

An Imagined Past?

Nomadic Narratives in Central Asian Archaeology

Robert N. Spengler III, Alicia Ventresca Miller, Tekla Schmaus,
Giedrė Motuzaitė Matuzevičiūtė, Bryan K. Miller, Shevan Wilkin,
William Timothy Treall Taylor, Yuqi Li, Patrick Roberts, and Nicole Boivin

Nomads, or highly specialized mobile pastoralists, are prominent features in Central Asian archaeology, and they are often depicted in direct conflict with neighboring sedentary peoples. However, new archaeological findings are showing that the people who many scholars have called nomads engaged in a mixed economic system of farming and herding. Additionally, not all of these peoples were as mobile as previously assumed, and current data suggest that a portion of these purported mobile populations remained sedentary for much or all of the year, with localized ecological factors directing economic choices. In this article, we pull together nine complementary lines of evidence from the second through the first millennia BC to illustrate that in eastern Central Asia, a complex economy existed. While many scholars working in Eurasian archaeology now acknowledge how dynamic paleoeconomies were, broader arguments are still tied into assumptions regarding specialized economies. The formation of empires or polities, changes in social orders, greater political hierarchy, craft specialization—notably, advanced metallurgy—mobility and migration, social relations, and exchange have all been central to the often circular arguments made concerning so-called nomads in ancient Central Asia. The new interpretations of mixed and complex economies more effectively situate Central Asia into a broader global study of food production and social complexity.

Online enhancement: supplement.

Archaeological models across Central Asia largely rest on the assumption that peoples, from at least the third millennium BC onward, were predominantly mobile pastoralists. The diversity of ancient cultures in this massive geographic region, spanning from eastern Ukraine to Mongolia, is often overshadowed by idealized images of specialized nomads. This assumption is epitomized in the myth of Scythian warrior nomads that dominates both popular and academic discourse. Scholarly literature regarding the prehistory of Eurasia tends to draw on images of the Issyk Golden Man (Beckwith 2009; Golden 2011a:4–5) or other large-scale elite burials, such as Arzhan (Askarov, Volkov, and Odjav 1992; Baumer 2012), Berel (Samashev 2012), or Pazyryk (Rudenko

1970), as indicative of nomadic populations. These burials are not, however, representative of the larger population, which in some regions of Central Asia consisted of people engaged in farming, herding, and craft production who supported an elite segment of society. Over the past decade, archaeological investigations in Central Asia have greatly clarified the image of past economies (e.g., Frachetti 2008; Hermes et al. 2018; Ventresca Miller et al. 2014a, 2014b). Scholars working in diverse regions of Central Eurasia are illustrating how dynamic and diverse cultural practices were in the past (Honeychurch 2015; Makarewicz 2015; Wright 2007). Based on recent scholarly studies, we discuss what economy looked like in the foothills of Central Asia during the second and

Robert N. Spengler III is Director of the Paleoethnobotany Laboratories of the Department of Archaeology at the Max Planck Institute for the Science of Human History (Kahlaische Strasse 10, 07745 Jena, Germany [junominerva@gmail.com]). **Alicia Ventresca Miller** is Assistant Professor of Anthropology in the Department of Anthropology and Assistant Curator of Asian Archaeology in the Museum of Anthropological Archaeology at the University of Michigan (Ann Arbor, Michigan 48109, USA) and Research Affiliate in the Department of Archaeology at the Max Planck Institute for the Science of Human History (Kahlaische Strasse 10, 07745 Jena, Germany). **Tekla Schmaus** is Visiting Assistant Professor in the Department of Anthropology at the University of Pittsburgh (3302 WWPB, Pittsburgh, Pennsylvania 15260, USA). **Giedrė Motuzaitė Matuzevičiūtė** is Associate Professor in the Department of Archaeology, History Faculty, Vilnius University (Vilnius, Lithuania). **Bryan K. Miller** is Lecturer in the History of Art Department and Research Affiliate of the Museum of Anthropological Archaeology at the University of Michigan (Ann Arbor, Michigan 48109, USA). **Shevan Wilkin** is Biological Anthropologist in the Department of Archaeology at the Max Planck Institute for the Science of Human History (Kahlaische Strasse 10, 07745 Jena, Germany) and Head of the Ancient Protein Laboratory at the Institute for Evolutionary Medicine at the University of Zurich. **William Timothy Treall Taylor** is Assistant Professor and Curator of Archaeology at the University of Colorado–Boulder Museum of Natural History (218 UCB, Henderson Building, Boulder, Colorado 80309, USA). **Yuqi Li** is Associate Professor in the Faculty of History at Nankai University (Tianjin, China). **Patrick Roberts** is W2 Research Group Leader in the Department of Archaeology at the Max Planck Institute for the Science of Human History (Kahlaische Strasse 10, 07745 Jena, Germany). **Nicole Boivin** is Director of the Department of Archaeology at the Max Planck Institute for the Science of Human History (Kahlaische Strasse 10, 07745 Jena, Germany). This paper was submitted 27 VI 18, accepted 7 X 19, and electronically published 10 V 21.

first millennia BC and propose ways to overcome the “nomadic bias” that is still directing broader arguments.

