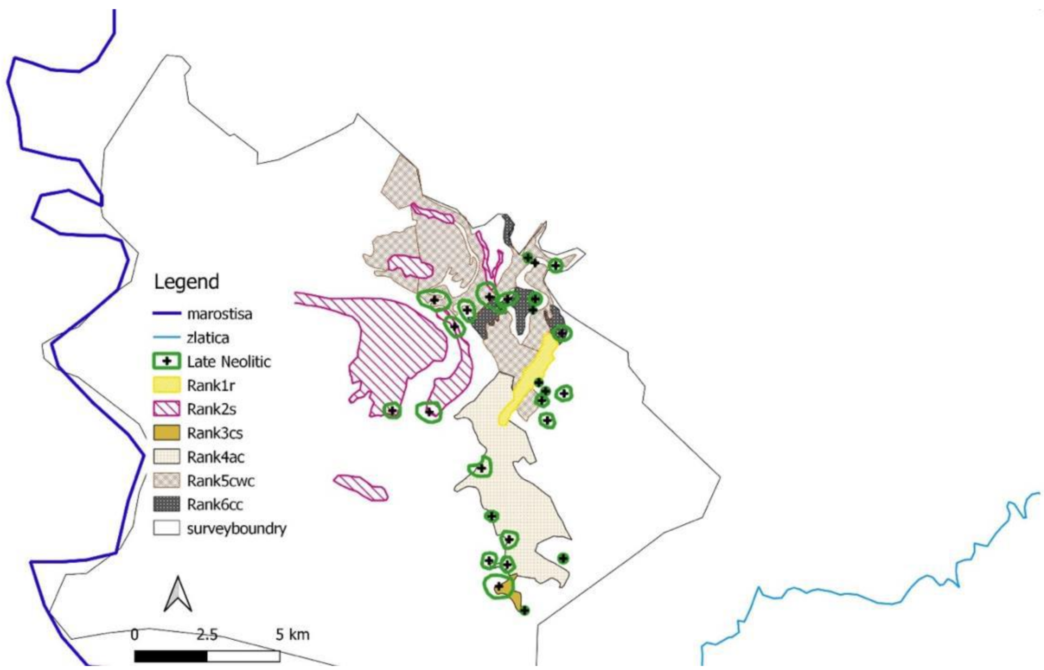


Figure 36 Ranked soils zones and local communities for the Late Neolithic.

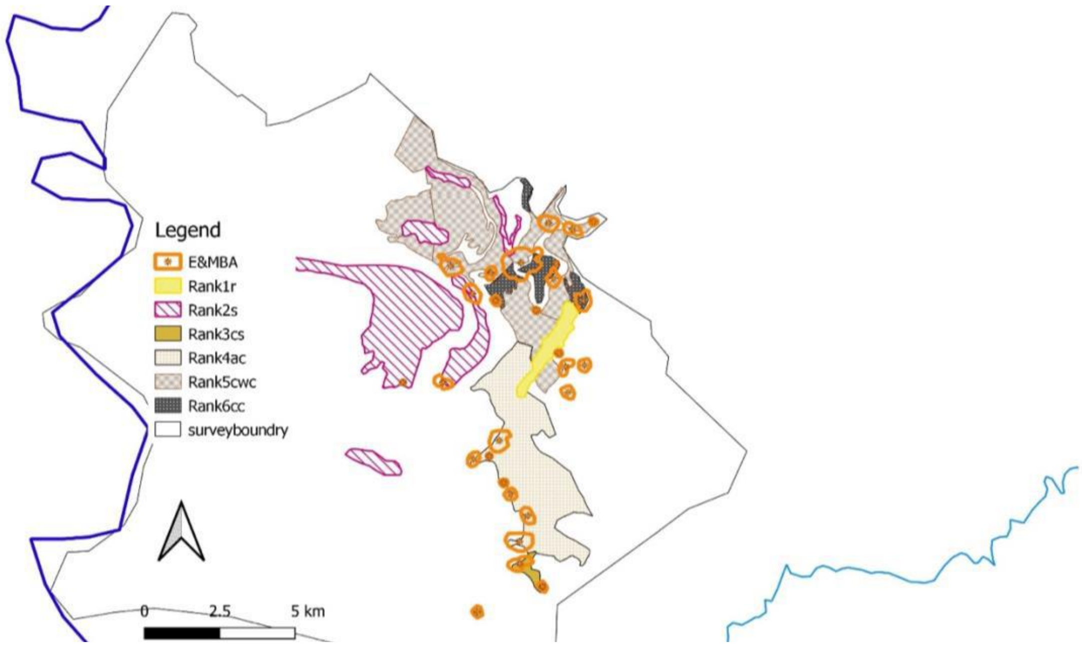


Figure 37 Ranked soil zones and local communities for the Early and Middle Bronze Age.

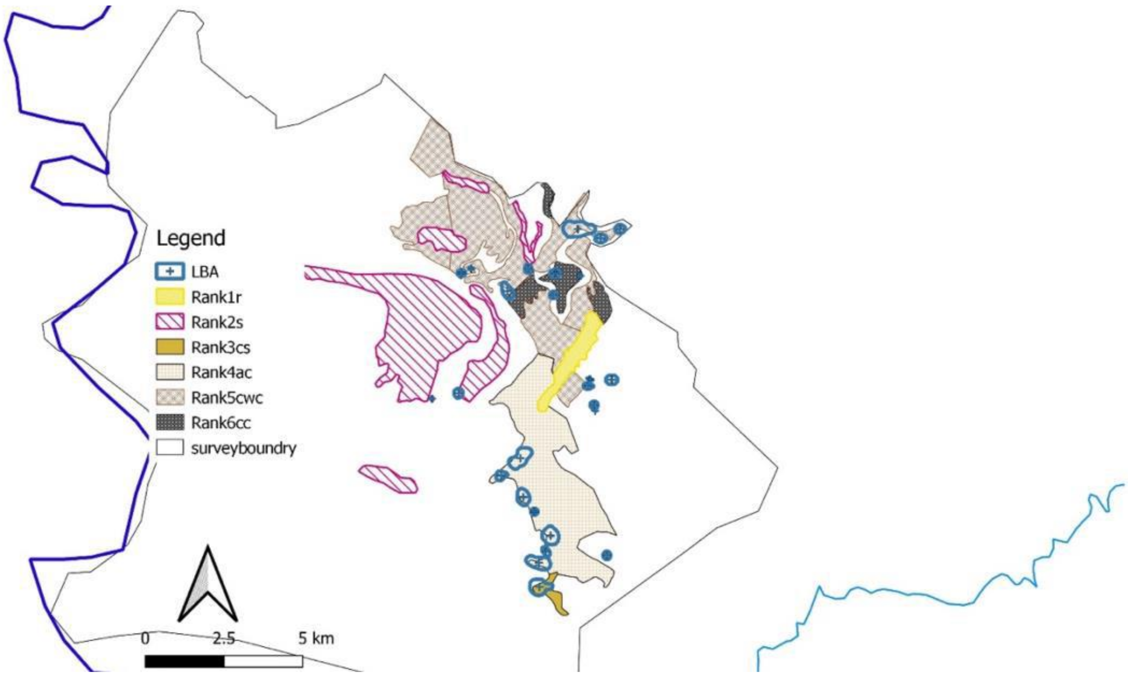


Figure 38 Ranked soil zones and local communities for the Late Bronze Age.

Table 16 Relationship between the proximity to rivers and demographic density.

Population inside the river buffer zone	Are of occupation %	Area density index %
Neolithic	51	62
Early and Middle Bronze Age	42	37
Late Bronze Age	74	62

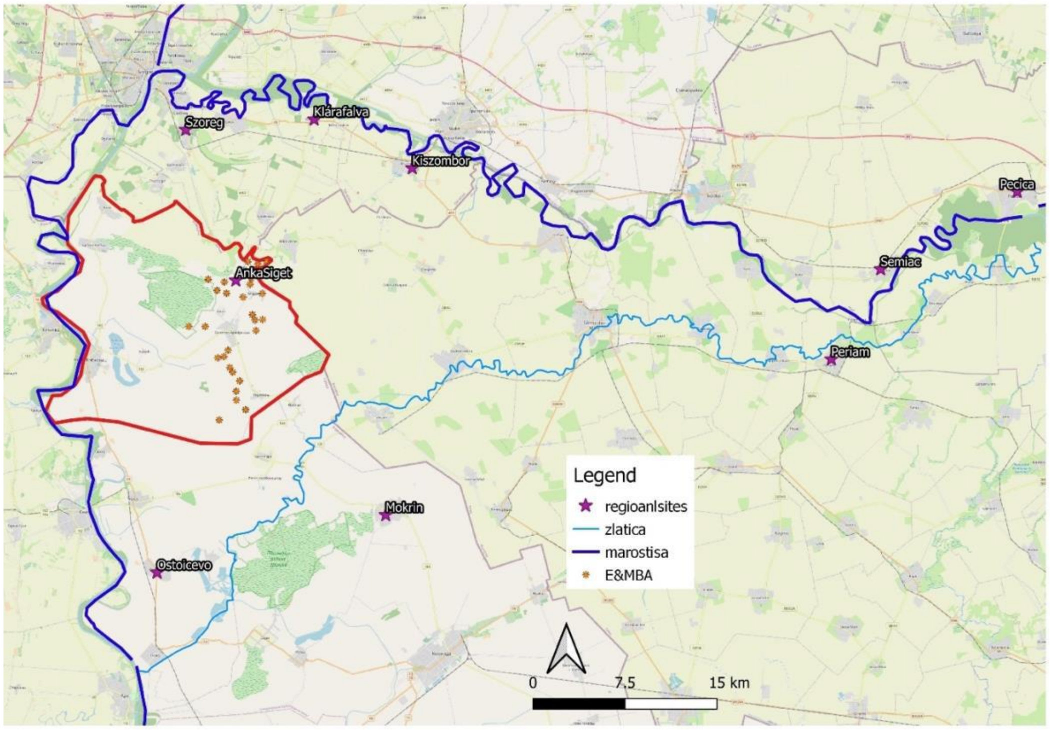


Figure 39 River network system within the survey region and associated distribution of Maros culture sites.

6.0 Archaeological Geophysical Survey

A brief campaign of geophysical survey was undertaken from March 24-29, 2019 to support the doctoral dissertation field research being completed by Gligor Daković (University of Pittsburgh, Department of Anthropology) in the Northern Banat district of the Republic of Serbia (Fig. 6.1). A team of five people supported this research that included the dissertation author, Dr. Bryan Hanks, and three undergraduate archaeology students from Belgrade University (Fig. 6.2). Specific locations chosen for geophysical survey were based on the identification of archaeological sites interpreted as Bronze Age occupations (Maros culture or other) during the regional pedestrian survey the previous year. A total of five site locations were selected (MA28, MA17, MA30, BA65 and BA31) (Table 6.1; Fig. 6.3).

Additional geophysical surveys were conducted in the district in 2017 and 2018 by a team from the University of Pittsburgh led by Dr. Bryan Hanks in connection with the Anka Siget Archaeological Project (ASAP). ASAP is directed by Dr. Amy Nicodemus (University of Wisconsin-La Crosse) and Dr. John O'Shea (University of Michigan) in collaboration with the Kikinda National Museum, Town Museum of Senta, and the Intermunicipal Institute for Protection of Cultural Monuments Subotica (Nicodemus 2018; Hanks et al. 2018a & 2018b). These surveys focused on the Anka Siget tell site near the modern village of Rabe that is also located within the Northern Banat District (Fig. 6.4).

6.1 Objectives

Non-invasive geophysical surveys were completed in order to assess subsurface magnetic anomalies, to spatially map surface soil magnetic susceptibility where possible, and to determine relationships between these data and the spatial distribution of collected surface artifacts from the regional pedestrian survey. Due to the period of time available for the geophysical survey, which coincided with a one week spring break period at the University of Pittsburgh, a strategy of collecting a sample of data from all five sites was prioritized over an attempt to complete full coverage geophysical surveys of only one or two sites. The rapid site characterization strategy was employed to identify subsurface and surface features and magnetic anomalies that would potentially correlate with prehistoric infilled enclosure ditches, house foundation features, hearths/furnaces, and general areas of soil magnetic enhancement linked to anthropogenic activities. These types of surveys were highly successful in identifying such features during the 2017 and 2018 geophysical prospection surveys at the Anka Siget tell site (Hanks et al. 2018a & 2018b; Nicodemus 2018).

This strategy would better inform the regional scale pedestrian survey and provide a wide range of comparative data on prehistoric sites within this region. It was anticipated at the time of the survey in 2019 that a future opportunity to return to the sites would be available to conduct more comprehensive surveys. However, with the outbreak of Covid-19 in March 2020, a return to Serbia during the spring or summer of 2020 was not possible. Nevertheless, the initial survey campaign data presented in this chapter will aid in the planning and organization of surveys in the region at a later date.

