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Interpolating geochemical patterning of activity zones at Late Neolithic and Early Copper Age settlements in eastern Hungary

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ABSTRACT

The Late Neolithic of southeast Hungary is known almost exclusively from excavations of large settlement mounds, or tells. Geochemical analyses of sediments collected from boreholes at small, flat Late Neolithic and Early Copper Age settlements in Hungary's Körös River basin provide data necessary to interpret the spatial organization of small settlements for the first time in this region. Principal Components Analysis of multi-element data produced a workable number of variables. Spatial analyses of these components via interpolation in ArcGIS 9 identified specific task areas, and when combined with sediment characterizations, phosphate 'spot-tests' and pH, suggest long-term cultural traditions in the location of activity zones within small farmsteads. The results demonstrate the usefulness of multi-element geochemistry as an intra-site prospection method.

1. Introduction

Detailed knowledge of historical processes, cultural and chronological relations, and subsistence, mortuary and exchange practices during the Late Neolithic (ca. 5000–4600 BC) on the Hungarian Great Plain results from over a century of excavations at tell sites, extensive surveys, and two decades of rescue excavations (e.g. Jankovich et al., 1998; Raczky, 1987). In spite of the breadth of these efforts, small Late Neolithic settlements have remained largely unexplored, and the use of space within small settlements during this period was unknown. Archaeologists have therefore been unable to ask questions about how spatial organization at small sites compares to larger sites, about the role of small sites in settlement systems, and what, if any, interaction was there among small settlements and between small and large sites.

The smallest settlements for the subsequent Early Copper Age (ca. 4600–4000 BC) in the Körös River basin have been examined and defined through the Körös Regional Archaeological Project (Parkinson et al., 2010; Parkinson et al., 2004). However, due to the dearth of investigations at small Late Neolithic settlements, comparing small settlements from these two periods remains problematic, and Early Copper Age sites have often been compared to large, nucleated Late Neolithic villages and settlement mounds.

Many of the sites from both periods have been disturbed by modern agricultural practices, some to such an extent that no intact layers remain for excavation. This is more of a problem for the Late Neolithic because there are fewer sites available, with 64 known Late Neolithic sites of all sizes from northern Békés County, Hungary compared to 394 for the Early Copper Age (hereafter ECA).

An alternative approach has been developed to overcome some of these difficulties, and reveal something of the internal differences and similarities between Late Neolithic and ECA single-layer settlements in southeast Hungary. This approach integrates archaeological geochemistry, stratigraphic characterizations and surface survey data within a GIS platform to explore the patterning of activity zones at the intermediate scale of small dispersed farmsteads through minimally intrusive methods (Salisbury, 2010, 2012). Similar methods have been employed in other areas, especially at the macro-scale, for example to examine large sites in Mesoamerica (Wells, 2004), and at the micro-scale to examine individual house floors in Anatolia (Middleton, 2005) and Mesoamerica (Middleton and Price, 1996). Repetitive human activity alters sediments in recognizable ways. Through the analysis of stratigraphy, qualitative and quantitative analysis of inorganic chemical elements and the magnetic susceptibility of sediments, traces of these practices can be identified and compared. Unlike traditional classes of artifacts, chemical signatures are more likely to remain in or near the original zone of activity unless the soil itself is removed. This paper focuses on one aspect of this integrated method; the application of Principal Components Analysis (PCA)

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and kriged interpolation of geochemical data in order to reconstruct internal spatial organization at small farmsteads and compare these farmsteads diachronically.

2. Background

2.1. Study area

The study area (Fig. 1) falls within the Körös-Berettyó River basin, a flat and poorly drained alluvial plain in eastern Hungary. Underlying geology is a thick layer of redeposited loess. The three branches of the Körös River, along with the Berettyó River to the north, form the primary drainage. During the Pleistocene, these rivers meandered widely, creating a subtly complex landscape of palaeochannels, oxbow lakes, backswamps and small lag islands and ridges. Prior to modern water controls, the rivers flooded regularly, a process that filled these meanders, lakes and swamps and brought annual deposition of new sediments. The resultant landscape was one of waterways, low-lying meadows and elevated ridges and islands (Gyucha et al., 2011; Sümegi et al., 1998; Timár and Gábris, 2005). All of the sites examined here are located on ridges or lag islands along palaeochannels of the Körös river system.

Natural soilscapes in the study area have a mosaic pattern that is directly related to landform, with heavier clays in the low-lying meadows and lighter, better drained soils on the ridges. All of these soils have good 'soil memory'; that is, they retain traces of chemical and physical transformations over time (Pomel, 2008). Soils on the low ridges were sites are typically found are primarily fine-grained clayey meadow soils that have developed over loess. These fine-grained particles adsorb ions to their mineral surfaces and trap cations between clay interlayers, fixing chemical compounds so that they resist movement and are retained for long periods (Wells, 2006: 126).