The foundation of many aspects of Eurasian prehistory is built on a succession of circular arguments that trace back to the basal assumption that ancient populations were nomadic. Many scholars over the past few decades have started to question the idea of high levels of mobility, but these concepts are deeply rooted in the literature. These circular arguments make broad-scale claims about social structure and cultural practice based on categories of archaeological finds, often specific ceramic forms, that are classified as nomadic. However, as all people in Central Asia are assumed to have been nomadic, all artifacts of their respective cultures are defined as products of nomadic societies. Hence, handmade pottery, as opposed to wheel-made pottery, is deemed an indication of nomadism—a perpetually self-fulfilling argument. Demonstrating that a portion, and possibly most, of the overall population in question was reliant on mixed agropastoralism calls into question the foundation of studies relating to Central Asian social complexity, craft specialization, population demographics, and economy more broadly. Here we do this by presenting nine categories of evidence, including (1) macrobotanical remains, (2) microbotanical data, (3) stable carbon isotope values of bone collagen and tooth enamel, (4) sedentary occupation structures, (5) agricultural tools and grinding stones, (6) large nonportable material culture, (7) ethnographic and ethnohistoric analogy, (8) zooarchaeological evidence, and (9) historical sources. Any one of these data sets could perhaps be called into question if presented alone, but as one combined body of evidence,

they create a strong argument for a significant reevaluation of Central Asian prehistory. These data do not exclude the possibility that local-scale movements were made by some groups or that segments of society moved seasonally, but they do give reason to question uniform narratives of nomadic or highly mobile people who were reliant predominantly on meat and dairy.

Geographic Focus of This Discussion

It is not possible in this paper to cover all of the recent archaeological advances in Eurasia. We do reference examples from various regions of Eurasia to fill in gaps in scholarship and discuss broader Central Asian patterns (see SI1). However, our main focus is on eastern Central Asia, which we define here as eastern Kazakhstan, western Xinjiang, and the southern Altai, as figure 1 depicts. Farther south in Central Asia, in the Pamirs and through Ferghana, clear evidence for sedentary farming communities of the third millennium BC onward is not disputed. Our area of focus roughly parallels what Frachetti (2012) has referred to as the Inner Asian Mountain Corridor (fig. 1), an area largely demarcated by its agriculturally rich river valleys and mountain foothills. In this paper, we also narrow our discussion to the second and first millennia BC, because there are currently ample archaeological data from this region to discuss paleoeconomy (Doumani et al. 2015; Frachetti 2008). The economic models that we present here should not be applied to all regions of Eurasia. Recent studies have illustrated that people across Eurasia were not directly connected and that economic strategies followed unrelated developmental trajectories (Frachetti 2012).