6.2 Geological conditions

Some physical aspects of the region were discussed in Chapter 2. Here it is important to add that the region is dominated by sediments extending from the Miocene that overlie a substantially deformed Paleozoic-Mesozoic basement made up of magmatic, metamorphic and sedimentary rock (Radivojević et al. 2010). Soils within the region are made up of deposits of silt, sand and clay with specific zones of loess formation. It should be acknowledged that modern day mechanized agricultural practices may have impacted the preservation of subsurface prehistoric sites and the potential identification of associated subsurface archaeological features.

As noted by Nicodemus (2018: 7), early explorations by Reizner (1891) in the area found cultural deposits at the Anka Siget tell site to be at a depth of 1.2-2 meters with a plow zone of 50-60 cm. Nicodemus completed a series of six hand-auger cores at the tell site in 2017 and confirmed that the depth of cultural deposits did not exceed two meters with several indicating that deposits were within this range, thereby confirming the previous estimates by Reizner. The 2017 cores also identified two major occupation strata, one that was an upper lighter silty fill and the other a lower dark clayier fill horizon (Nicodemus 2018: 18). It may be expected that cultural deposits in some zones of the tell site would be deeper and more substantial than at the hinterland sites that were investigated through geophysical survey and that are detailed within this chapter. It is possible that these sites may have had shorter duration occupations and/or more horizontally distributed architectural features and structures. In the future, a more systematic program of hand-auguring would be useful to better assess depth of archaeological features and cultural lenses at the hinterland sites and would assist with future interpretations of geophysical data.

All five of the Bronze Age occupation site surveys were conducted in arable land and the surface conditions varied from alfalfa fields to recently tilled areas that were being prepared for spring planting. During the one week survey, the weather was dry and cool (50’s-60’s Fahrenheit) and overall the field conditions were excellent.

6.3 Methods

The spatial distribution of surface artifacts at the five hinterland occupation sites informed the placement of geophysical survey grids. In most cases, an effort was made to place grid units in locations where there was a greater density of surface artifacts and/or where distinct changes in topographic elevation might indicate subsurface enclosure features (e.g. ditches, palisades, etc.). In this case, we often chose to set out a series of grids over a determined long axis of the site to provide magnetic data that might distinguish “on-site” and “off-site” zones based on the distribution of surface artifacts. This initial data was processed in real time in the field on a day to day basis with a laptop computer and then additional grid units were placed to further explore promising anomalies identified in the initial exploratory dataset. No fixed site datum was available at any of the five occupation sites and therefore a handheld GPS unit (Garmin GPSMAP 64sc) was used to record the position of survey grid corners. A similar handheld GPS unit had been utilized during the previous pedestrian survey in the area. This typically resulted in a reported 3-4 meter accuracy error by the GPS units. Grid units and string lines used for geophysical survey were oriented to align with field boundaries and/or specific topographical features. Grids were set out utilizing uniform 20m x 20m “blocks” and corner points were triangulated using fiberglass meter tapes. Small diameter bamboo canes and plastic stakes were used to mark grid corner positions. Orientations of grids were recorded using a Brunton handheld compass and magnetic north.

6.3.1 Fluxgate Gradiometry Method

Magnetometry is one of the most productive and commonly used methods for geophysical prospection in archaeology (Gaffney & Gater 2002; Aspinall et al. 2008). A Bartington Grad 601-2, which is a high resolution single axis fluxgate gradiometer, was utilized for the surveys detailed in this report. This instrument is passive and can detect and record minute variations in the earth's magnetic field due to archaeological and geophysical subsurface features (parameters set at +/- 0.01 to 100 nT). Fluxgate gradiometry is highly useful for identifying subsurface pits, ditches or trenches, and fired or burnt features such as hearths, kilns and ovens. It offers a rapid method for quickly assessing archaeological sites for geomagnetic responses. Such responses are typically associated with either (i) thermoremanent or (ii) induced magnetism and magnetic susceptibility associated with cultural or natural features (Kvamme 2006).

When rocks or sediments are heated above the ferromagnetic Curie temperature (approx. 500-700o C) their magnetic orientation is realigned to the local magnetic field resulting in a permanent remanent magnetization. This will typically contrast with surrounding unburnt soil contexts. Hearths, ovens, furnaces, and other heated/burned soils within archaeological sites are often associated with thermoremanent magnetizations. Induced magnetism and magnetic susceptibility relate to rocks, sediments, etc. that are susceptible to the earth's magnetic field. In soils, this is commonly associated with the three oxides of iron, hematite, magnetite, and maghemite, with the last two being the most magnetic. Many cultural and natural processes influence the degree to which soils may be susceptible to magnetization and these include a wide range of anthropogenic activities including the formation of magnetotactic and other bacteria common to topsoil and organically enriched soils (Kvamme 2006: 208). Pits, trenches, wells, and other infilled archaeological features generally present a magnetic contrast between the feature and the natural background soils due to infilled sediments that are more magnetically visible.

Parallel transects were walked with the Bartington 601-2 instrument using rope lines and/or fiberglass rods for path alignment. Due to the rapid and exploratory nature of the surveys, measurements were taken with transects spaced every 1.0 m with 160 measurements collected along each transect (every 12.5 cm) within 20m x 20m grid units. All survey data was downloaded and processed with Terrasurveyor software (v.3.0.33.10) using a Panasonic Toughbook CF30 laptop with an external hard drive as a backup. Typical software processing steps included de-spiking, de-striping, low pass filtering, and data clipping to enhance contrast. In some cases, edge matching of grid units was utilized.

6.3.2 Low Field Magnetic Susceptibility Method

The other method employed during geophysical survey, where ground conditions allowed access to bare surface soils, was low field soil magnetic susceptibility (MA17, MA28, BA 65, and BA 31). While magnetometer surveys record the net effect of any induced and remanent magnetization, magnetic susceptibility surveys differ in that they only measure the induced component of the magnetic signal (Dalan 2006). One application of this particular method is to horizontally map variability in surface soils across archaeological sites. This can be done through utilizing a portable meter connected to a field coil that generates a localized alternating magnetic field. The susceptibility of soil magnetization can then be measured in dimensionless SI units as one moves throughout the survey area (Gaffney & Gater 2002).

The instrument used to collect data in this manner was a Bartington MS2 sensor with a MS2D Loop Probe (Fig. 6.2). This particular probe is placed directly on the ground surface to collect a reading and has an overall penetration of approximately 10cm in depth depending on topsoil conditions. Readings were taken with this instrument using the same grid that was set out for gradiometer survey at the sites. Three data readings were recorded at each chosen location and then averaged during data processing (samples taken every 10 m x 10 m, following guidelines for coarse-sample topsoil surveys; David 1995) across the survey zone in either a gridded format (MA17 and BA 65) or as a single transect along the long-axis of the gradiometer survey (MA 28 & BA 31). A shovel was used to clear debris and smooth an area large enough for the MS2D Loop Probe to be placed on the ground surface for the readings (Fig. 6.2).

The magnetic susceptibility survey was completed primarily as an exploratory method to see whether pedogenic enhancement could be identified spatially across the horizontal plane of the sites and whether variation in magnetic susceptibility correlated with surface artifacts and/or subsurface magnetic anomalies identified through fluxgate gradiometry. Readings were recorded with pen and paper in the field and later entered into a Microsoft Excel spreadsheet on a laptop computer. Following this step, data were processed and plotted using Golden Software Surfer 13 using the interpolation and contouring functions.

6.4 MA17

This site is located 1.6 km northeast from the Anka Siget tell site (Fig. 6.4). The area chosen for the survey was situated within a disked field and the initial exploratory survey was set as a 20m x 200m transect (ten 20m x 20m grid units) across the site area (Figs 6.5-6.7). Following processing of this initial data, an additional 10 grid units were added to produce a 0.8 ha total survey area. Magnetic susceptibility survey was also conducted and due to time constraints was only employed over the initial 20m x 200m area across the site (0.4 ha) (Fig. 6.7).

Results from FGS indicated numerous major magnetic anomalies. Three of these were linear positive anomalies, with an approximate northeast - southwest orientation, running across the full area surveyed (Fig. 6.8: 1, 4 & 5), and an additional curvilinear anomaly near the center of the survey zone (Fig. 6.8: 2). These anomalies varied from 1-3 meters in diameter. Numerous small (1-2 m diameter), medium (3-4 m diameter) and one large (10 m diameter) infilled pit like anomalies (monopolar positive) also were identified. The linear anomalies may be interpreted as ditch or trench like features. The anomaly of this type in the center of the survey zone (Fig. 6.8: 4) may be a palisade type feature based on the abbreviated nature of the positive responses. The widest linear anomaly in the survey, located in the SE, was situated along a distinct elevation transition in the survey zone at the edge of a terrace running parallel with the anomaly (Fig. 6.8: 1). Based on the topography in this area, this would be a logical location to place an enclosure ditch/fortification to make best use of the natural topography. The medium size infilled pit like anomalies noted above may be interpreted as possible pit house features and the smaller anomalies may be pits or post molds. Four medium sized pit anomalies are located near the center of the survey zone and indicate possible burning associated with them as the readings were both positive and negative nT in this area (Fig. 6.8: 3).

As noted above, the MSS was employed along the long axis of the survey zone (Fig. 6.7). The results indicated elevated magnetic susceptibility in the northwest zone of the survey and in the area of clustered infilled pit house type features noted above (Figs 6.7 & 6.8: 3). Lower susceptibility was noted in the SE zone in the area of the large linear ditch or trench anomaly and in areas near the other linear anomalies and an area just northwest of the aggregated medium sized pit house anomalies.

Based on the distribution of surface artifacts across this site, which included Early and Middle Bronze Age, Late Bronze Age and Neolithic finds, the anomalies identified in the FGS survey may relate to multi-component occupation phases (Fig 6.6). Magnetic anomalies are very distinctive due to the quiet nature of the surrounding natural soil contexts and therefore this site is an excellent candidate for extending FGS survey across all areas in which artifacts were recovered and would help to provide more data and better context to inform interpretation of the possible “ditch” and “palisade” anomalies. MSS also indicated substantial variability across part of the surveyed area and appears to correspond to aggregated pit like anomalies and especially the larger ditch features in the southeastern area of the survey. MSS should therefore be utilized in tandem with FGS survey in the future as this may assist in identifying activity zones related to surface artifacts and subsurface magnetic anomalies.

6.5 BA28

This site is located 0.36 km southwest from the Anka Siget tell site (Fig. 6.4). The survey area was divided into two separate zones, one running roughly northwest to southeast (Survey A; sixteen 20m x 20m grid units; 0.64 ha) and the other northeast to southwest (Survey B; ten 20m x 20m grid units; 0.4 ha) (Figs 6.9-6.12). Most of survey zone A was located in a disked field where the topographical elevation decreased towards the north. Grids were placed in this area in an attempt to identify an enclosure boundary or ditch. Survey zone B was located in an alfalfa field running parallel to a dirt track between the fields and was placed to correspond with surface artifact collection units (Fig. 6.10, 6.11). A single transect of MSS also0 was employed in Survey Zone A.

There were numerous major and minor magnetic anomalies of identified in both survey zones. Although less distinctive than site MA17, several small (1-2 m) to medium (2-3 m) infilled pit like (monopolar positive) anomalies were identified (Fig. 6.12). In addition, numerous simple and complex dipole anomalies were identified that likely relate to intrusive historic metal objects within the survey zones. Importantly, there is a strong distinction between the magnetic readings in survey Zone A in the northwest vs. the southeast (Fig. 6.12: 1 & D). There does appear to be a linear positive set of anomalies running across this zone that may relate to a boundary or palisade line (abbreviated) that corresponds to the transition from the upper to lower elevation area within the survey zone. There is a marked difference in the background magnetic responses northwest of this line with only four or five positive monopolar features likely representing infilled pits.

Based on the FGS survey results summarized above, a single transect utilizing MSS was employed along the base line of survey zone A (Fig. 6.13). The results of this exploratory survey indicated that magnetic susceptibility decreased towards the northwest corresponding with the contrast in magnetic responses noted above and a possible site boundary associated with the topographical slope. This appears to indicate an "on-site" to "off-site" transition that would correlate with the distribution of surface artifacts and subsurface magnetic anomalies.

FGS survey at this site identified several magnetic anomalies, however, their interpretation is challenging. There are numerous simple dipole anomalies that likely represent modern debris (ferrous objects). A few of the dipole anomalies in survey zone A may relate to burning as well and so should be further investigated with test pitting and/or hand-auguring. The "boundary" noted in Figure 6.12: 1 is difficult to interpret but there is a substantial change in the background magnetic “noise” as one moves towards the north of the survey area and the MSS and surface artifact distribution supports the interpretation that these are two very different zones. A future expansion of FGS, MSS and subsurface testing would be required to support more detailed interpretations of this site.

