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Early indicators to C4 plant consumption in central Kazakhstan during the Final Bronze Age and Early Iron Age based on stable isotope analysis of human and animal bone collagen

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ABSTRACT

In this paper, we present new stable isotope data from central, southern and eastern Kazakhstan (KZ) that date to the Early Iron Age. Our primary data together with results from previously published studies demonstrate that the consumption of C_4 plants, possibly millet, started in the Final Bronze Age in central KZ and continued into the Early Iron Age. Data from southern KZ, however, demonstrate that over half the human population consumed C_4 crops in the Early Iron Age as opposed to the central regions of KZ, where just a few individuals within the population, often males buried in elite kurgans, have high $\delta^{13}C$ values indicative of C_4 plant consumption. In this paper we aim first to understand if any dietary changes can be seen in the central KZ population during the transitional period between the Bronze and Iron Ages; secondly, we investigate the extent of C_4 plant consumption in central KZ during these time periods. Here we present new human isotopic data from nine central sites of the Tasmola culture (n = 11), two eastern KZ sites (n = 3) and two southern KZ sites (n = 26).

1. Introduction

Kazakhstan is located in the center of the Eurasian continent. Understanding the social and economic processes there is particularly important as their development could potentially affect both the eastern and western portions of the continent. Soviet archaeology used to see the transitional period from Bronze (ca. 2500–800 BCE[1]) to Iron (ca. 800 BCE–500 CE) Ages as marking the rise of early nomadic cultures in the Kazakh steppe (e.g. Habdulina et al., 2013). Some scholars still argue that in the Late Bronze Age settlements became less abundant and therefore less visible archaeologically as people adapted to a more mobile economy (Kuzmina, 2000), that eventually gave rise to "pure nomadism". The origins of pastoral nomadism and the transitions to it have been reviewed and discussed by several scholars proposing causal relationships with climatic fluctuation, population pressure, and territorial expansion (e.g. Hanks, 2002; Honeychurch and Makarewicz, 2016; Khazanov, 1994; Koryakova and Epimakhov, 2007; Spengler, 2014). During the past decades, however, the idea of a purely nomadic Early Iron Age economy the Early Iron Age has been critiqued and challenged by a growing body of archaeological evidence which points to a more complex economic situation in the steppes in the beginning of Iron Ages (Chang et al., 2003; Chang, 2012; Frachetti, 2008). Systematic archaeological research carried out mainly in south-eastern Kazakhstan has improved our understanding of Early Iron Age socio-economics (e.g. Benecke, 2003; Chang et al., 2003; Chang and Beardmore, 2016; Haruda, 2007; Rosen, 2001; Rosen et al., 2000;

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[1] All dates in this manuscript are in calibrated, calendar years BC (unless specified otherwise).

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Spengler et al., 2013a). Nevertheless, Early Iron Age archaeological realities remain largely enigmatic for other regions of the Kazakh steppe. Recent discoveries of Early Iron Age settlements in central and northern Kazakhstan (e.g. Beisenov, 2015; Habdulina, 2003) and large geometric earthworks (see below) (Motuzaite Matuzeviciute et al., 2016), argue against "pure nomadism" in the region and call for more thorough archaeological research to understand the cultural and economic situation in the heart of the Kazakh steppe during the transitional period.

The transition from the Bronze to Iron Ages in the Kazakh steppe is connected to cultural changes that can be seen from archaeological material. Data for the Early Iron Age of Kazakhstan point towards an increase in a social complexity as suggested by the appearance of very rich burials showing the rise of an elite social order (e. g. Akishev, 1978; Gryaznov, 1980; Rudenko et al., 1971; Samashev, 2011), new forms of warfare (Hanks, 2008), the development of elaborate animal-style ornaments (Yablonskyi, 2000) and the increasing importance of iron. The appearance of massive geometrical earthworks during the Early Iron Age period, ca. 800–750 BCE indicates the presence of centralized power and the consolidation of people into large social units (Motuzaite Matuzeviciute et al., 2016).

Until recently, no stable isotope or macro-botanical research has been carried out for the Early Iron Age of central Kazakhstan. In this paper, we present new stable isotope evidence for human diet during the Early Iron Age in Kazakhstan. Through stable isotope analysis of human and animal bone collagen we examine dietary change during the transitional period between the Bronze and Iron Ages of central Kazakhstan, and we evaluate the role of C_4 plants in the economy and lifestyle of communities in central Kazakhstan during the Final Bronze and Early Iron Ages. Though we focus on the central regions of Kazakhstan, we include both primary and published data from other parts of the country for comparison.

2. Background

2.1. Geography, archaeology, and environment of central Kazakhstan

Central Kazakhstan is situated within the Kazakh Uplands, which is frequently referred to as Sary-Arka. The Kazakh Uplands consist largely of lowland steppes with rocky hills and rare low mountains that reach up to 1000-1500 m above sea level. These mountains often contain small oases with pine forest patches, mountain creeks, and natural shelters from wind created by granite rock outcrops. In contrast to the open steppe landscapes, the environment and resource diversity in these geographic niches attracted humans during the Bronze and Iron Ages, which is evident by the large number of archaeological sites located near mountains within Kazakh Uplands (Beisenov et al., 2016a).