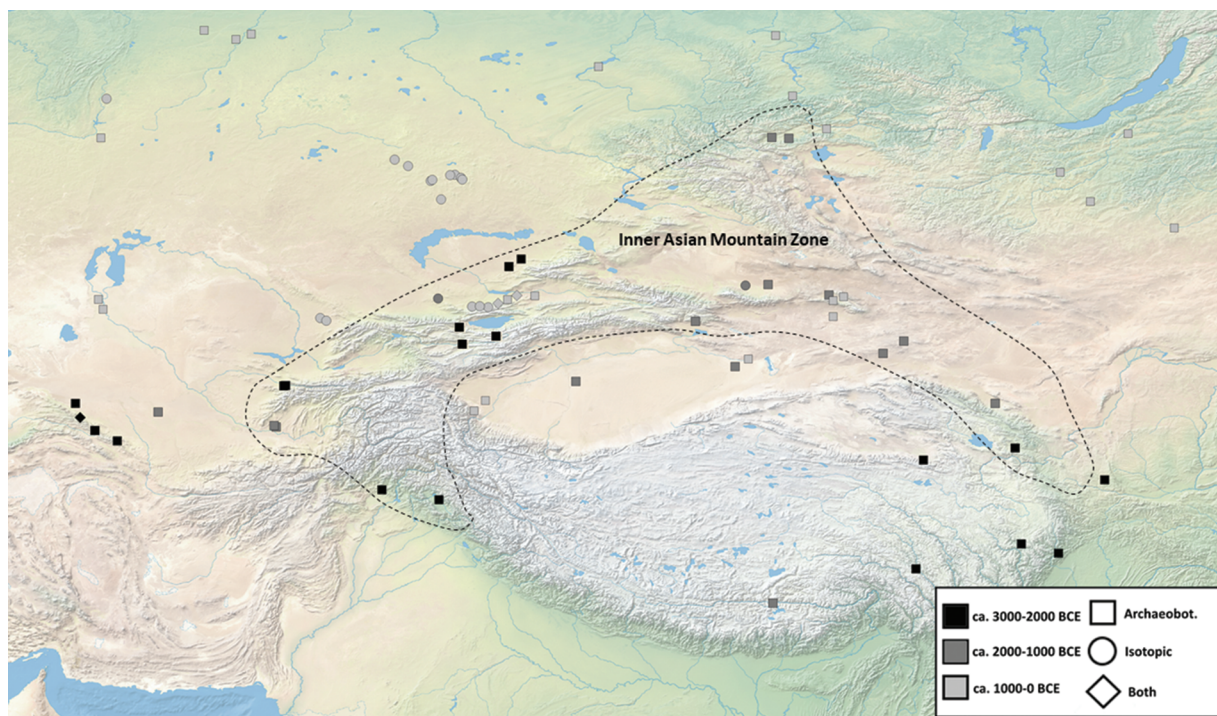


Figure 1. Key archaeological sites from northern Central Asia, with archaeobotanical and carbon isotope data; all indicated sites provided evidence for farming from the third through the first millennia BC. Reference and site numbers are as they appear in S2 table 1, available online.

While we discuss a specific temporal and geographic pocket in the broader area of Central Eurasia, this pocket rests along a key route of cultural connectivity in prehistory (fig. 1). Understanding the paleoeconomy of this region is thus important for a clearer understanding of Eurasian archaeology as a whole. Furthermore, as we note in supplementary section one, similar arguments are emerging in other parts of Eurasia that were also thought to be predominantly pastoral (e.g., Hammer and Arbuckle 2017; Myadar 2011; Potts 2014; Spengler 2015; Spengler et al. 2016; Williams 2015) as well as earlier periods. Therefore, in focusing on the second and first millennia in the geographic center of Central Asia, we ultimately suggest revisiting a broader foundational assumption for Eurasian prehistory as a whole.

The Nomadic Bias

For decades, books about the history or prehistory of Central Asia have focused on the image of a highly mobile warrior nomad (e.g., Beckwith 2009; Drews 2004; Koryakova and Epimakhov 2010; Golden 2011a; Grousset 1970; Liu 2010; Simpson and Pankova 2017). This image dominates the academic discourse concerning this region and has largely directed the research questions that scholars ask. Over the past few years, new scholarly research has illustrated that the picture of past economies was not as clear-cut as previously thought (Frachetti 2008; Lightfoot et al. 2014; Spengler 2019; Ventresca Miller and Makarewicz, forthcoming). It is also interesting to note that until recently, economic models of the mountain foothills of Central Asia during the second millennium BC tended to focus on mixed economies and linear evolution toward “pure” pastoralism of the late first millennium BC (Kuzmina 2008). In these models, mobile pastoralism (as exemplified by the Scythians) was assumed to develop from mixed agropastoralism, therefore suggesting that second millennium BC populations had to be simple farmers and herders. Soviet research often presented a polarized view between intensive irrigated farming and all other strategies—noting that Bronze Age populations only practiced simple hoe-based farming. While placing them in direct contrast to the intensive farming villages of low-elevation river valleys, scholars such as Zadneprovsky (1962:95) noted that the Andronovo tribes practiced a combination of shepherding and hoe farming, with occasional metalworking.

Over the past few decades, scholars have pushed the model of a mobile-pastoral-dominant economy back into the second and third millennia BC. Many recent archaeological projects across Central Asia specifically target mobile pastoral occupation sites and have focused on ecologically marginal landscapes, often in higher elevations or more arid regions (e.g., Frachetti and Mar'yashev 2007; Rouse and Cerasetti 2014). Informatively, even these more marginal sites have provided evidence for farming, but these research agendas leave open the question of what the second millennium BC in Central Asia looked like in the many rich river valleys and in the lowlands. Scholarship often fails to recognize how diverse this massive geographic region was/is and how dynamic cultures have been through time (Barfield 1989; Chernikov

1960; Gryaznov 1969; Liu 2010). The explosion of scientific research in Central Asian archaeology over the past decade has greatly clarified these points.

More archaeologists working in Central Asia are starting to argue that there was a complex mix of economic activities practiced and that people adapted their cultural practices to fit local ecological constraints (Chang 2018; Haruda 2018; Spengler et al. 2017). Therefore, we are not arguing that mobile populations did not exist during the second millennium BC, but if scholars are going to continue to construct arguments based on nomadic models, they need to also grapple with the growing evidence for sedentism and farming. Many archaeological sites recorded thus far would be construed as sedentary and agropastoral if they were recovered anywhere else in the world. It is possible that a portion of the population, possibly young males, took herds into higher meadows a couple of days' walk from the homestead during the summer, which is similar to modern practices in the Alps and/or other mountainous parts of Eurasia. Archaeologists have increasingly emphasized diversity in pastoral strategies, relying on ethnographic analogies to interpret the growing botanical evidence for farming, resurrecting Salzman's (2004) “multiresource pastoralism” (Honeychurch 2015). While there is utility in such terms, they also downplay the complex array of farming strategies that were used to grow a mixed assemblage of crops.