6.6 MA30

This site is located 0.36 km south from the Anka Siget tell site (Fig. 6.4). The survey was rectangular in shape with twelve 20m x 20m grid units (0.48 ha) and was located in a field of alfalfa (Figs 6.15-6.17). There was a slight elevation decrease towards the north and the grids were placed in an attempt to identify a possible enclosure boundary or ditch.

There were numerous major and minor magnetic anomalies identified within the survey area. There were several small (1-2 m diameter) to medium (2-3 m diameter) infilled pit like (monopolar positive) anomalies with two additional large pit like anomalies (10-12 m diameter) identified (Figs 6.16 & 6.17: 1 & 2). In addition, numerous simple and complex dipole anomalies were noted that likely relate to intrusive metal objects within the survey zone. Two large complex dipolar anomalies were identified near one of the large pit like anomalies (Fig. 6.17: D and 1) and likely relate to historic debris and/or structures. One dipolar simple-concentric anomaly was identified in the eastern area of the survey (Fig. 6.17: E).

Due to time constraints and the survey zone being placed within a field of alfalfa, where it was not possible to access bare soil without digging below the root level of the crop, no MSS was conducted at the site.

FGS survey at this site identified several magnetic anomalies. The two large pit like anomalies are difficult to interpret but may be historical “barrow pits” for the dumping of waste. This would be most likely associated with the pit in the northeastern zone of the survey (Fig. 6.17: 1), however, the second large pit does not appear to have any simple or complex dipolar anomalies associated with it and this should be investigated further through auguring or test pitting (Fig. 6.17: 2). No anomalies that may be associated with linear/curvilinear enclosure features such as ditches or trenches were identified in the survey. Several monopolar anomalies are interpreted as infilled pit features and these also should be further explored through auguring. As noted above, one dipolar simple-concentric anomaly was identified (Fig. 17: E) and this should be examined more carefully. Archaeologically, such anomalies may relate to burned features such as pits, hearths, furnaces, etc.

6.7 BA65

This site is located 9.38 km to the southwest of the Anka Siget tell site (Figs 6.4 & 6.18). Two survey zones were selected, survey A was located within a plowed filed (twenty-three 20m x 20m grid units, two of which were partial grid units; 0.90 ha). Survey B was located within a field of grain to the northeast of survey A (seven 20m x 20m grid units; 0.28 ha) (Figs 6.19-6.22). The areas chosen for the surveys were determined through distribution of surface artifacts found during the pedestrian survey (survey A) and a topographical feature that resembled a barrow mound (survey B). Survey A was located in an area that was elevated topographically near the center of the survey area and decreased in elevation to the north and south ends of the survey zone. Grid placement in this area was done in such a way as to potentially correspond with prehistoric subsurface enclosure features that may have been placed near the periphery of the site and the transition from higher to lower elevation areas. (e.g. ditches, palisades, etc.) (Fig. 6.22). Magnetic susceptibility survey also was conducted in Survey A over an area of twenty 20m x 20m grid units with samples being taken every 10m across the gridded zone (0.8 ha) following the sampling procedures outlined above for other sites.

Results from FGS indicated a variety of major magnetic anomalies. These included monopolar pit like anomalies and linear ones that are interpreted as relating to “wall bedding trenches” (Fig. 6.23: 1 & 2). These may relate to architectural foundation features for prehistoric houses. Such anomalies were identified in the 2017 survey (Hanks et al. 2017) at the Anka Siget tell site and were confirmed through ground truthing during test excavations there (Nicodemus 2018: 14). Numerous small (1-2 m diameter), medium (3-4 m diameter) and large (5 m diameter) infilled pit like anomalies (monopolar positive) also were identified across the survey zone. Some of these appear linear in shape and may relate to other prehistoric architectural features. However, these were not as clear definable as those noted in Figure 6.23:1 & 2.

There were only a few simple dipole anomalies identified at the site and the survey data are largely unaffected by metal objects. No linear or curvilinear anomalies were identified that might relate to an enclosure system for the site, such as those noted above for MA17 and at the Anka Siget tell site (Hanks et al. 2018).

Results from FGS indicated a variety of major magnetic anomalies in this survey zone as well with most being related to linear and curvilinear monopolar anomalies (Figs 6.22, 6.25 & 6.26). Although similar to the potential “wall bedding trenches” identified in Survey A, those in Survey B appear to relate to rectangular structures but with larger overall dimensions (width and length) than those in Survey A (Fig. 6.26: 3).

The FGS survey also identified a circular ditch like anomaly and curvilinear anomaly that is only partially revealed within the survey zone (Fig. 6.26: 1 & 2). The round ditch anomaly corresponds to an area that is elevated within the topography and resembles a burial mound feature. Four simple dipole anomalies also were identified that may relate to modern metal objects within the survey area and one large complex dipolar anomaly was located near the field boundary that also likely relates to modern intrusive material.

As noted above, MSS was conducted in the Survey A zone and yielded very good results. There appear to be to main zones with soils of higher magnetic susceptibility (Fig. 6.24). Similar results were obtained through MSS at the Anka Siget tell site in 2017 (Hanks et al. 2018) and are interpreted as corresponding to enhanced anthropogenic activities (e.g. middens, economic activities, etc.). There also does appear to be a transition to lower magnetic susceptibility in both the north and south zones of the survey area and this may relate to the periphery of the settlement/occupation area of the site (Fig. 6.24). This does appear to parallel the natural topography of the site location.

FGS and MSS both produced excellent data at the BA 65 site. Subsurface magnetic anomalies correspond with those that would be expected from Bronze Age settlements in the region and are analogous to those encountered at the Anka Siget tell site in 2017 and 2018 (Hanks et al 2018a; 2018b) (e.g. infilled pit features, wall bedding trenches, enhanced soil magnetic susceptibility, etc.). Both FGS and MSS should be extended across the entirety of the “site” where surface collection indicates potential Bronze Age activities.

The topography of the site is very interesting, as it represents a peninsula of higher elevation (site area) surrounded by a broad lower elevation zone. MSS suggests soils of higher susceptibility across the higher elevation area as one might expect for site occupation in this area.

FGS results in Survey Area B also were very good, however, interpretation of the circular, linear and curvilinear anomalies is somewhat challenging. Neolithic artifacts were collected near these subsurface features during the pedestrian survey and therefore it is possible that these relate to a different period (Fig. 6.25). It will be necessary to consider possible analogies from site excavations within the region to better interpret these anomalies.

Overall, FGS and MSS should be further extended at site BA 65 as this may greatly assist in interpreting the site. It should be noted, however, that modern mechanized agriculture (e.g. plowing) may have compromised some subsurface features at the site. An indication of this may be associated with the possible wall bedding trenches in Figure 6.23: 1 & 2, as these appear to only be partially visible through magnetic survey. Test excavation would be needed to confirm this.

6.8 BA31

This site is located 10.13 km to the southwest of the Anka Siget tell site (Figs 6.4 & 6.18). Due to time constraints (i.e. last day available for survey), a single rectangular survey area was organized in a grain field that comprised four 20m x 20m grid units (0.16 ha). (Figs 6.27-6.30). There was a slight elevation rise near the center of the survey zone and the survey grids were placed to bisect this area. Magnetic susceptibility survey also was conducted with one single transect west to east utilizing the grids established for FGS.

Results from FGS indicated a variety of major magnetic anomalies. These included monopolar positive pit like anomalies in the range of 1-5 m in diameter. Linear infilled trench like anomalies (monopolar positive) also were identified in the eastern area of the survey and appear to define a rectangular feature (Fig. 6.30 & 6.31). This does appear similar to those encountered in Survey Zone B at the BA 65 site and have a very similar northwest to southeast long axis orientation and may relate to wall bedding trenches for house structures.

The results of this exploratory survey (single transect) indicated that magnetic susceptibility increased as one moved eastwards across the topographically elevated area of the survey (Fig. 6.32). Additional samples were included that extended westwards (4 samples) and eastwards (3 samples) from the FGS survey area. This was done to increase the number of samples that bisected the elevated area. This provided a more robust set of data indicating higher and lower magnetic susceptibility values as one moved along the long axis of the survey area and may indicate an "on-site" to "off-site" transition.

FGS and MSS both produced excellent data at the BA 31 site. Although the surveyed area was a small sample of the larger site area, as determined through pedestrian survey and surface artifact collection, they were successful in identifying numerous magnetic subsurface anomalies and clear variability in soil magnetic susceptibility at the site. Both warrant additional surveys at the site.

6.9 Conclusions and recommendations for future geophysical research

Geophysical surveys conducted at the five identified sites contributed important information on subsurface magnetic anomalies likely relating to infilled pit features, enclosure or boundary features (ditches, trenches, palisades, etc.), and possible burned structures or features. The collected geophysical data, combined with the spatial distribution of surface artifacts, will significantly inform future research at these sites. In particular, MA 17, BA 65 and BA 31 are all excellent candidate sites for extended geophysical surveys utilizing both FGS and MSS. Key anomalies have already been identified through the March 2019 survey that warrant further examination and ground truthing through auguring and/or test pit excavation. MA 28 and MA 30, while providing important information, require some form of ground truthing before additional FGS and MSS are employed at these sites. Auguring and/or test excavation of positive monopolar infilled pit features and potential subsurface burned features. In the latter example, the anomaly at site MA 30 (E) should be investigated as this could be some form of thermal feature such as a hearth, furnace, burned pit, etc.

It is important to restate that further FGS survey would benefit by employing a denser data collection method by overlapping probes on survey transects. In this case, data would be collected every 0.50 m along the X axis rather than every 1 m and this may allow for the identification of smaller diameter features such as architectural post molds, pits, etc. The surveys presented in this report do indicate that the courser method of data collection (1 m transect spacing) is acceptable for identifying potential archaeological features. This also provides for a more rapid coverage of large survey areas. However, select areas of the course surveys should then be resurveyed in a more detailed manner with 0.50 m transect spacing to potentially provide more accurate and detailed plots of magnetic anomalies and to ensure that others are not being missed.

The results achieved through MSS, particularly at MA 17 and BA 65, Survey Zone A, were excellent and indicate that this method should be employed with FGS whenever possible. It should be noted that to better develop MSS at these sites small cores of subsurface samples should be taken in conjunction with the locations where surface soils are being measured for comparison. The collection of soil samples would provide for later processing in a laboratory setting and a finer grained approach to the analysis of MSS at both high and low frequencies and the drying and sieving of soils to measure different fractions for magnetic susceptibility. As pedogenic enhancement can frequently be related to anthropogenic activity, MSS is an exceptionally valuable geophysical prospection method (Dalan 2006: 176).

Table 17 General information relating to surveyed archaeological sites.

Site	Period	Methods	Geophysics Coverage	Site Size	Artifacts Collected	Artifact Density
MA 17	Neolithic, BA, LBA	FGS; MSS	0.8 ha	4.7 ha	500	106 art/m²
MA 28a & 28b	BA	FGS; MSS	MA 28a: 0.64 ha; MA MA 28b: 0.4 ha	2.2 ha	300	136 art/m²
MA 30	Neolithic, BA	FGS	0.48 ha	0.53	18	34 art/m²
BA 65a & 65b	BA, LBA	FGS; MSS	BA 65a: 0.92; BA 65b: 0.28 ha	9.5	604	63 art/m²
BA 31	BA, LBA	FGS; MSS	0.16 ha	0.8	55	68 art /m²

** FGS = fluxgate gradiometry survey, MSS = magnetic susceptibility survey, ST = Single Transect, GS = Grid Sampling; BA = Bronze Age; LBA = Late Bronze Age*

Figure 40 Google Earth satellite image showing location of 5 principle Bronze Age sites in the northern zone of the survey region: Anka Siget tell site, MA 17, MA 28 and MA 30.

