Journal of Archaeological Science 97 (2018) 14–25

Contents lists available at ScienceDirect

Journal of Archaeological Science

journal homepage: www.elsevier.com/locate/jas

Bronze Age diet and economy: New stable isotope data from the Central Eurasian steppes (2100-1700 BC)

Bryan Hanks[a,*], Alicia Ventresca Miller[a,b,c], Margaret Judd[a], Andrey Epimakhov[d,e], Dmitry Razhev[f], Karen Privat[g,h]

[a] University of Pittsburgh, Department of Anthropology, Pittsburgh, 15260, USA
[b] Christian-Albrechts-Universität zu Kiel, Human Development in Landscapes, Institute for Prehistoric and Protohistoric Archaeology, Stable Isotope Laboratory, Johanna-Mestorf-Str. 2-6, 24118, Kiel, Germany
[c] Max Planck Institute for the Science of Human History, Department of Archaeology, Stable Isotope Group, Kahlaische Str. 10, 07745, Jena, Germany
[d] Southern Ural State University, Chelyabinsk, 454080, Russia
[e] Institute of History and Archaeology, Urals Branch, Russian Academy of Sciences, 8 Marta St., Yekaterinburg, 620990, Russia
[f] Tyumen Scientific Centre, Siberian Branch of the Russian Academy of Sciences, Institute of the Problems of Northern Development, 86 Malygina St., Tyumen, 625026, Russia
[g] Electron Microscope Unit, Mark Wainwright Analytical Centre, Kensington, UNSW, NSW 2052, Sydney, Australia
[h] PANGEA Research Centre, School of Biological Earth and Environmental Sciences, University of New South Wales, Kensington, 2052, NSW, Australia

ARTICLE INFO

Keywords:
Pastoralism
Bronze age
Central Eurasia
Sintashta culture
Stable isotopes
Prehistoric diet

ABSTRACT

This paper presents new stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotope data obtained from human and animal remains from the Kamennyi Ambar 5 cemetery (KA-5) (Southeastern Urals, Russian Federation) and represents one of the largest stable isotope datasets from a single prehistoric site in the steppes of Central Eurasia. These results are compared with other regional faunal, botanical and archaeological datasets to examine late prehistoric trends in pastoralism and human dietary patterns. The findings of this research emphasize a subsistence regime consisting of broad-spectrum resources that include domestic and wild animal species, wild plants and fish. This study contributes to current knowledge regarding the diversity in isotopic values of human and animal remains and indicates that variation in subsistence was related to distinct local resource biomes and economic strategies. These results suggest a more complex model of late prehistoric subsistence trends in the steppes that emphasizes the need for enhanced micro-regional studies combining environmental, biological, and archaeological datasets. The study presented here also provides information on the most detailed bioarchaeological study of human remains and stable isotopes to date related to the Sintashta archaeological pattern.

1. Introduction

Recent research programs examining late prehistoric subsistence patterns in the Eurasian steppes have produced detailed zooarchaeological, isotopic, botanical, and lipid residue results (Anthony et al., 2016; Schulting and Richards, 2016; Gerling, 2015; Motuzaite Matuzeviciute et al., 2015; Ventresca Miller et al., 2014a, 2014b; 2017; Spengler et al., 2013; Outram et al., 2010, 2012; Bendrey, 2011; Frachetti and Benecke, 2009). These data contribute to a growing body of literature that indexes variation in pastoral lifeways and economies, and builds on earlier studies documenting the use of fish and other wild resources by ancient steppe communities (Privat, 2002, 2004; O'Connell et al., 2003). The development of such empirically grounded studies is a crucial step if scholarship is to achieve more nuanced explanatory models to account for regional interaction processes and multi-scalar networks that facilitated the flow of ideas, technology, and resources across prehistoric Eurasia (Renfrew, 2002; Hanks, 2010; Frachetti, 2008, 2012; Potts, 2012).