In Central Asia, the category of “nomad” has persistently been a problematic blanket term, referring to all people who did not live in large urban settings (e.g., Hermes et al. 2018). There is no clear acceptance among scholars about how to use terms such as “nomadism” or “mobile pastoralism,” and semantics can complicate archaeological inquiry. In this paper, we use “nomadism” to denote a population of people who regularly engage in population movements (possibly two or more times a year) and consume a diet heavy in dairy and meat products. We use the term “agropastoral” to refer to mixed economic strategies, where all or most of the population remains stationary throughout the year and invests in significant farming activities.

Macrobotanical Data

Spengler et al. (2016) recently compiled a data set (fig. 1) of second millennium BC archaeobotanical remains from Central Asia. Collectively, these data depict a mixed agropastoral economy in the second and first millennia BC across the mountain foothill ecotone. As an example, systematic macrobotanical analysis at the second millennium BC farmsteads of Tasbas identified considerable evidence for late second and first millennia BC cultivation and grain processing (Doumani et al. 2015). These data include ubiquitous remains of long- and short-season crops, as well as water-demanding crops, including bread wheat (*Triticum aestivum*) and peas (*Pisum sativum*; Spengler, Doumani, and Frachetti 2014). The most prominent crop in the assemblage was barley, which was found in association with its chaffing residue; additionally, mudbrick at the site contained barley straw binder (Spengler, Doumani, and Frachetti 2014). In the

mountains farther south, archaeobotanical remains from high-elevation sites such as at Aigyrzhal-2, Uch-Kuribu, or Chap in Kyrgyzstan suggest similar mixed economies (Motuzaite Matuzeviciute et al. 2015). There are also robust data from Xinjiang illustrating that farming economies were present in the early second millennium BC and that villages appeared by the mid-second millennium BC (Dodson et al. 2013; Jia and Betts 2010; Jia, Betts, and Wu 2009, 2011).

Spengler et al. (2017) recently summarized the growing data that illustrate a first millennium BC intensification of farming practices across the foothill zone of Central Asia. These data include remains of irrigation structures and the appearance of farming village sites (Chang 2018). Miller, Spengler, and Frachetti (2016) point out that the wider distribution of millet crops in southern Central Asia at this time likely correlates with increased irrigation and crop-rotation cycles that used broomcorn (*Panicum miliaceum*) and, eventually, foxtail millet (*Setaria italica*) as dry-season crops. While we cannot verify that these rotation cycles were in play in northern Central Asia, the diversity of crops identified at these sites speaks to an intense and mixed economy. Notably, cultivated grape seeds (*Vitis vinifera*) were recovered from Tuzusai in southeastern Kazakhstan (Spengler, Chang, and Tourtellotte 2013; Spengler et al. 2017). In addition, farmers of the first millennium BC were cultivating hulled varieties of barley (*Hordeum vulgare* var. *vulgare*) as opposed to the more water-demanding naked varieties (*H. vulgare* var. *nudum*) that dominated assemblages in the second millennium BC (Spengler, Doumani, and Frachetti 2014). Farmers were growing lax and compact-eared varieties of wheat, broomcorn millet, foxtail millet, and, in some regions, a wide variety of legumes (Spengler 2015).

Zhao et al. (2013) identified early crop remains at the settlement of Xintala in Xinjiang. Many other archaeobotanists have found remains of wheat, barley, and both broomcorn and foxtail millet at settlements and cemetery sites across Xinjiang. These carbonized remains were recovered from sites dating as far back as the early second millennium BC, but they become far more abundant starting in the mid-second millennium BC (Dodson et al. 2013; Jia and Betts 2010; Jia, Betts, and Wu 2009, 2011; Yang et al. 2014). By the late first millennium BC, irrigated farming villages existed across the oases of the Taklamakan and the foothills around Xinjiang. In addition to the abundance of grain crops, by the first millennium BC, legumes were cultivated, as were peaches (*Prunus persica*), apricots (*Prunus armeniaca*), walnuts (*Juglans regia*), and grapes (Jiang et al. 2009). Collectively, the macrobotanical evidence from across Central Asia illustrates that a complex farming economy was used in certain regions in prehistory.

Microbotanical Data

The few microbotanical studies conducted in Central Asia complement the macrobotanical conclusions, suggesting that domesticated grains were prominent at late second and first millennia BC sites and that cereals were processed on-site. Phytolith

analyses conducted at Tuzusai and Tseganka 8, both on the Talgar alluvial fan, attest to a complex agricultural component in the economy, including such crops as bread wheat, barley, foxtail millet, and perhaps (albeit less clearly) broomcorn millet (Chang et al. 2002, 2003; Rosen, Chang, and Grigoriev 2000). In follow-up research at these sites, specialists also identified phytolith remains of cereal chaffing material (Chang and Beardmore 2016).