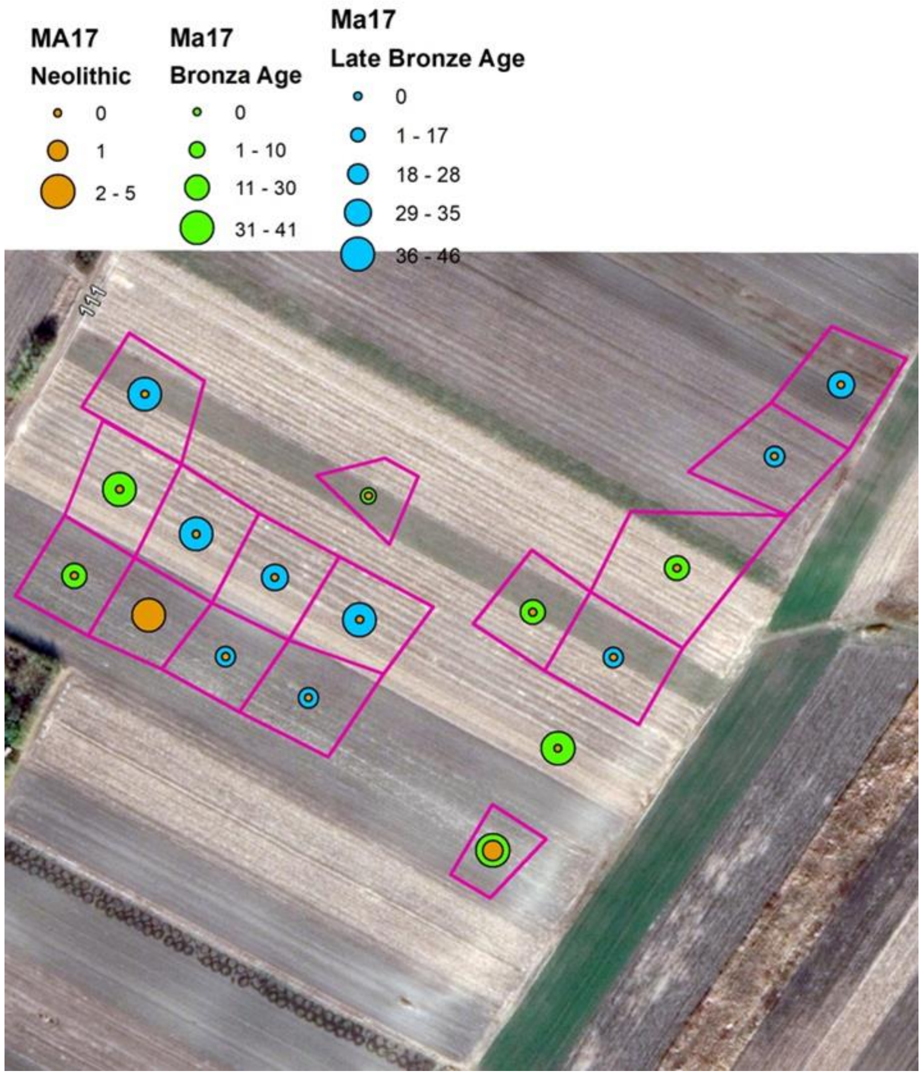


Figure 41 Plot of surface artifacts across MA17 site area from dissertation regional pedestrian field survey.

Figure 42 MA17 site. Top – greyscale plot of fluxgate gradiometry; Bottom – plot of magnetic susceptibility of surface soils over gradiometry plot, red indicates higher magnetic susceptibility and blue indicates lower susceptibility (10-5 SI).

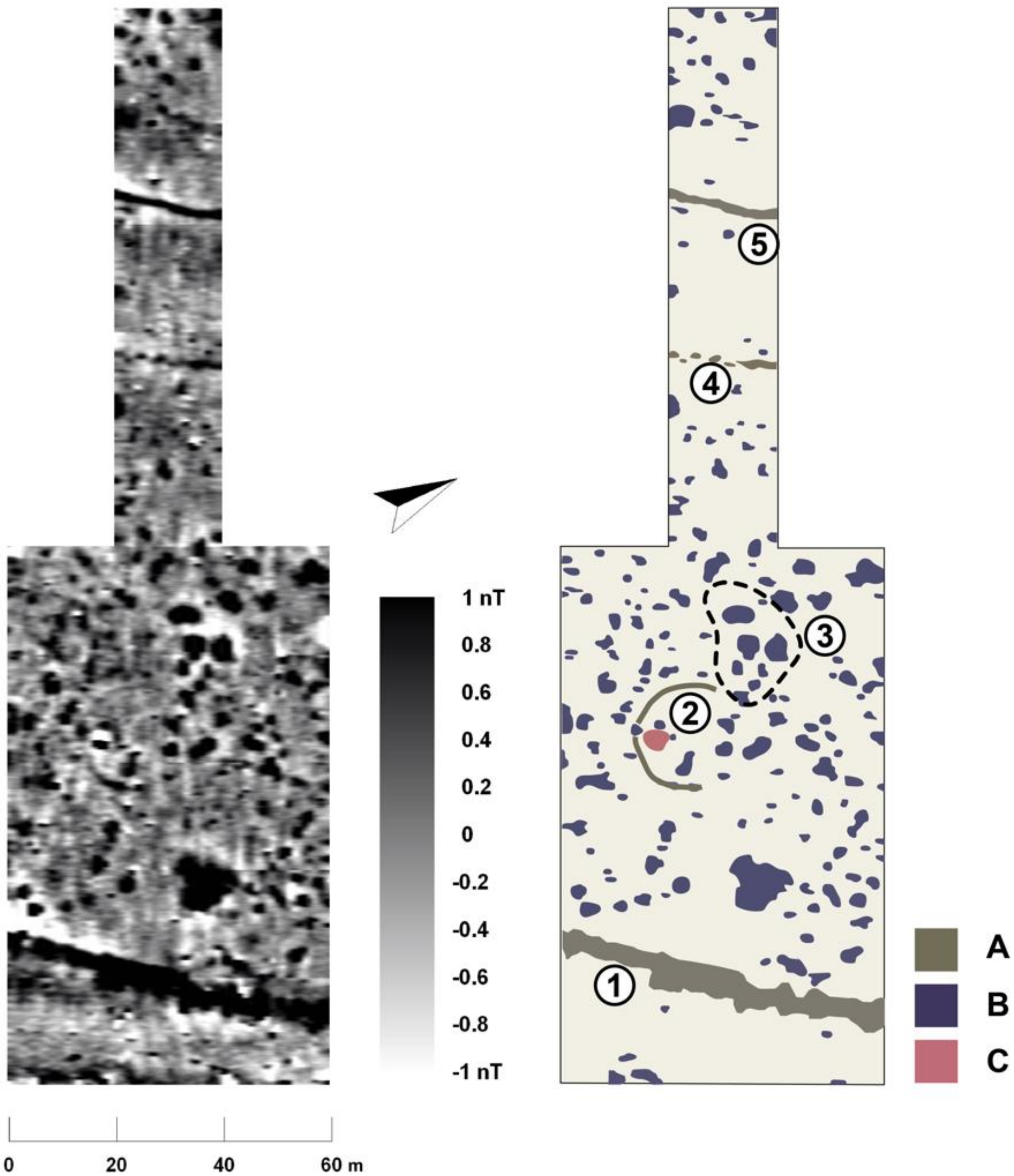


Figure 43 Site MA 17; Left - fluxgate gradiometry greyscale plot; Right – interpretation of magnetic anomalies: A – probable in-filled ditch or trench feature; B – probable infilled pit features; C – modern ferrous object (simple dipole).

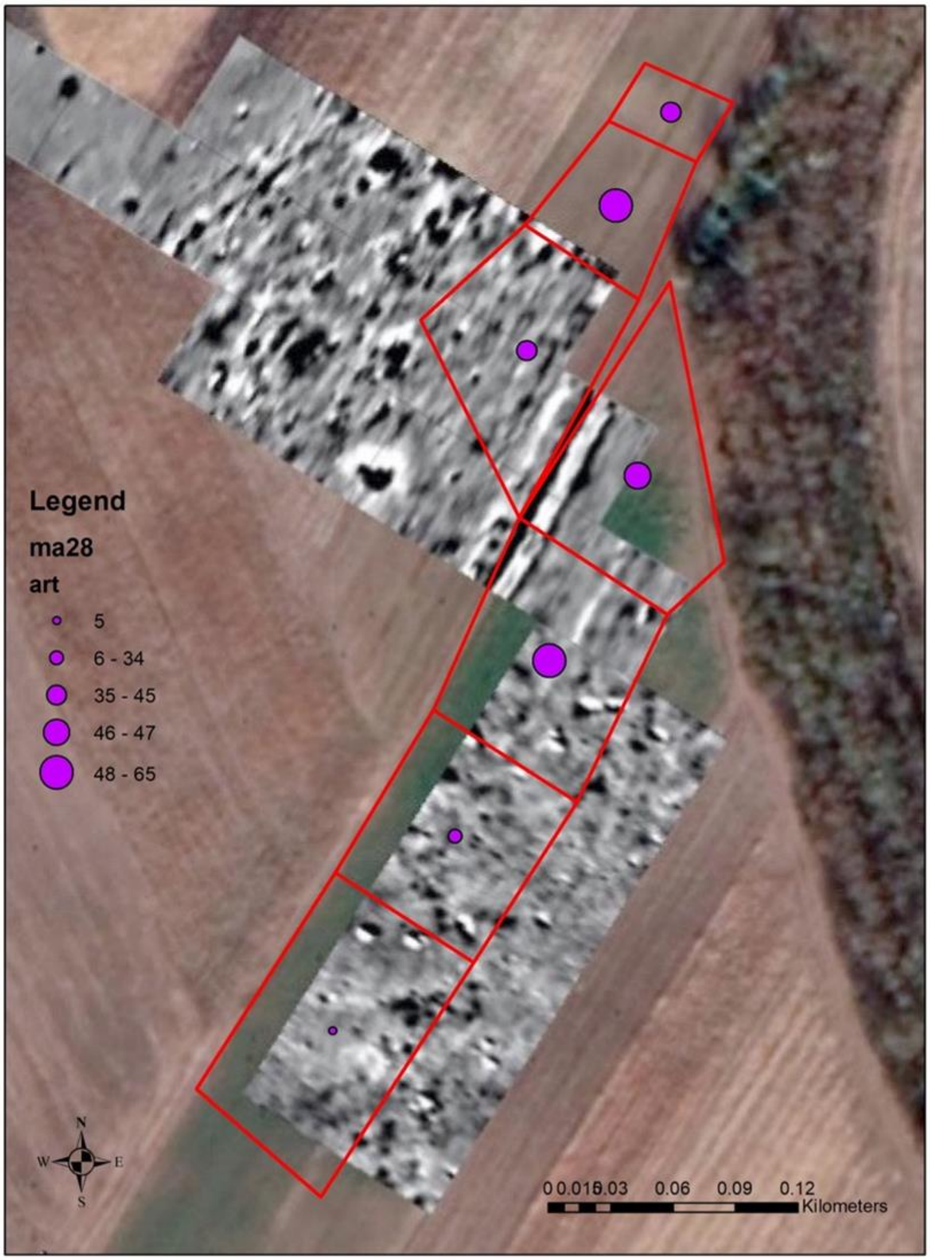


Figure 44 Plot of surface artifacts across MA28 site area from dissertation regional pedestrian field survey

Figure 45 Greyscale plots of fluxgate gradiometry surveys of site MA 28.

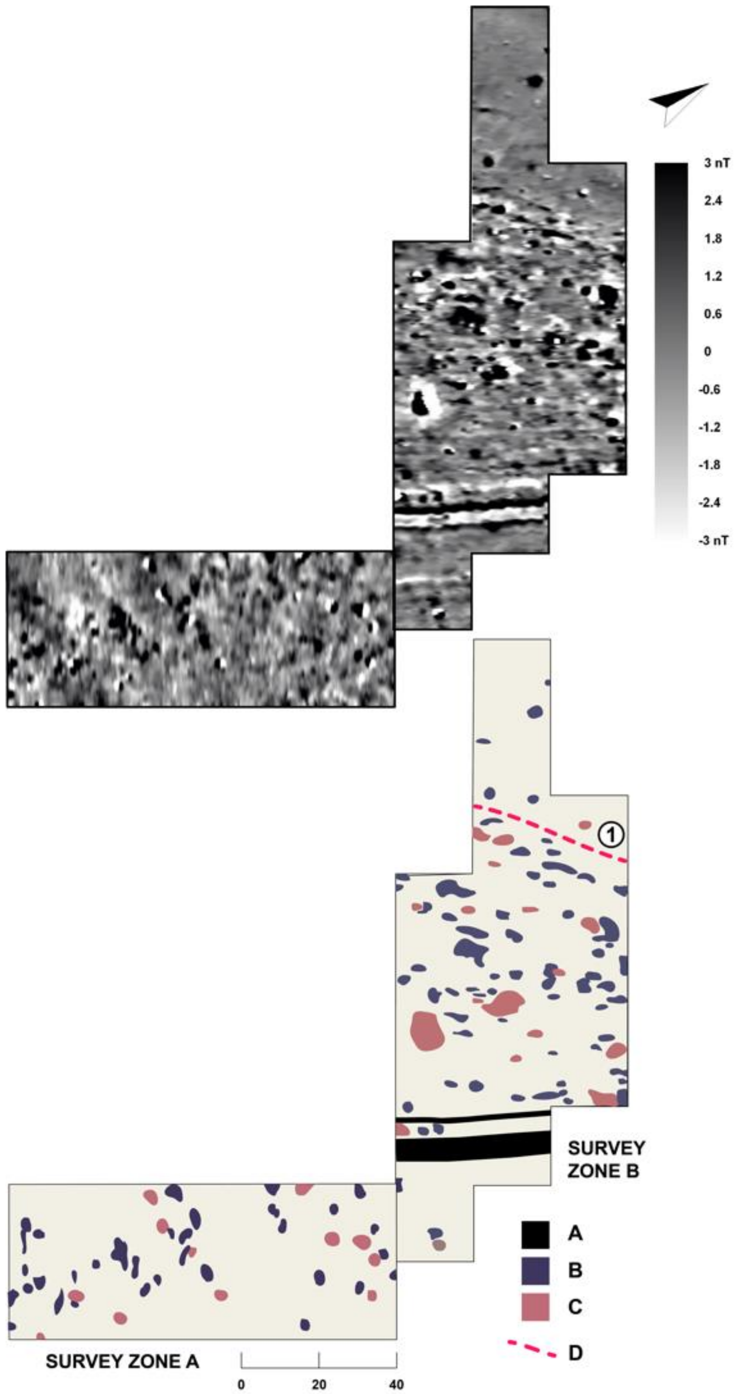


Figure 46 Site MA 28, Survey Zones A & B; Left - fluxgate gradiometry greyscale plot; Right – interpretation of magnetic anomalies: A – infilled ditch-like anomaly; B – infilled pit-like anomaly; C – simple or complex dipole anomaly (e.g. ferrous object and/or burned soil); D – boundary between highly magnetic area to the southeast and less magnetic area to the northwest.

