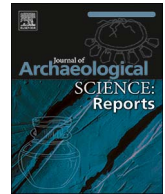


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Settlement placement and socio-economic priorities: Dynamic landscapes in Bronze Age Transylvania

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ABSTRACT

The Bronze Age was a period of significant socio-economic transformation that gave rise to the first complex regional polities with institutionalized inequality in Europe. Communities in southwest Transylvania, a major source of gold, copper, and salt, played a critical role in this transformation. This article examines how socio-economic changes affected how people situated settlements in resource procurement zones during the Early and Middle Bronze Age (2700–1500 cal. BCE). Taking advantage of the heterogeneous distribution of natural resources across the landscape, a GIS catchment analysis of the orientation of settlements toward particular constellations of resources is presented. Our results show increased preference for access to high quality agricultural land and access to interregional trade through the Mureș River corridor over the course of the Bronze Age. Despite the increased importance of metal within Bronze Age economies, there is no evidence that Transylvanian communities placed their settlements to maximize their ability to contest or secure access to the metal ore sources in the Apuseni Mountains. The organization of settlement systems in the Bronze Age demonstrates that Transylvanian communities prioritized socio-economic institutions beyond metal procurement. This study demonstrates that tracing how humans situate themselves in variable landscapes can provide new insights into the conditions and mechanisms of social change.

1. Introduction

The Bronze Age was a period of profound transformation in European societies. During this time, socio-economic institutions – the rights and obligations that structure behavior (North, 1990; Wiessner, 2002) – became increasingly centralized and hierarchical (Earle, 2002). By the end of the Bronze Age, these changes had resulted in the emergence of complex regional polities with institutionalized inequality (Earle and Kristiansen, 2010). Since the early work on the Bronze Age by V. Gordon Childe (1930, 1954), archaeologists have emphasized the importance of metal as a key factor in the rise of complex polities (e.g., Pare, 2000). The expansion of extractive industries and increase in interregional exchange associated with the commodification of metals may have provided opportunities for emerging elites to exert influence over the flow and production of metals across the European continent (Earle et al., 2015; O'Shea and Nicodemus, 2017).

Mining districts play a critical role in understanding how socio-economic complexity emerged (O'Brien, 2015). These regions are resource procurement zones – landscapes where resources are procured

locally and exchanged widely. Because metal is locally abundant in mining districts, it would have been difficult for emerging elites to control metal procurement (Kienlin and Stöllner, 2009). In these regions, other socio-economic pathways to complex polities must also be considered (Bartelheim, 2009; Kuijpers, 2008, 2012). Consequently, archaeologists must employ a holistic perspective that also considers how other socio-economic factors affected, and were affected by, broader community organization. This view is supported by a trend in Bronze Age archaeology which notes that the wider European continent was a mosaic of societies with different forms of complexity following different trajectories of socio-economic change (Duffy, 2014; Earle et al., 2015; O'Shea, 2011; O'Shea and Nicodemus, 2017). Since communities occupy extremely different landscapes, archaeologists should not expect all communities to experience socio-economic transformation in the same way. Studies of trajectories of socio-economic organization in mining districts are therefore critical to understanding change within resource procurement zones as well as how these communities articulated with other regions that relied upon these metal-rich landscapes for their core economic needs.

Southwest Transylvania functioned as a crucial, though poorly

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understood, resource procurement zone during the Bronze Age. The region is home to abundant gold, copper, timber, and salt deposits that were critical to economies during this period (Boroffka, 2006; Ciugudean, 2012; Harding, 2013; Harding and Kavruk, 2010; Papalas, 2008). Currently very little is known about the method of metal extraction in Transylvania, due to a lack of prehistoric mining sites in the region (see Boroffka, 2006; Ciugudean, 2012; Papalas, 2008). If Transylvanian mining was conducted in the same way as other prehistoric mining districts, such as Rudna Glava in Serbia (Filipović, 2015; Jovanovic and Ottaway, 1976) and Ross Island and Mount Gabriel in Ireland (O'Brien, 2007, 2015), it likely involved fire-setting and digging using antler picks in open-cast mines and shafts. The resources from southwest Transylvania would have been exchanged widely, particularly with communities in the resource-poor Carpathian Basin to the west and the Transylvanian Plateau to the east along the Mureş River, and the tempo and nature of trade would have affected socio-economic trajectories in those regions (Găvan, 2012, 2013; O'Shea, 2011). Changing technologies, social connections, and commodification of such resources would have resulted in dynamic changes in the relationship between humans and the landscape.

In this study, we examine how socio-economic changes affected, and were affected by, how people situated settlements in resource procurement zones during the Early and Middle Bronze Age (2700–1500 cal. BCE). We present an analysis of the orientation of settlements toward particular constellations of resources in a landscape characterized by heterogeneously distributed natural resources. There is a recursive relationship between ways people position themselves relative to resources in mining districts and their socio-economic priorities. This study demonstrates that tracing how humans situate themselves in heterogeneous landscapes can provide new insights into the conditions and mechanisms of social change.