A phytolith study at the late second millennium BC farmstead of Tasbas also identified chaffing remains of domesticated grains, illustrating that grains were processed on-site (Doumani et al. 2015). In addition, phytolith studies conducted in Xinjiang during the past few years have identified siliceous deposits from the chaff of domesticated grains. For example, at the sites of Luanzagangzi (1300–900 BC) in the Dzungarian Basin on the northern slope of the Tian Shan Mountains in northern Xinjiang, scientists identified phytoliths from grains, including wheat, barley, broomcorn, and foxtail millet (Zhang et al. 2017). Starch grain studies on material from the Saensayi and Chawuhu cemeteries also identified wheat, broomcorn, and foxtail millet, as well as legumes (Jia et al. 2013; Yu 1999).

Isotope Studies

Stable isotope research in Eurasia focuses heavily on $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ analyses of human bone collagen recovered from burials across this broad zone. Human burials have been studied from the early second through the first millennia BC and span all of Central Asia. The burials mainly represent elites and reflect extensive collective labor in funerary ritual. A recent meta-analysis of previously published isotopic data from the northern Caucasus to eastern Mongolia clarifies the timing, introduction, and intensification of farming (Ventresca Miller and Makarewicz 2019). During the second half of the second millennium BC, there is clear evidence for the consumption of C_4 plants across much of this zone, except in Mongolia. Scholars collectively agree that this is the result of millet consumption (Ventresca Miller and Makarewicz 2019). Ecologically rich areas like the Minusinsk Basin have groups exhibiting high levels of millet consumption during the mid-second millennium BC (Murphy et al. 2013; Svyatko et al. 2013). What is most astonishing is that, even in the most arid parts of central Kazakhstan, by the second half of the second millennium BC, people appear to have been consuming millet (Ananyevskaya et al. 2018). By the mid-first millennium BC, most populations across Eurasia were consuming significant levels of millet (fig. 1; Motuzaite Matuzeviciute et al. 2015).

Studies from Xinjiang collectively show a shift in C_4 plant consumption from being more prominent at eastern sites in the early second millennium BC to being prominent at all sites by the late second millennium BC. Isotope data illustrate that millets were prominent in these mixed cultivation systems across Xinjiang and southern Kazakhstan by the early second millennium BC (Li et al. 2017; Motuzaite-Matuzeviciute et al. 2015) and across central Kazakhstan by the end of the second millennium

BC (Ananyevskaya et al. 2018). However, the level of consumption was variable between regions (Motuzaite-Matuzeviciute et al. 2015; Murphy et al. 2013; Svyatko et al. 2013). Additionally, wheat and barley dominated most archaeobotanical assemblages and were likely prominent in the economy, despite being overlooked isotopically. These data furthermore show that some groups adapted their economic pursuits to fit ecological constraints, while in other regions humans chose not to adopt cultigens.

The application of strontium and stable oxygen isotope analyses to human tooth enamel offers the possibility of directly tracking the extent of mobility in a given region. There are still few studies of mobility in Central Asia, and the absence of isotopic reference data have constrained interpretations of mobility (Gerling 2015; Ventresca Miller et al. 2018). Gerling (2015) investigated the link between mobility and culture change across a vast zone using $^{87}\text{Sr}/^{86}\text{Sr}$ and $\delta^{18}\text{O}$ isotopes. This work suggested that in the Altai region of Kazakhstan, in the first millennium BC, horses had greater mobility than humans (Gerling 2015). Recent work has attempted to resolve issues of the extent of human mobility through comparison with isotopic reference data that clarify the distribution of contemporary bioavailable strontium and the oxygen isotope variation in modern drinking water (Ventresca Miller et al. 2018). This study demonstrated that local communities engaged in small-scale mobility with limited ranges, and showed that mobility decreased from the early to mid-second millennium BC in northern Kazakhstan (Ventresca Miller et al. 2018). The preliminary studies that have been undertaken suggest that Central Asian mobility was potentially far more limited than often assumed. In the future, the study of human mobility using $^{87}\text{Sr}/^{86}\text{Sr}$ and $\delta^{18}\text{O}$ isotopes may help further clarify these issues.

Ethnographic and Ethnohistoric Analogies

Many of the archaeological interpretations of Central Asian prehistory have relied on an ethnoarchaeological approach. Observations of Kazakh economies on the central steppe during the nineteenth century have been used as a broad-brushstroke analogy for all peoples of Central Asia in the past, despite the extreme environmental and cultural variability that exists across this vast region. Ethnoarchaeological approaches often overlook the fact that ancient human genomic data directly complement archaeological and historical research in showing that major demographic changes occurred in this region during the past few millennia (Damgaard et al. 2018). Demographic turnover, such as during the Turkic expansions, brought with it cultural and economic changes. Additionally, these approaches, largely ignoring historical urban Kazakhs, assume that the segment of society that lived a mobile and pastoral-focused lifestyle is somehow a better representation of ancient populations. The majority of Central Asians today reside in large cities and maintain an economy based primarily on farming, including labor-intensive grain crops such as bread wheat and rice (*Oryza sativa*). Cities such as Almaty, which has roughly 1.5 million residents, are

supplied by extensive irrigated field systems. Additionally, few herders today survive on a subsistence diet; most are supported by the demand for meat products in the densely populated cities.