Figure 47 MA28 site. Plot of magnetic susceptibility of surface soils over gradiometry plot of Locus A. Size of bubbles represents higher to lower values (10-5 SI), large to small, respectively).

Figure 48 Plot of surface artifacts across MA30 site area from dissertation regional pedestrian field survey.

Figure 49 Fluxgate gradiometer plot of MA 30 site

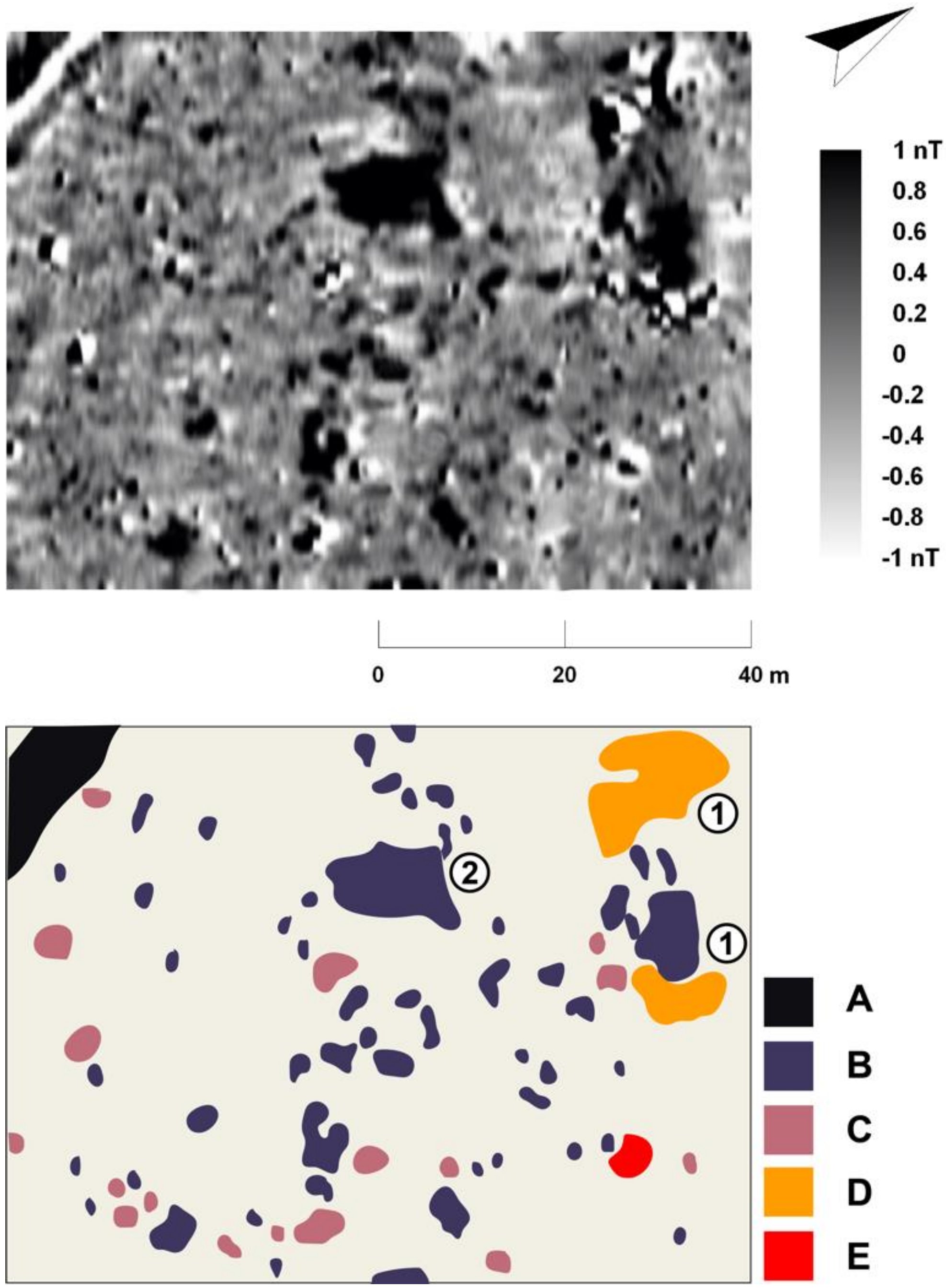


Figure 50 Site MA 30; Top - fluxgate gradiometry greyscale plot; Bottom – interpretation of magnetic anomalies: A – modern field boundary; B – likely infilled pit-anomaly; C – simple dipole anomaly, (e.g. metal object); D – complex dipolar anomalies (e.g. probable historic refuse or structure remains); E – dipolar simple-concentric (e.g. cylindrical pit or other feature with burned soil).

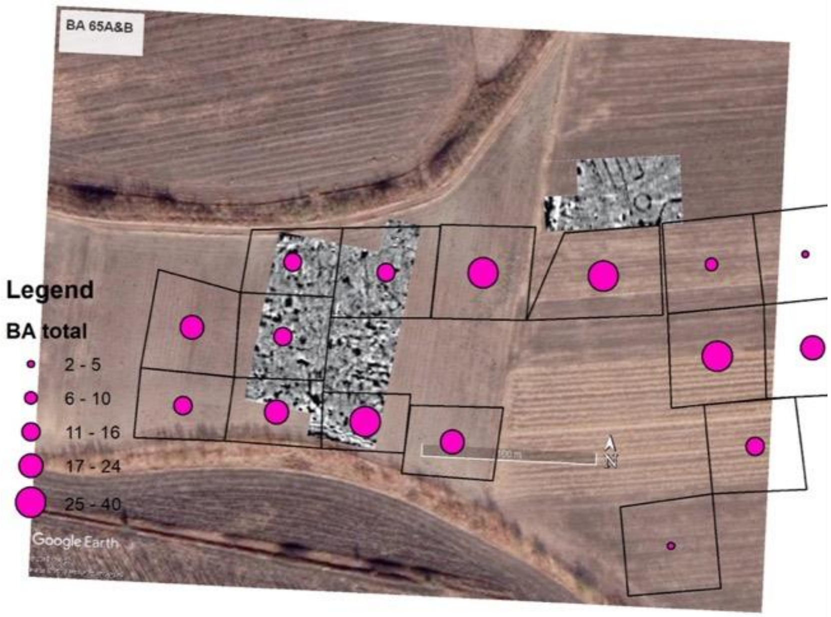


Figure 51 Plot of Bronze Age surface artifacts across BA65 site area from dissertation regional pedestrian field survey.

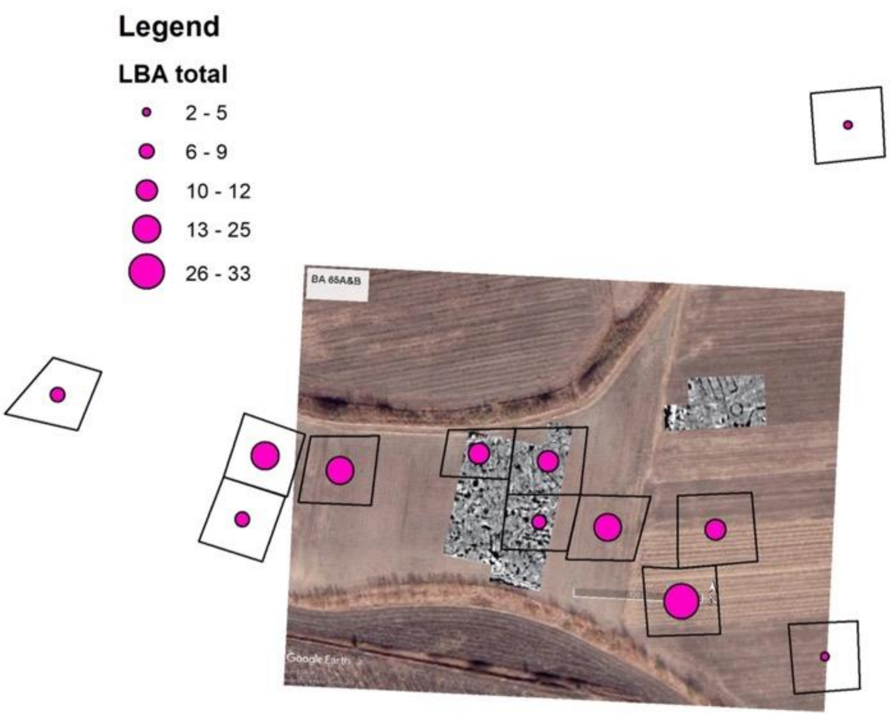


Figure 52 Plot of Late Bronze Age surface artifacts across BA65 site area from dissertation regional pedestrian field survey.

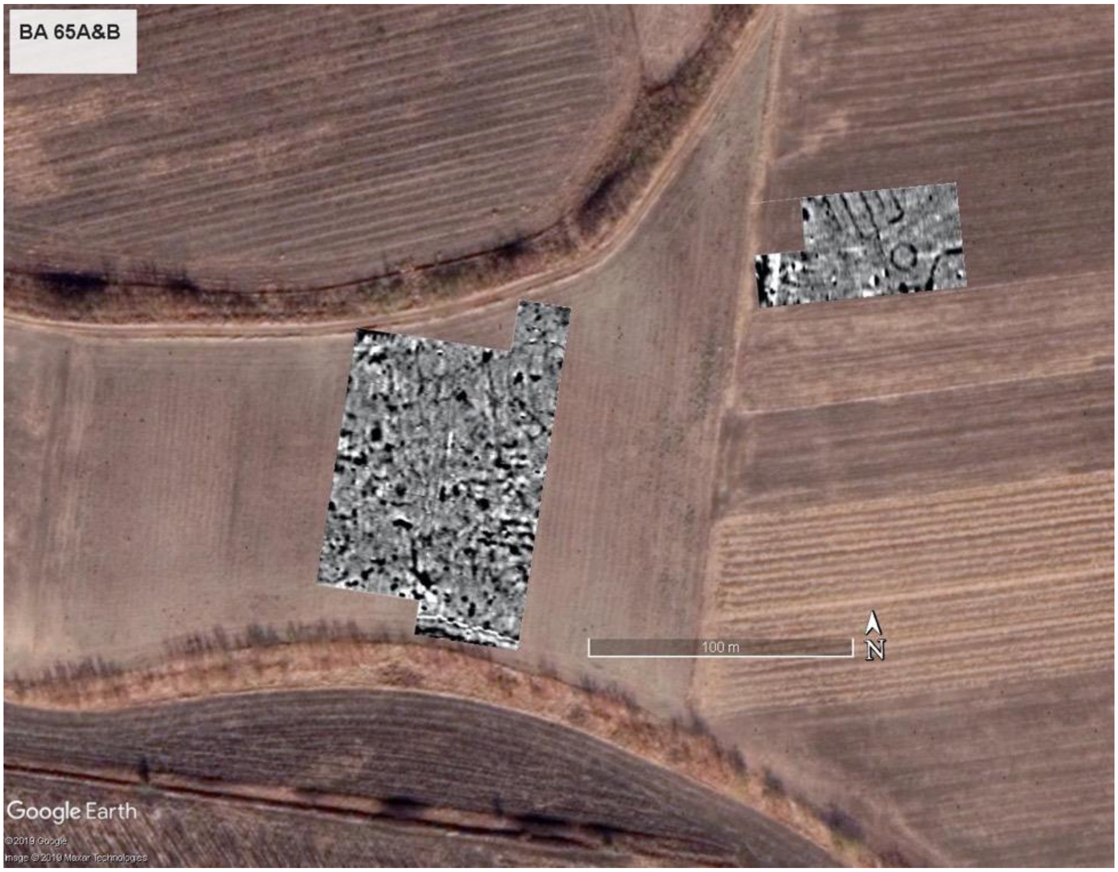


Figure 53 Fluxgate gradiometer survey plots of BA 65 site, Survey Zones A (left) and B (right).