2.2. Archaeological background

During the Late Neolithic, the Hungarian Great Plain was occupied by three culture groups, the Tisza, Herpály and Csőszhalom, distinguished by their distinctive ceramic styles. During the Early Copper Age, the Tiszapolgár culture occupied those areas that had been home to the Tisza–Herpály–Csőszhalom complex, and the buffer zones that appear to have existed between the Late Neolithic groups were settled (Parkinson et al., 2004). In addition to the settling of previously abandoned areas and the changes in ceramics, the transition from three groups to the more homogeneous Tiszapolgár culture included the emergence of separate cemeteries, new exchange networks and changes in house size and structure. Despite these apparent discontinuities in material culture and settlement distribution, people maintained continuity in some culture traditions during the Neolithic and Copper Age (Gyucha, 2009; Parkinson, 2006; Salisbury, 2010). Some of this continuity occurs in the organization of space within the settlements, and can be seen through chemical signatures in the soil.

3. Methods

3.1. Field methods

Geochemistry and the textural and visual qualities of sediments are used to characterize use of space at six settlements from the Late Neolithic and ECA (Fig. 1). The location of these sites had been

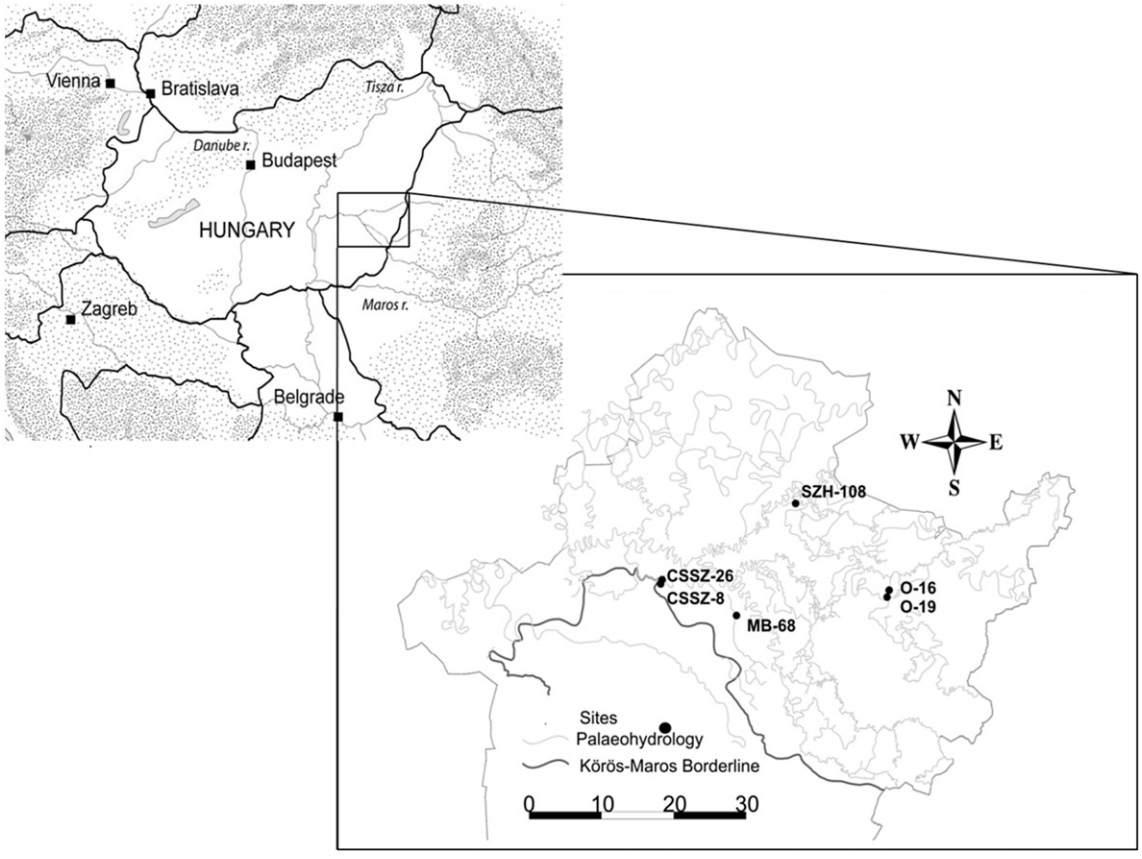

Fig. 1. Location of the Körös-Berettyó River system, including study area and sites examined, within the Carpathian Basin.