Outside big cities, people tend to live in small towns located along rivers or near oases. A recent ethnographic study of modern peoples in the remote Kazakh Altai and Saur Mountains (Hauck et al. 2016) illustrated that almost all of the people in question maintained a small-scale agropastoral economy, and only a few of the younger males in these regions actually performed short-distance herd movements. Every household interviewed in the study was sedentary (Hauck et al. 2016:105), despite all of the households maintaining herd animals. A few households did send young boys into the hills with herds; however, they only traveled short distances and were gone from a few weeks to a couple months. The economy largely relied on market goods and household gardening. Most summer herders today are freelance labor workers; few Central Asian shepherds own their own herds. Bread, rice, and vegetables are purchased in the market, tying these shepherds into a broader agropastoral system. While herders with larger herds may take advantage of separate summer pastures, low densities of herds, roughly 10 animals per household in the Altai Mountains (Hauck et al. 2016; Robinson et al. 2017), can be maintained on a small plot of land near a village without mobility or importing fodder. From the 1940s to the 1980s, the Soviet government implemented numerous agricultural campaigns and expanded markets across Central Asia. Historical descriptions of the economy in these regions, before Russian and Soviet imperialism, may provide a better analogy for what paleoeconomies looked like. A detailed discussion of the complex farming systems, including crop-rotation cycles and arboriculture, described in these early explorers' accounts is presented in Spengler (2019).

Sedentary Occupation Structures

Villages and Fortified Sites

The dense proto-urban settlements of the Sariarka uplands of central Kazakhstan, dating to the middle and end of the second millennium BC, include clusters of small villages and funerary monuments along waterways, such as those in the Sherubaynura and Taldy River basins (Margulan 1979; Margulan et al. 1966). Most notable is the site of Kent, which was a dense village along the Kyzylkinesh River, and included 130 pithouses, an enclosure ditch surrounding the site, and a large open ritual platform. Small satellite villages are located along the river and outside the boundaries of Kent, and these bear evidence of metallurgical activity (Evdokimov and Varfolomeev 2002; Varfolomeev 2011). Similarly, monumental constructions, such as the geoglyphs of Kazakhstan (440 m in size), dated to 800 BC, show power consolidation, territorialism, and limited mobility (Motuzaite Matuzeviciute et al. 2016).

Specifically focusing on the study area discussed in this paper, there are first millennium BC sites in the Tian Shan that appear to be farming villages. Kemal Akishev (1969, 1970) wrote about first millennium BC farming economies in Semirech'ye and referenced

earlier research (e.g., Bernshtam 1941). Bernshtam (1941) built his conclusions on data from the settlement site of Lugovoe-Holm in the Talas Valley of northwestern Kyrgyzstan, with numerous grindstones, mudbrick architecture, and reported finds of grains. Akishev's (1970) conclusions relied on the diversity and abundance of cooking vessels at sites in the Semirech'ye foothills, as well as grinding stones, stone hoes, bronze sickles, and contemporaneous irrigation canals and field plots. Most of his data came from the sites of Aktas I, II, IV, and V, as well as accompanying burial mounds, along the Kegen tributary of the Ili River system. These data have been supported by finds of other farming village sites, such as Amirisai in the central Tian Shan, which also has irrigation systems that likely date to the first millennium BC (Baipakov 2008).

Other examples of late first millennium BC sedentary village complexes include the sites of Chirik Rabad, Badishmola, and Balandy and the Dzetyasar fortifications (Baipakov and Maryashev 2001; Baipakov and Taimagambetov 2006). One of the more interesting of these sedentary villages, which is still under archaeological investigation by Kazakh scholars, is the hillfort site of Rakhat. Rakhat is roughly contemporaneous with the Issyk Golden Man, and the site complex includes numerous house structures and fortifications as well as a cemetery (Nurmukhanbetov, Akhatov, and Bermagambetov 2005; Nurmukhanbetov and Mukhtarova 2011).