During the Late and Final Bronze Ages (~1300–800 BCE), the Sargary/Alekseevo and Begazy-Dandybaevo archaeological cultures developed in central Kazakhstan. Both cultures are identified archaeologically by "valikovaya" pottery types (Chernykh, 1984), which predominated during the Late Bronze Age. The Begazy pottery type is represented by fine vessels with elaborate design. This type is often found in mausoleums, unique funerary monuments typical of the Begazy culture (Varfolomeev, 2003). In contrast, the Sargary/Alekseevo pottery is found at Late and Final Bronze Age settlements and cemeteries. Varfolomeev (2011a) suggests that the Begazy-Dandybaevo and Sargary/Alekseevo cultures represent the same cultural community due to the scarcity of Begazy vessels at Late and Final Bronze Age sites in central Kazakhstan, and their association with rich mausoleum burials. A great input of time and energy required for construction of mausoleums suggests that Begazy-Dandybaevo funerary monuments were built for high status individuals (Habdulina et al., 2013), which points to the existence of the elite.

Massive settlement sites such as Kent (~30 ha) are also known in the Late Bronze Age period in central Kazakhstan (Varfolomeev, 2011b). The archaeological complex of Kent represents a concentration of smaller settlements located in the Karkaraly mountain oasis. Kent has features of a proto-city such as large territory; monumental architecture; production of ceramic vessels, bone tools, ornaments, metal items; developed trade (Varfolomeev, 2011b), which suggest an increase of social complexity in central Kazakhstan in the Late and Final Bronze Ages.

Major metal production centers dated to the Late and Final Bronze Ages were identified in the steppes of central Kazakhstan (Beisenov and Ermolayeva, 2016). The metallurgical district Alat, which is a part of the Kent complex, provided evidence of iron refining furnaces (Evdokimov and Zhauymbayev, 2013) dated to about 1300 cal. BCE ("Research Center of Ancient East Asian Iron Culture", 2016–2017 pamphlet). This indicates the transition to the Iron Age economy had already begun in the Final Bronze Age.

In the Early Iron Age (~800–200 BCE), a new cultural community Tasmola developed in the steppes of Kazakhstan. Sites of the Tasmola culture are dated to the 800–400 BCE (Beisenov et al., 2016a). Early Iron Age Tasmola settlements in central Kazakhstan are often located on hill slopes and rocky surfaces near mountains and near small creeks, such as the Edirey settlements in the eastern part of central Kazakhstan (Beisenov, 2015). Most of them are small, comprise 2–3 dwellings (Beisenov, 2014), and do not have intense cultural layers, which might indicate their seasonal character. Settlements Sarybuirat and Keregetas-2, however, are quite large. Sarybuirat, dated to 747–403 cal. BCE (Beisenov et al., 2016b) is about 1 ha (Beisenov, 2015). In the past decades, Early Iron Age settlements have been more frequently found in central Kazakhstan steppes than previously. Geographical positions and plans of the Early Iron Age settlements indicate their considerable difference from the Early and Middle Bronze Age settlement sites (Beisenov, 2015). Nevertheless, some similarities between the Late Bronze Age and Early Iron Age settlements are seen in the architectural design of the dwellings, planning of the settlements and their topographic location (Habdulina, 2003). Excavated Early Iron Age settlements look similar to the ethnographic Kazakh winter settlements - kystau (Usmanova and Boyaubayeva, 2011). Dwellings within a Kazakh ethnographic settlement also stand close to each other; they are rectangular in shape, and have large amount of stone in the base. Moreover, few Early Iron Age settlements were found near or occupying the same area as Kazakh kystau (Beisenov, 2015). Burial grounds of the Tasmola culture are represented by kurgans, which can be divided into two types: ordinary mortuary complexes and large (tsarskyi) kurgans. Tsarskyi kurgans can be characterized as rich burials with elaborate artifacts, vast sacrifices of animals, complex constructions of burial chambers, golden jewelry and art objects (Beisenov et al., 2011). Such mortuary monuments dated to the Iron Age were discovered in different areas of Kazakhstan.

It has been suggested that the climatic conditions changed frequently during the Early Iron Age, which forced people to adopt new economic strategies (Koryakova and Epimakhov, 2007). Environmental reconstructions in central Kazakhstan suggest that the climate became colder and moister about 1200–1100 cal. BCE; however, by 1000–900 cal. BCE the conditions changed towards less continental and dryer climate (Kremenetskyi et al., 1994). Palynological data from archaeological sites in the Trans-Ural region indicate an increase in continental climatic conditions during the transitional period from Bronze to Iron Ages (Larin and Matveeva, 1997). Archaeological investigations carried out at Early Iron Age settlements in central Kazakhstan suggest a cold and wet climate during the period of occupation (Beisenov, 2015). Early Iron Age settlements are often located far from river banks, which might indicate that frequent floods made areas around rivers unavailable for human use. Moreover, dwellings within Early Iron Age settlements are often clustered close to each other, and significant quantities of stone were used for wall foundations (Beisenov, 2015). This suggests that inhabitants may have tried to create a defense against the wind and preserve a warm temperature inside the dwellings.