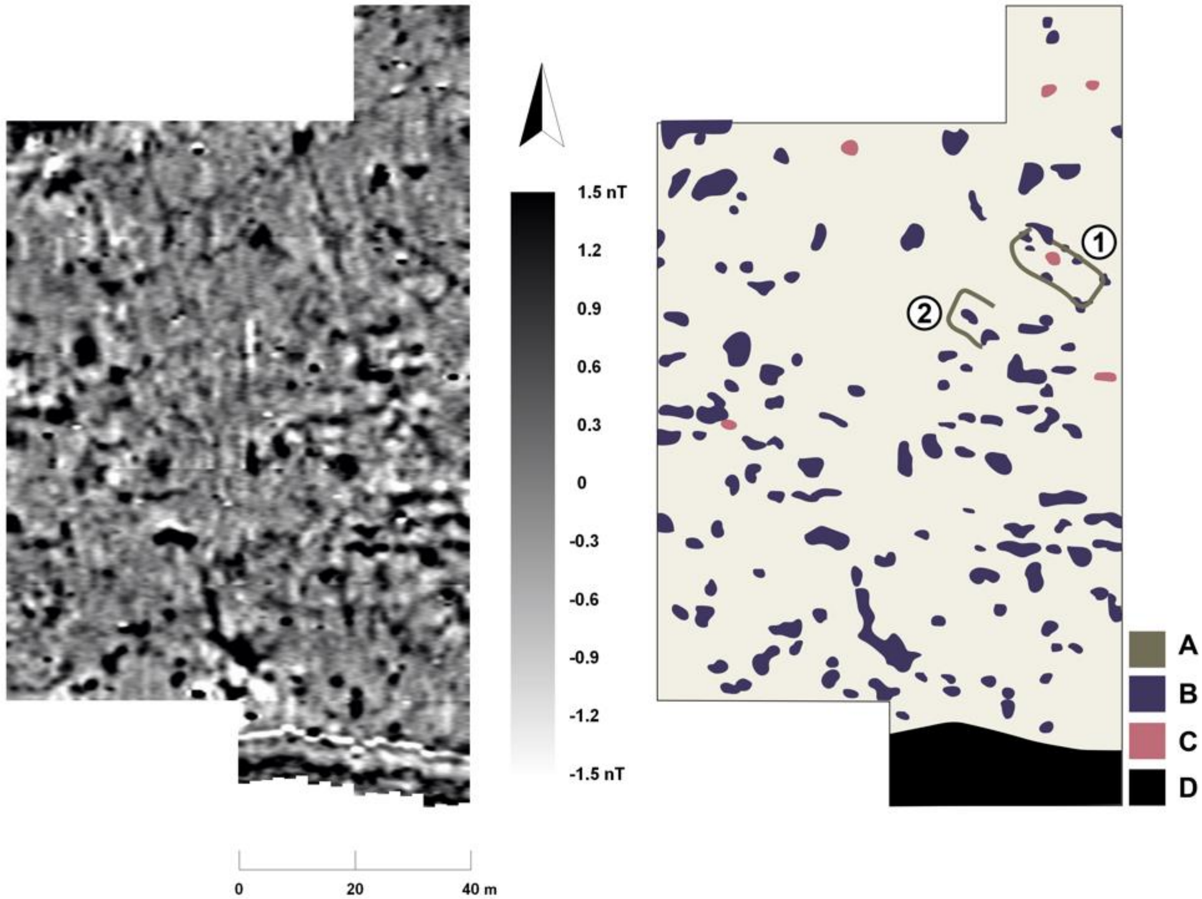


Figure 54 BA 65 Site, Survey Zone A. Left - fluxgate gradiometer greyscale plot; Right – interpretation of magnetic anomalies: A – modern field boundary; B – probable infilled pit anomaly; C – simple dipole anomaly, (e.g. iron object); D – probable prehistoric house foundation trench anomaly.

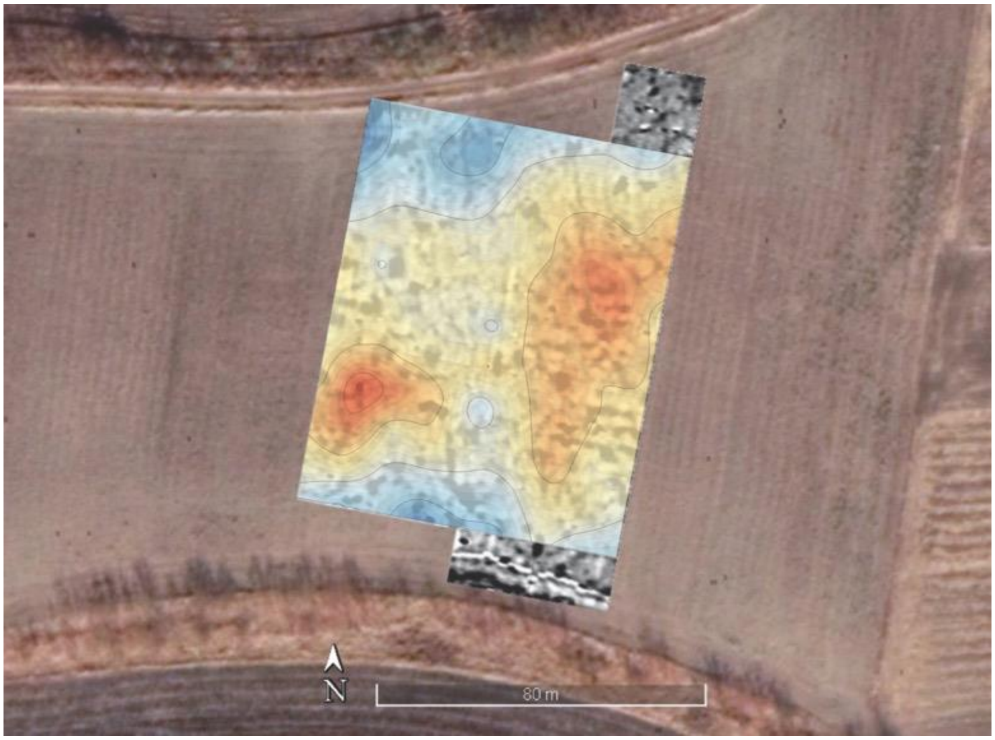


Figure 55 Plot of magnetic susceptibility of surface soils over gradiometry plot at site BA 65 zone A (red represents higher and blue represents lower magnetic susceptibility values (10-5 SI).

Figure 56 Plot of Neolithic surface artifacts across BA65 site area from dissertation regional pedestrian field survey.

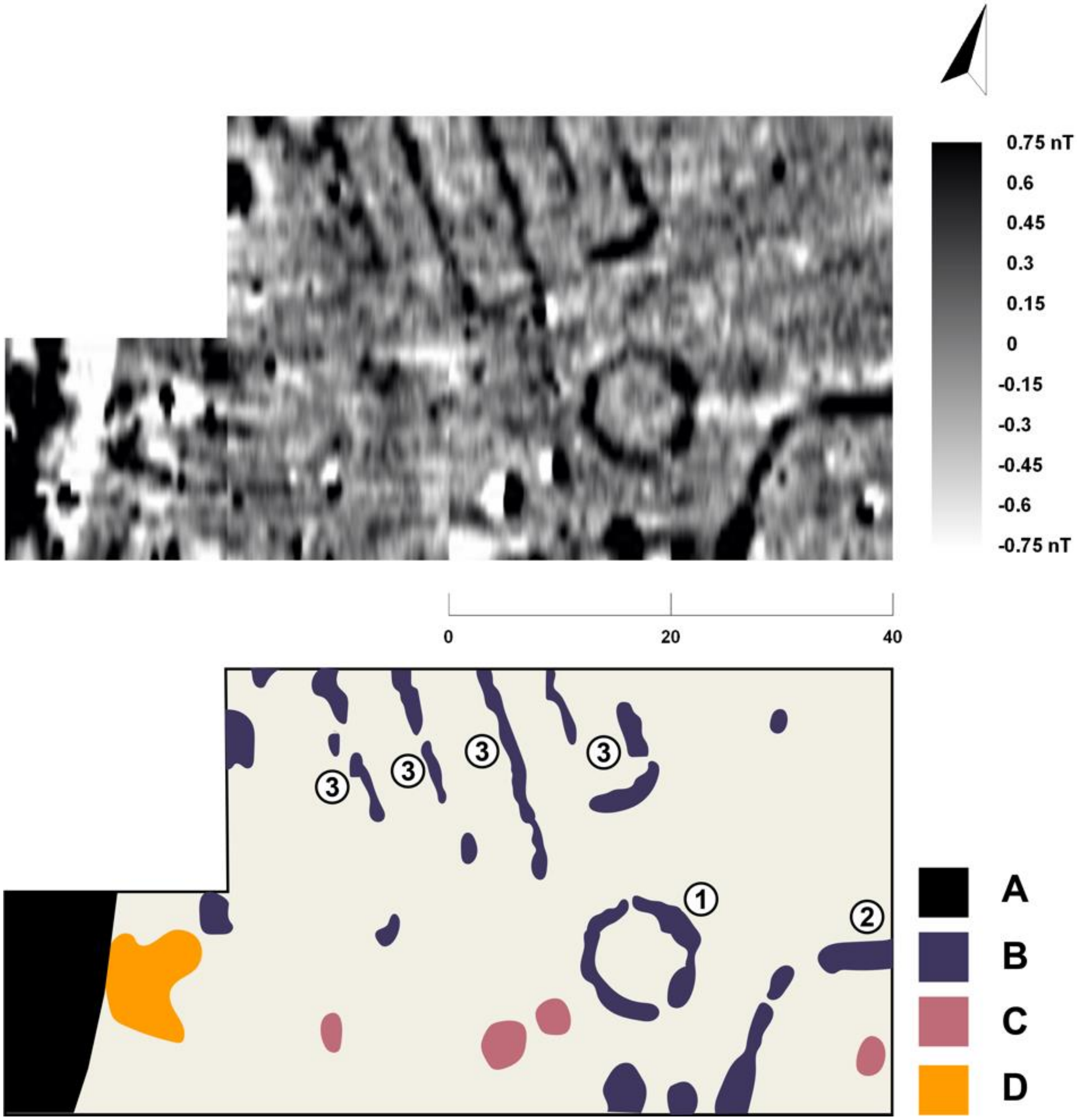


Figure 57 Site BA 65, Survey Area B; Top - fluxgate gradiometry greyscale plot; Bottom – interpretation of magnetic anomalies: A – modern field boundary; B – likely infilled pit-anomaly; C – simple dipole anomaly, (e.g. iron object); D – complex dipolar anomaly (e.g. modern intrusive material).

Figure 58 BA 31. Plot of collection samples of surface artifacts (Bronze Age) across site area from dissertation regional pedestrian field survey.

Figure 59 BA 31. Plot of collection samples of surface artifacts (Late Bronze Age) across site area from dissertation regional pedestrian field survey.

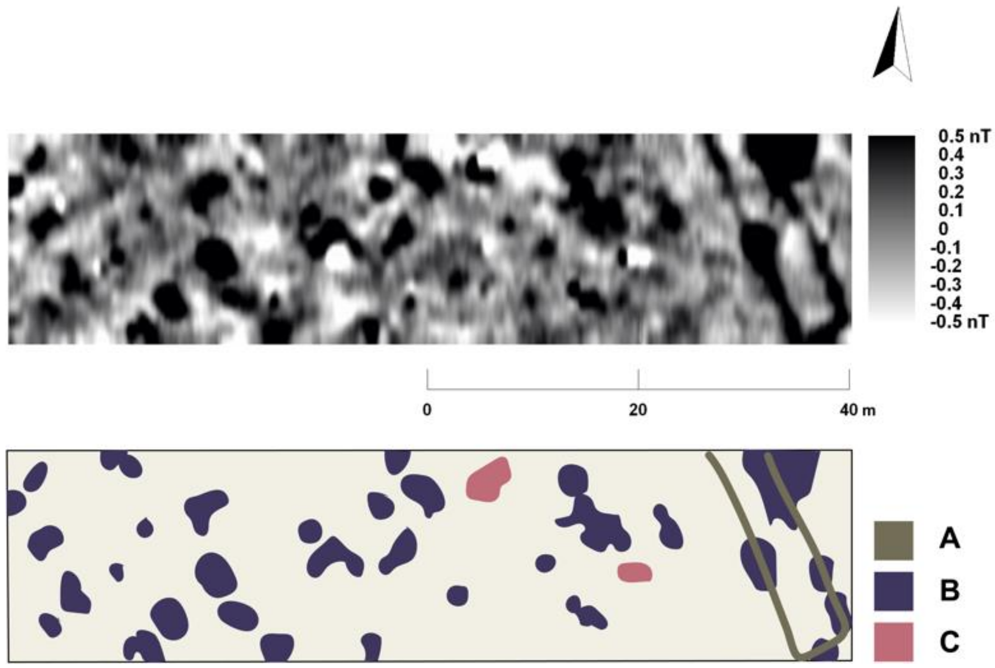


Figure 60 Site MA 31; Top - fluxgate gradiometry greyscale plot; Bottom – interpretation of magnetic anomalies: A – linear trench; B – infilled pit; C – simple dipole anomaly, (e.g. intrusive metal material).