Chang (2018) recently summarized more than two decades of systematic excavation at the sites of Tuzusai, Taldy Bulak 2, and Tesganka 8 (fig. 1). She asserts that these village sites were supported by a sedentary farming economy (see also Spengler, Chang, and Tourtellotte 2013; Spengler et al. 2017). The agropastoral villages consist of domestic structures constructed from mudbrick with interlocking rooms and plastered floors, which represent continual building and rebuilding events surrounded by numerous storage pits. Survey work conducted in the region by Chang et al. (2002) identified more than 70 archaeological sites dating to the first millennium BC on one alluvial fan. Chang also pointed out that at Tuzusai, in the 2013 excavation season alone, more than 8,000 ceramic sherds were recovered from an area of 96 m². The archaeobotanical assemblage illustrates that a complex farming system was in place, relying on seven distinct crops (Spengler, Chang, and Tourtellotte 2013; Spengler et al. 2017). The grains include both long- and short-season crops in addition to water-demanding and drought-tolerant crops, suggesting that they were harvested and sown at various times throughout the year. Furthermore, the archaeobotanical assemblage shows that herd animal dung rather than wood was the main fuel source used at the site. This observation, in addition to the lack of good evidence for wild foraging and the limited remains of hunted animals, hints at the likelihood that the foothills were deforested by this time (Benecke 2003; Haruda 2018). Fluvial geomorphological analyses suggest that the main rivers at this time were channeled for irrigation (Macklin et al. 2015).

A full discussion of the spread of irrigation technology in Central Asia is beyond the scope of this paper, but it is likely that

simple gravity channeling of water existed as far north as the southern Altai by the first millennium BC. Vainshtein (1980:145) referenced irrigation canals in Tuva in the Khemchik valley, which have Kazyrgan burials overlaying them. Zhao et al. (2013) argued that the antiquity of irrigation farming in Xinjiang dates back to the early second millennium BC. Akishev (1969:39–47) discussed the remains of first millennium BC irrigation systems associated with farming communities in southern Kazakhstan. The presence of first millennium BC irrigation in southern Semirech'ye is supported by research at the Talgar sites (Chang 2018). Irrigation is also well attested at farming sites across southern Central Asia.

Other small-scale village sites include the early first millennium BC houses ($n = 2$) at Serektas, at the edge of the semiarid steppe. The Turgen site complex contains the Kyzylbulak cemetery and the settlements of Acy and Butakty (Mar'yashev and Goryachev 1999). While Acy (ca. 1200–700 BC) is located at 2,350 m asl (Chang et al. 2002), beyond the typical crop-growing ecocline, its deep occupation levels and seemingly permanent houses led excavators to suggest that it was a sedentary site. The settlement of Butakty consists of stone-wall foundations and provided a large number of grinding stones, notably, saddle quern forms (fig. 6; Frachetti 2004). The settlement site of Talapty is also an archaeological complex located 6.2 km above the Koksus River dam, and excavations recovered abundant grinding stones, ceramics, pestles, and spindle whorls (Frachetti 2004).

Sedentary village sites have been identified from first millennium BC contexts as far north as the southern Altai. For example, in the Ob River region, small villages with semisubterranean houses (ca. 200 m²) were excavated and interpreted as belonging to a farming economy (Bokovenko 1995:292; see also Abdulganeev 1997). Material culture at these sites included agricultural tools, evidence for bronze working, and textile production, including loom weaving. They had large handmade ceramic cooking vessels and similar material culture to contemporaneous sites in the Minusinsk Basin. Bokovenko (1995) noted that first millennium BC sites in the Minusinsk also appear to have been agropastoral, consisting of villages, with bronze sickles, large handmade ceramic pots, massive bronze cooking cauldrons, and sedentary house structures. In addition, as described above, stable carbon isotope and archaeobotanical data have supported this view of an early farming economy in the Minusinsk (Murphy et al. 2013; Svyatko et al. 2013). Early archaeologists working in the Minusinsk recognized the prominence of farming in the first millennium BC (Evtyuhova 1948).

Farmsteads (Homesteads)

Archaeologists have pointed out how ephemeral modern mobile pastoral seasonal sites are, especially summer sites (Wright 2016). Some populations of ethnographic transhumant herders do make relatively labor-intensive winter structures, but in general “in the case of Eurasian mobile pastoralists the fixed elements are stripped down to a bare minimum” (Wright 2016). In contrast, archaeological sites in the mountain foothills from the second