2. Landscapes, settlement systems, and socio-economic organization in Bronze Age Transylvania

Landscapes are both cultural and physical entities (Smith, 2014:309). Landscape approaches thus provide a unique perspective on socio-economic organization that complements investigations at smaller scales. There is a long history of archaeologists examining cultural landscapes to understand socio-economic organization and change (e.g., Binford, 1980; Duffy, 2015; Flannery, 1976; Galaty, 2005; Wright, 1986; Wright and Johnson, 1975).

There is a recursive relationship between social and economic institutions. What resources are part of the economy, how resources are mobilized within a society, and where people choose to place their settlements all affect one another. The choice to place a site in a particular part of the landscape is in part the byproduct of socially-mediated decisions that reflect a community's weighing and preferencing different economic needs. Decisions about where to place settlements in a landscape are informed by existing economic institutions, but placement of sites in turn effected how social and economic institutions were organized.

In southwest Transylvania (Fig. 1), economic resources have different spatial distributions across the landscape, and resources rarely overlap. As a result, the landscape is a mosaic of different catchment types. For example, metal ores are primarily distributed in the uplands of the Apuseni Mountains (including the Metal Mountains and Trascău Mountains) while direct access to interregional trade is located along the lowland Mureş Valley. When placing settlements, communities make cost-benefit assessments of the trade-offs of being close to, or far from, different resources. In order to provide a holistic assessment of priorities across all institutions, we consider how landscapes affect subsistence economies as well as the procurement and distribution of copper, gold, and salt.

Catchment analyses, as employed in this study, define the availability of economic resources for individual settlements. Our approach

then quantifies cultural preferences across settlement systems. We hypothesize that if control of metal procurement was a high priority for Bronze Age communities, people would differentially place their sites in landscapes with metal nearby. Additionally, if control of access to metal ore was a key pathway to authority in southwest Transylvania, we would expect that the largest sites, potentially home to an emerging regional elite, should also be located in catchments where metal is available. If socio-economic factors other than access to metal were of the highest priority to Bronze Age communities, then we would expect more sites, and larger sites, to be differentially positioned near those resources. For example, if agricultural resources and surpluses were mobilized by emerging elites, we would expect to see evidence of preference for agricultural land. Additionally, if controlling the movement of resources, including metal and salt, was a high priority, we would anticipate observing both a higher number of sites, and larger sites, near interregional trade routes.

Understanding where people situated themselves in this heterogeneous landscape can reveal socio-economic priorities and help reconstruct the organization and evolution of social and economic institutions throughout the Bronze Age. Large settlements (over 7 ha in size), associated with the Wietenberg Culture, emerged during the Middle Bronze Age in southwest Transylvania. By monitoring change through time in the catchment selection, it is possible to monitor changes in the importance of different resources to Bronze Age communities in southwest Transylvania and evaluate their roles in transforming social complexity.

3. Materials and methods

By looking at the distribution of all sites within a particular phase, we can identify how access to resources influenced settlement location. If sites are intentionally positioned toward specific resources more than would be expected due to random chance, these resources can be viewed as more prominent in these communities' culturally mediated decision-making framework. To quantify whether settlement patterns prioritized access to particular resources we develop a null hypothesis (H_0): Site catchments are the product of the overall abundance and distribution of different catchments in the landscape. To test this hypothesis, we compare the distribution of catchments from sites for each Bronze Age phase with a random distribution of sites. The survey region encompasses a 3000 km² portion of Alba County, Romania. The random sample of sites was created in ArcGIS through a random generation of 100 sites in the area where sites were found. This process was run 50 times, producing 5000 sites distributed randomly throughout the landscape. We then compiled the distribution of sites in different types of catchments. Using Fisher's exact tests, we evaluated whether the observed site distribution was statistically different from the random sample for each phase of the Bronze Age.¹ If the catchment distributions do not differ statistically, then we cannot reject the null hypothesis. If the catchment distributions are statistically significantly different, we can attribute deviation from a random sample to human agency, with people preferencing certain catchments as areas in which to place settlements.

Three primary resources were used to define site catchments: (1) land use (agricultural or pastoral land), (2) interregional trade routes, and (3) metal.² These catchments are simplified abstractions of significant topographic and geological variation. Land use is derived from slope of the land rather than modern land use practices. This model assumes that land forms with slopes of six degrees and higher

¹ For comparing the access to metal between different periods, we omitted sites from the random sample where the nearby metal access is high ($n = 32$; 0.6%), to be able to have a 2×2 contingency table to fulfill the requirements of the Fisher's exact test, as no known Bronze Age sites were found in that type of catchment.

² Salt was omitted from this analysis because the largest salt-producing sites, including Pânade and Ocna Mureş, are at and beyond the margins of the study area.

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