7.0 Conclusion

In this final chapter, the discussion will return to the research questions introduced in Chapter 1. These questions strongly structured the objectives of the dissertation field research, subsequent data analyses, and interpretation of key social, economic, and political trends within the region under study. The methods used to address the questions were described in Chapters 3-6.

The main goal of these heuristic tools was to assess social political trajectories of the communities of the Northern Banat Region during the late prehistoric period and, in particular, the Neolithic, Early to Middle Bronze Age and Late Bronze Age phases. The research questions will be restated below with a discussion of the results and interpretations gained through the doctoral research. These results are then discussed within the broader context of "big picture" perspectives on trajectories of socio-political developments, trends in inequality, and demographic and centralization tendencies within the region based on settlement patterning study and artifact analysis.

7.1 Research Question #1

What is the spatial and demographic scale of late prehistoric communities in the Northern Banat region? How does this change diachronically from the Neolithic to the Bronze Age?

As seen in Chapter 3, the combined methods of surface collection and laboratory analyses were used to create a data set that was spatially analyzed using GIS software tools to address the research question. For the Late Neolithic period, as demonstrated in Chapters 3 and 4, it was possible to delineate 30 local and 3 super local communities with a total population estimations of approximately 3,200 people for the region. Local communities vary in size with the majority (70%) falling between 0.3 and 0.7 ha in size with estimates of population ranging from 6 to 60 people. Higher demographic estimates, represented by communities between 0.8 and up to 3.8 ha in size, had population estimates ranging from 100 to 700 people. The largest settlement identified in the survey zone is N28 (3.8 ha and 700 people), which is located in the southern supra local community. The next two largest settlements are N6 (1.6ha and 470 people), which is located in the central district, and N10 (2.6 ha and 470 people) that is located in the northern district. While all three supralocal communities are of roughly the same size in terms of territorial coverage, demographic estimates vary significantly. The central local community appears to have been less populated than the other two with only 3 local communities and 20% of the population, as opposed to 11 (38%) for the North and 7 local communities (33%) for the South. Of particular note is that local communities N18-N22 do not appear to have had the demographic potential to form a supra local community on their own – as they only represented 9% of the total population in the region during this period.

The Early and Middle Bronze Age period is vastly different. As demonstrated in Chapters 3 and 4, 33 local communities were delineated, which does not stand in stark contrast to the previous period, but based on the survey data it appears that only one supra local community emerged. Population estimates indicate a significant increase to around 5,000 people for the region. The largest community identified is B10 (8.1ha) where almost half of the population of the entire region (45%) was residing. Again, the majority of communities (78%) can be classified as relatively small with population estimates between 3 to 100 people, which also does not strongly contrast with the previous period. It may be argued that the entire region falls under the domination of the local community B10, which incorporates the tell site of Rabe Anka Siget. While the majority of the regional population outside of the B10 local community was situated in the north of the region in close proximity to B10 itself, B22 (4% and 3ha) and B27 (8% and 5ha) stand in stark contrast to this as they are located in the south of the region. In any case, these two local communities are still firmly under the demographic pull of the regional supra local structures(Fig 7.2).

Finally, analysis for the Late Bronze Age period yielded 28 local communities and 2 supra local communities. Population estimates for this time period are only 800 - 900 people, signaling a sharp demographic decline. During this period, 82% of the local communities can be considered as relatively small with estimated populations ranging from 2 to 75 people and occupation areas from 0.01 ha to 1ha. The largest local community is L12 (3ha), which represented 22% of the total regional population estimate, and was situated in the identified northern supra local community. This is represented by the site of MA17 where the best examples of the Belgish type pottery were recovered during the regional survey. The next largest local communities are L27 (14%), L26 (12%) and L23 (9.5%) – all of which are situated firmly in the center of the southern supralocal community. This district is also where 68% of the total population lived during the Late Bronze Age with the remaining 32% located in the northern supra local community (Fig. 3.8;3.9).

As explained above, and as represented in Table 7.1 the demographic scale of the late prehistoric communities of the region underwent significant change diachronically. While we see a relatively stable number of local communities, their populations reflect greater variability. This ranges from a significant increase during the entire Maros phase (Early and Middle Bronze Age) with a drastic decline by the Late Bronze Age. A shift in the nature of the local community structures is also notable: 3 supralocal communities (districts) of the Late Neolithic transform in to 1 during the Maros phase and are again dissolved after the end of Maros in tandem with an overall population decline for the region. Regional polity integrated, during Early and Middle Bronze Age a high proportion of the survey area population which could very well be a sign of a period of vastly increased spatial and demographic scale of political integration signaling the emergence of a polity and its disintegration in the Late Bronze Age.

7.2 Research Question #2

Can settlements be identified by the Bronze Age with evidence of centralization of resources, craft production, and supra local exchange? Do these settlements exhibit substantial demographic growth or are populations still dispersed in smaller farmsteads at the local and regional scales? Is there evidence of settlement enclosure and fortification and how does this co-vary with more centralized sites?

7.2.1 Centralization Tendencies

As shown in Chapter 4, using the B coefficient method, there are several differences related to the demographic centralization of the region not only diachronically but also between different supra local communities within the same periods. The results discussed in detail in Chapter 4 indicate that the southern Late Neolithic supralocal community was strongly centralized and the northern one was comparatively less so. However, the central supra local community can still be considered as centralized and falls closest of all 3 supra local communities to the mean value (0.64) of the B coefficient. While the northern and southern supralocal communities seem different in terms of centralization, their demographic size estimates are not very dissimilar with the northern community being somewhat larger. Nevertheless, the largest demographic center for the Late Neolithic period reflects the least centralized community. This characterization of the Late Neolithic is somewhat similar to the one found in the western Liao Valley of China during the Hongshan period (Drennan and Peterson 2008). However, the Late Neolithic of the broader region, be it either the Tisa or Vinča cultures, as described in Chapters 1 and 2, represents a period of relatively low levels of social organization.

Demographic aggregation during the Neolithic is evident, but it does not seem to be corelated with the rise of social inequality and economic differentiation within these communities. What the centralization analysis of the Late Neolithic Northern Banat region points to is very similar to what is expected in this case. Even though the B coefficient is relatively high, the mean value as well, there is still a high variability in the centralization of the communities which can suggest very different approaches to social organization with no overarching hierarchical structures.

As discussed above, the region is by the Early and Middle Bronze Age well integrated into one supra local entity and centralized regional systems emerged concurrently with hierarchical social organization, as evidenced in burials and domestic remains (Girić 1971; O'Shea 1996; O`Shea and Nicodemus 2018). Accordingly, the B coefficient value for this time period strongly suggests a centralized supra local community. The transition from Late Neolithic to the beginning of the Bronze Age Maros phase, as seen by these demographic and centralization results, is not at all different then how the trajectory is portrayed in the wider literature. With this transition, the entire region is strongly centralized by Rabe Anka Siget with potentially smaller outposts in local communities such as B22 (site BA51) and B27 (site BA65) (BA## stands for Banatsko Aradjelovo ##, a designations given by Banat Survey Project).

The Late Bronze Age represents another substantial shift in settlement patterning and demographic trends. The area becomes divided again by two strongly centralized supra local communities with very high B coefficient values. The southern district is most centralized but in contrast to the Neolithic this community is significantly more populated than the northern one. It is worth pointing out that the mean B coefficient centralization value is the highest of all three periods.

7.2.2 Social Aggrandizers: Craft production and Feasting

In Chapter 4, artifacts related to specialized craft production, feasting proportion ratios, and related spatial patterning indicate interesting differences between the three periods in question. For the Late Neolithic period, the local community N8, of the northern supra local district, stands out in terms of ceramic proportions. This community is not the demographic center of this district yet it has the highest proportion radio of all the communities in the survey zone. The other two supralocal communities of the Late Neolithic are different, and their demographic centers are precisely where the highest proportion of fine-ware pottery has been assigned. As discussed above, this same northern supra local community also has the lowest form of centralization. With that in mind, the fine-ware proportion ratio can serve as another indicator of how people were organized in this district, with two or more competing centers of feasting, as opposed to the one in a more centralized social context.

For the Early and Middle Bronze Age period, in terms of craft related artifacts and their spatial patterning, the interpretation is more straightforward and somewhat predictable. Nearly all the artifacts are located at or very near the tell of Rabe Anka Siget. This can potentially indicate specialized production, and in cases of brasiers, feasting activities may have been centralized on the tell itself. Fine-ware ceramic proportion distribution also seems to support this interpretation, as discussed in Chapter 4, and points to three other loci. In this case, the site B27 attracts particular attention as it may have been a potential provincial center or an outpost of some form (Fig. 7.1).

7.2.3 Enclosure and fortification

There is very little doubt that the tell site of Rabe Anka Siget had some form of fortification and enclosure based on interpretations of the fluxgate gradiometer surveys completed there (Nicodemus 2018; Hanks et al. 2018). Archaeological geophysics undertaken as part of this dissertation research in 2019 also indicate (detailed in Chapter 6) possible enclosed diches and/or palisades at the site of MA17. Site BA65 is another potential candidate where possible evidence of a ditch, or boundary zone, was identified through geophysical survey. In both cases it can be noted that there is a correlation with centralization and possible enclosure features. Site BA65 was a central part of a local community group that was most likely centralized during all three time periods. Site MA 17 was a central part of the centralized local community, most likely during the Late Bronze Age period. Further ground truthing, either through trench excavation or auguring, will be required to confirm these interpretations but the strong correlation with the regional demographic patterning and subsurface geophysical surveys are noteworthy and deserve further investigation.

7.3 Research Question #3

Does regional scale settlement patterning indicate settlement proximity to important natural resources (productive soils, grazing, etc.) and regional river waterways that could be associated with long-distance exchange? If such evidence exists, is this more closely associated with Bronze Age archaeological patterning?

7.3.1 Natural Resource Patterning in the Region

As seen in chapter 5 for the Late Neolithic period, correlations between soil type and human demography are inconclusive. For the Early and Middle Bronze Age and Late Bronze Age periods the correlation analysis results are more revealing, however, the results are negative. This would suggest that there is no direct correlation for the population distribution and the soil quality during and after the Maros cultural phase in the region. This result may indicate that the populations were not invested in maximizing their agricultural productivity and is therefore contrary to a response that is frequently triggered by increased population pressure. It is possible that landscape use during this period was more specialized in some way.

Based on the data in Table 5.5, demographic trends do vary when compared to zones of higher soil productivity. This could be interpreted in relation to farming practices varying by period and through different forms of social organization across the region. Such patterns may also signal the changing oscillations in desire for producing different commodities in order to follow shifting exchange trends locally or regionally. During the Maros phase there appears to be more interest in using soils of relatively poorer quality that are better suited for livestock grazing. This may signal an increase in population pressure and/or an interest in intensifying the production of cattle and horses for local and/or regional trade. It should also be pointed out that, based on Figure 5.3, the most densely occupied area (Rabe Anka Siget tell and surrounding local communities) is the area within the region with the highest access to the richest soil type in terms of agriculture (Calcareous chernozem– rank 6). No such observation can be seen for the Neolithic and Late Bronze Age periods.

7.3.2 Rivers and Waterways

The data analysis presented in Chapter 5 suggested that proximity to rivers, as important conduits for long distance communication and trade, was an increasingly important influence on demographic patterns by the late prehistoric period in the Northern Banat Region. Table 5.6 indicates a clear correlation with placing settlements relatively close to one of the major rivers by the Late Neolithic. A sharp difference is apparent in the Table 5.2 results for the two later periods and may be explained by vastly different regional distributions of people and supralocal community structures. The lower value in the percentage of people living in proximity to rivers for the Early and Middle Bronze Age may be a product of social complexity in that this encouraged more specialized communities (hubs) that depended on the rivers for trade and communication. In fact, since Zlatica is the river that was likely to be the most easily navigable at this time (Based on its size and lack of significant signs of meanders and old riverbeds) ,this may explain an important conduit for trade with the Bronze Age tell site of Pecica located in present day Romania. Additionally, this might be the reason why provincial centers, or an outpost in the south of the Northern Banat Region, formed during the Maros phase.

7.4 Conclusion

As the Greek philosopher Heraclitus proclaimed, “the only constant in life is change”. This axiom applies to the late prehistoric period of the Northern Banat Region as well. While the exact form and intensity of change was not uniform among the prehistoric communities in this region, several important demographic trends do emerge and can be connected with the evolution of social, economic and political complexity of these early societies.

Through the data collected through the regional survey, and the subsequent analysis presented in this dissertation, it is possible to describe the trajectory of these changes for the Northern Banat Region. The Late Neolithic period does not reflect a form of distinct political centralization and control of resources. However, people seem to be living in relatively modest complex ways within more disperse and divers social systems of organization.