Recent archaeological research in the central steppes region has been increasingly focused on socio-cultural developments during the second millennium BC. One particular case study, relating to the appearance of Sintashta culture communities in the Southeastern Urals peneplain, has stimulated significant debate (Fig. 1). The Sintashta pattern has been dated to 2050-1700 cal BC (Hanks et al., 2007; Epimakhov and Krause, 2013) and is represented by nucleated settlements with fortified enclosures, early spoke wheeled chariot technology, and copper mining and metal production. These notable social and technological transitions have been debated in the context of

* Corresponding author.
E-mail address: bkh5@pitt.edu (B. Hanks).

https://doi.org/10.1016/j.jas.2018.06.006
Received 2 June 2016; Received in revised form 7 May 2018; Accepted 13 June 2018

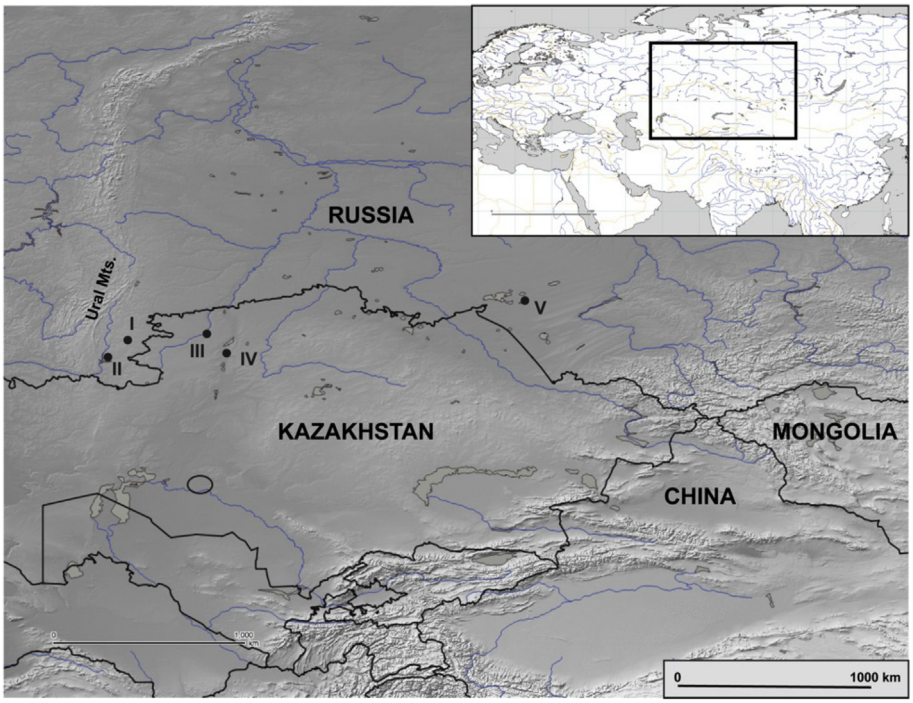

Fig. 1. Map of Eurasia with location of archaeological sites discussed in the paper: I – Kamennyi Ambar-5 cemetery and Kamennyi Ambar settlement; II - Bolshekaragansky cemetery; III – Lisakovsk cemetery; IV – Bestamak cemetery; V – Čiča settlement (map prepared by utilizing open source QGIS Geographic Information System, Open Source Geospatial Foundation Project: http://qgis.osgeo.org).

emergent middle range societies as well as the formation of long distance trade in metal commodities and horses with polities in Central Asia (Gening et al., 1992; Zdanovich and Zdanovich, 2002; Anthony, 2007, 2009). Although archaeological research has been carried out at Sintashta settlements and cemeteries since the late Soviet Period, persistent questions remain regarding the political organization of these populations and the nature of their subsistence economies (Hanks and Linduff, 2009).

This article details the results of a study of Sintashta adult diet using stable isotope biochemistry. These new data, which stem from bioarchaeological research carried out on human (Judd et al., 2018) and animal remains recovered from the Kamennyi Ambar 5 cemetery (KA-5) is compared with recently published archaeological evidence from the associated settlement of Kamennyi Ambar (Krause and Koryakova, 2013). The results of this study support a model of multi-resource pastoralism that included livestock herding complemented by fishing, hunting and the collection of wild plant resources. The settlement and cemetery data do not confirm the production and/or consumption of agricultural plant foods (especially C_4 cultivars) among Sintashta populations as was inferred in previous publications (Gayduchenko, 2002; Zdanovich and Zdanovich, 2002). This is a significant finding given recent publications on patterns of diffusion of agricultural crops across prehistoric Eurasia (Spengler, 2015).

2. Sintashta communities in the Southeastern Urals

The Sintashta archaeological pattern was recognized in the late 1970s and has gained international recognition due to evidence of innovative warfare technologies, metal production, and “proto-urban” developments in settlement organization (Koryakova and Epimakhov, 2007). The Sintashta subsistence pattern has been previously characterized as reliant on pastoralism and agricultural production, with minimal exploitation of wild plant and animal resources (Zdanovich and Zdanovich, 2002: 254-155). To date, extant evidence for agriculture has been based on the chance recovery of millet (*Panicum* sp.) from house floor levels at the Alandskoe settlement and ceramic vessels from Alandskoe and the Arkaim settlement, wheat (*Triticum* sp.) from ceramic vessels at Alandskoe and Arkaim, and barley (*Hordeum* sp.) from ceramic vessels at Arkaim (Gayduchenko, 2002: 403–404). Until 2007, soil flotation and detailed paleobotanical studies were not carried out during excavations at Sintashta sites and questions regarding the scale and ubiquity of agriculture remained entirely unresolved (Hanks and Doonan, 2009; Frachetti, 2012; Spengler, 2015). Recent excavations at the Sintashta period settlements of Kamennyi Ambar and Stepnoye, which employed intensive soil flotation studies, have not produced any evidence of domesticated cereal use (Krause and Koryakova, 2013; Ng, 2013). While this does not rule out the possibility of the production and/or use of domesticated cereals within the region the ubiquity of such practices is not supported by current data.

2.1. Kamennyi Ambar 5 cemetery complex

The KA-5 cemetery is in the Kartaly District, Chelyabinsk Oblast’, of the Russian Federation (Fig. 2; Lat. 52.82°, Long. 60.46°). The Bronze Age phase of this cemetery complex is associated with a contemporaneous enclosed settlement (Kamennyi Ambar) situated 1000 m to the northeast along the Karagaily Ayat River. Previous research at KA-5 was carried out by A. V. Epimakhov in 1994–1995 and 2002–2003 and resulted in the excavation of three Sintashta culture barrows (*kurgans*) that produced 35 burial pits and a reported 100 skeletons (Epimakhov, 2002, 2005; Epimakhov et al., 2005; Razhev and Epimakhov, 2004). Seven AMS radiocarbon dates on human remains from the cemetery yielded a date range of 2040–1730 cal. BC (2 sigma), which placed the cemetery within the Sintashta phase of the regional Bronze Age (Hanks et al., 2007). Twelve recently obtained AMS radiocarbon dates, taken from short-lived wood and charcoal species recovered from the Kamennyi Ambar settlement, have provided a date range of 2050–1760 cal. BC (2 sigma). Importantly, these dates confirm the close chronological relationship between the settlement and cemetery for the Middle Bronze Age phase and discount the possibility of a freshwater reservoir effect influencing the earlier dating of the human remains from the Kamennyi Ambar 5 cemetery (Epimakhov and Krause, 2013). A total of 94 human skeletons were available to sample for stable isotope analysis; however, samples were removed only from well preserved skeletons and from long bone elements (Kovacik et al., 2009). This resulted in 49 individuals being sampled from Kurgan 2 (Table 1) and 20 individuals from Kurgan 4 in our study (Table 2). We also utilized 60 indivdiual comparative faunal samples from the region in our