As discussed above, the supralocal demographic formations indicate a quite pronounced diversity in social structure and potentially economic and subsistence practices as well. It is likely that within the region there was a synchronous mixture of different cultural traditions, defined archaeologically as the Vinča and Tisa cultural complexes. However, this ”cultural” patterning is likely more of a product of archaeological typologies than it was an ethnic distinction in prehistory. For example, in the northern supralocal community there appears to be two or more local communities that happened to be on equal terms when it comes to demographic potential and elite activity indicators. Yet they are positioned near different soil types in which N8 was in greater proximity to productive grazing soils and N10 was substantially less so. This might signal some form of symbiosis or codependence at the supra local level. The other two communities do not seem to share these aspects, as they are much more centralized. In this case, such centralization would reflect a large village of approximately 100 people with surrounding farmsteads.

The southern supralocal district, and the central local community N28, appear to be organized in precisely this way. In this case, the soils are much more productive for domestic cereals and the “larger village” is surrounded by small farmsteads. The central supra local community main settlement of N6 appears to be completely encircled by grazing areas and marshland. There are only two other communities in this demographic formation, which contrasts with both of the other supra local structures. Considering this, it is possible to describe the Late Neolithic period as a time of greater lateral social interdependencies without a distinct overarching social structure that centralized and controlled them in a hierarchical fashion.

With the Bronze Age and the beginning and eventual end of the Maros phase, new changes emerged across the Northern Banat Region and surrounding areas. Whether or not the Late Neolithic period formed a foundation for these new social formations is difficult to ascertain. In any case, the Bronze Age is indicative of the demographic, and most likely socio-political, integration of the majority of communities identified in the survey zone. While it comes as no surprise that the Rabe Anka Siget tell site is in the middle of this aggregation, the actual scope of integration is remarkable.

According to the results and interpretations presented above for the Maros phase, this larger supra local community took shape with a pronounced and likely enclosed and fortified tell complex that was surrounded by villages in the northern part of the region. The landscape is also populated with sporadic farmsteads and most of these communities seemed to gravitate towards occupying land that was very productive in terms of mixed agriculture. A significant percentage of the associated population preferred locations that would have been the best suited for the intensification of domestic livestock herds such as cattle and horses. This suggests not only the probability of economic interdependence in the region but also the possibility of commodity production. Few local communities have the potential to be second tier regional centers, or outposts, that would have been under the direct influence of Rabe Anka Siget. The most notable of these are local community B28 (site BA65), a village of no more than 400 people, where a pronounced proportion of artifacts likely connected to elite-centered practices were recovered. This area also has a greater potential of being associated with waterways via the Zlatica River, where regional exchange may have been managed and imported goods may have been traded from as far away as Pecica, some 60km away.

The Late Bronze Age period brought new changes to the Northern Banat Region. Demographically, the area became significantly depopulated during this period and there is little evidence of widespread integration. Populations appear to have returned to a pattern of demographic organization representing single, relatively large villages and few small farmsteads. Unlike the Late Neolithic period, there does not appear to be much diversity between the two supralocal structures. The lower quality soils, typically utilized for grazing livestock herds, were likely abandoned and this suggests a trend that likely went beyond the region itself. While there is a much bigger emphasis on the southern area of the region the demographic potential is still considerably lower than the other two time periods, suggesting basic subsistence farming with no economic interdependence. Since the Late Bronze Age across the broader region represents the appearance of mega forts, as discussed in Chapter 2, the Northern Banat Region seems to have declined substantially and became somewhat isolated or was an outpost for the mega fort site Gradiste Idos.

The trajectory of the social developments of the Northern Banat Region during late prehistory, while very unique in their own right, does to some degree follow similar trends identified in the Carpathian Basin and surrounding areas. With the increase in demographic potential and social economic interdependence, dispersed communities eventually reform in to more integrated and larger supra local structures that offered many opportunities for social elite aggrandizers during the Maros phase of the Bronze Age. While the evidence for strong hierarchical organization and pronounced social inequality can still not be directly assigned to this period, it is reasonable to think that this eventually did occur during the Late Bronze Age or Iron Age transition. However, this did not occur in the Northern Banat Region, which for the most part remained a remote and somewhat isolated landscape during these later transitions.

7.5 Potential future directions of study

This study has provided a firm groundwork and beginning of the insights into regional diaconal development of late prehistoric communities. However, the surface has only been scratched and there is much potential for further archeological investigation in the Northern Banat and the surrounding territories. The interpretation of multiple cultural groups residing in close proximity in symbiotic relationship would benefit from further testing. A targeted excavation campaign within local communities N8 and N10 would provide material that would be more conclusive when it comes to establishing potential typological differences. This would also be able to address in more details the nature of the substance practices and how they very between Late Neolithic communities. There is a great potential for bringing more lines of evidence about the lifeway of more egalitarian societies and social interaction and integration developments at these political settings. Similar approaches can be used for targeted excavation and geophysics campaigning of periphery communities during the Bronze Age especial the Maros phase. While there are already indications of interconnectedness with the tell community, the forms of interactions between these two entities would still benefit from further research. Understanding what socio-economic part the hinterland was involved would shad more lite on the potential and the scale of the political organization of the supra-local communities at this time. Creating a tight stratigraphy of the smaller sites would also create a better chronological control for the Marosh phase and inevitable more refine demographic picture. These dynamics would answer some of the important question related to demographic aggregation, such as when dowse it acutely happened during the Marosh phase. How is this related to the other mayor Maros centers in the regions and the use of cemeteries such as Mokrin or Osticevo. Another approach for the Bronze Age period would be to apply similar methodology of the regional survey used for this dissertation south of the Zlatica river. This would use demographic analysis to investigate Maros regions to the south of Anka Siget and the interactions with the Vatin cultural complex. This would bring before mentions cemeteries in to direct spatial analysis and enhance the interpretation of its place on the social and physical landscape. This hypothetical survey would also be very beneficial for the Late Bronze Age because it would be at the position to address question related to patterns of interactions between the aforementioned mega-forts and their hinterland. This whole hypothetical approach would carte a comparative data set that would be able to address the social and political changes and variations for the late prehistory and societies on the path of emerging social complexity. There are many more directions the futures studies, much more then there are ways to acquire funding for these seam studies.

Table 18 Overview of demographic data collected during the dissertation survey and population estimations

	Neolithic (5500-4400BCE)	Early to Middle Bronze Age (2200-1500BCE)	Late Bronze Age (1500-800BCE)
	NEO	**BA**	**LBA**
Local community number	30	33	28
Supra local community number	3	1	2
Total area of occupation (ha)	24.6	45	23.6
collection units	106	190	107
Population estimates	3200	5050	826
population density (km2)	12.8	20.2	3.3

Table 19 Centralization analysis results (B-coefficient)

B coefficient	North	Center	South
Late Neolithic	0.483761	0.602927	0.844445
Early and Middle Bronze Age	n/a	0.651	n/a
Late Bronze Age	0.708583	n/a	0.815461

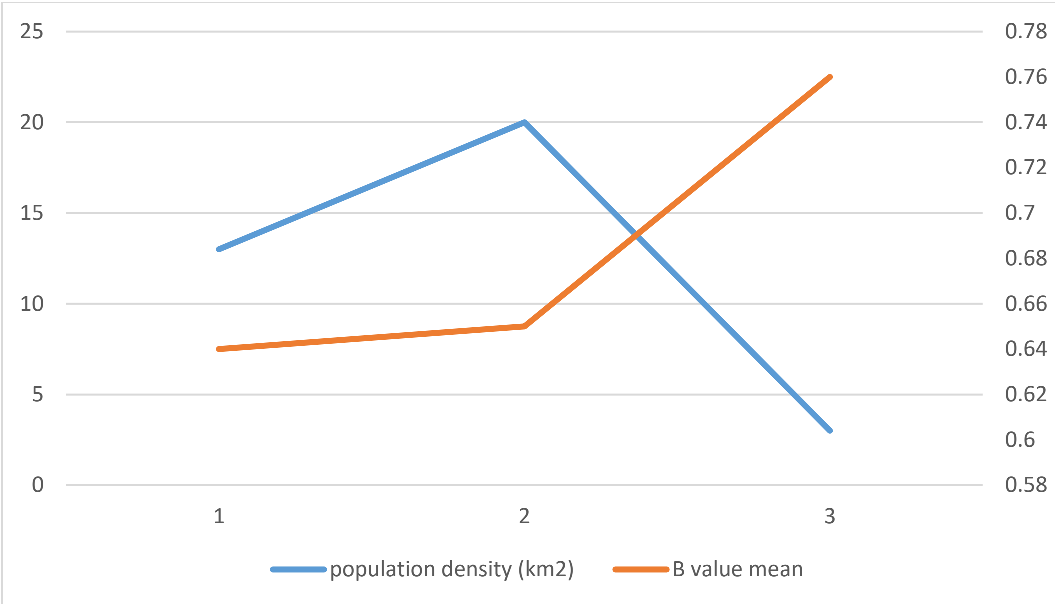


Figure 61 Demographic changes over time

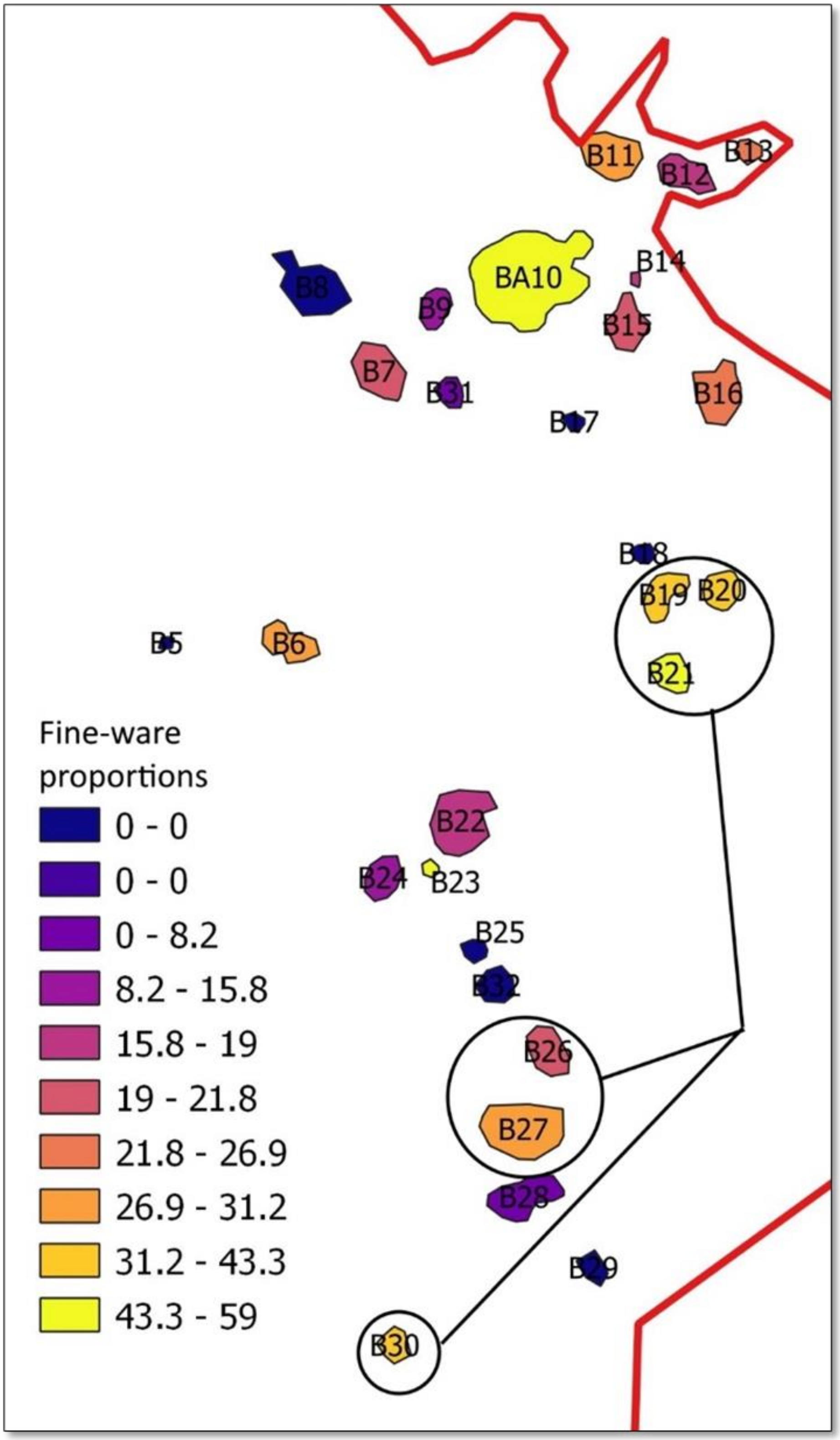


Figure 62 High proportion areas outside of the tell zone for the Early and Middle Bronze Age period.

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