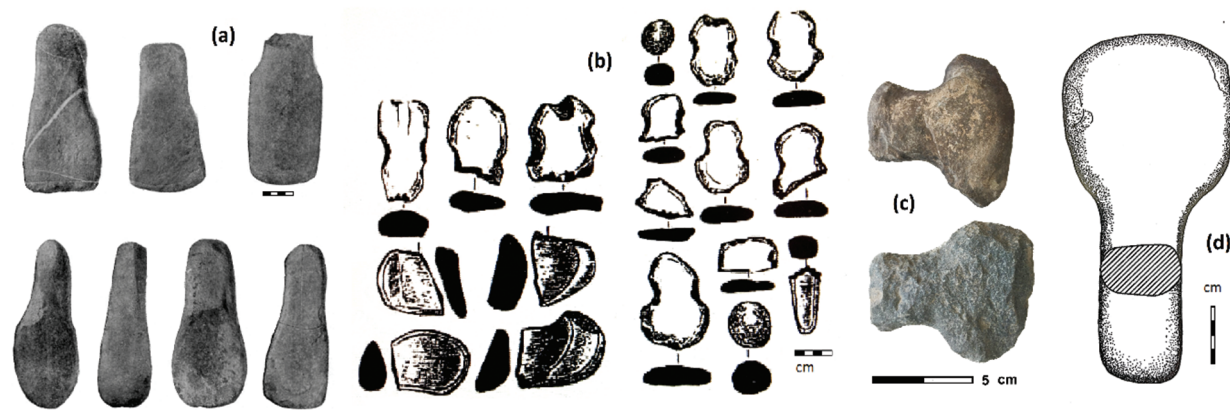


Figure 2. Similar styles of stone hoes were used across eastern Central Asia during the first millennium BC. *a*, A collection of second millennium BC stone hoes from Ferghana (Zadneprovsky 1962:274). *b*, A collection of stone hoes from Akishev's 1970s excavations at Aktas, Kazakhstan (Baipakov 2008). *c*, Two examples of stone hoes from Xinjiang, likely dating from the first millennium BC (Li et al. 2017). *d*, A stone hoe from the Dongheigou (Shirenzigou) site in far western Xinjiang in Balikun County (Wang et al. 2010; Xinjiang and Xibei 2009).

millennium BC onward tend to have dense deposits of ceramic sherds, bone, and sedentary domestic structures made from mudbrick on stone foundations or rammed earth and lined with stones (fig. 4). The handful of these small-scale homesteads or farmsteads that have been investigated for agricultural remains illustrate that farming was part of the economy (Jia et al. 2013; Spengler, Doumani, and Frachetti 2014). In fact, as Kuzmina (2008:65) pointed out, most scholars working in Central Asia prior to the past few decades did not consider these structures as belonging to nomadic people. She argued that light-framed portable structures, similar to yurts, were not invented until the mid-first millennium BC. Maintaining small semisedentary herds and low-investment fields would have been easier if farmsteads were widely distributed, as opposed to colocated in a village where the concentration of pasture animals would have put pressure on local pastures.

Generally speaking, archaeologists prior to the 1990s viewed the second millennium BC people of eastern Central Asia as sedentary or semisedentary and living in dwellings with stone walls, wooden or latticework supports, and wooden or thatched roofs (see reconstruction in Agapob and Kaderbaev 1979). The site of Begash (figs. 3, 4; Frachetti and Mar'yashev 2007) constitutes one of the earliest of these farmsteads. While the entire house structure at Begash was not excavated, it appears to resemble other similar contemporaneous structures in the region, such as the stone-wall foundation at Buguly II (Margulan et al. 1966), which was roughly 8 × 10 m. Several similar sites have been identified in western Xinjiang (Jia et al. 2017), and other examples exist from across the northern and central foothills of Xinjiang (Dodson et al. 2013). However, because heavy wind deflation has removed all stratigraphic integrity, these deflated houses consist of stone-wall foundations. In some cases, such as the site of Adunqiaolu (Jia et al. 2017), the lines of rocks outline what would have been a rammed earth construction. Farther

north, in the southern Altai, many scholars have suggested that people of the second and first millennia BC lived in sod, mudbrick, or log-cabin-style houses (Bokovenko 1995). One of the best excavated of the homestead sites is Tasbas (figs. 3, 4), with mid- to late second millennium BC occupation layers and remnants of a domestic structure that had a large mudbrick oven (Doumani et al. 2015). This house structure was only partially excavated but sits against a rock outcrop that constitutes one of its four walls. The excavators interpreted the site as a "multi-season residence, and a mixed economy," with evidence for farming and craft production (Doumani et al. 2015:19). They note that the density of ceramic sherds and the complexity of forms are not characteristic of a mobile seasonal encampment.

It is also likely that the timber graves or log-cabin burials in the southern Altai, with interlocking notched logs, reflect smaller versions of houses for the deceased. These log-cabin burials show an impressive level of craftsmanship in house building, with locking boards and flattened inner walls and floors (Askarov, Volkov, and Odjav 1992; Baumer 2012). Rock art depictions from the southern Altai also illustrate the prominence of these domestic living structures; for example, the Boyar petroglyphs located in the Minusinsk Basin (Bokovenko 1995:280; fig. 5) contain village scenes. Archaeologists have interpreted the domestic structures in these scenes as being log cabins or mudbrick houses with wooden pole supports for the roofs and grass or straw roofs. Similarly, petroglyphs from the Kazakh Altai contain images of houses, notably, from the Tarbagatay region; one of the rocks in this region has several square and rectangular houses, seen from an aerial view without roofs; in other regions, these squares have depictions of people in them. Additional depictions of house clusters or villages have been noted in the southern Altai along the Yenisei River. Samashev et al. (2012) and Jacobson-Teper (2015) also provide examples of petroglyphs with houses that have room divides. It is worth pointing out that small-scale

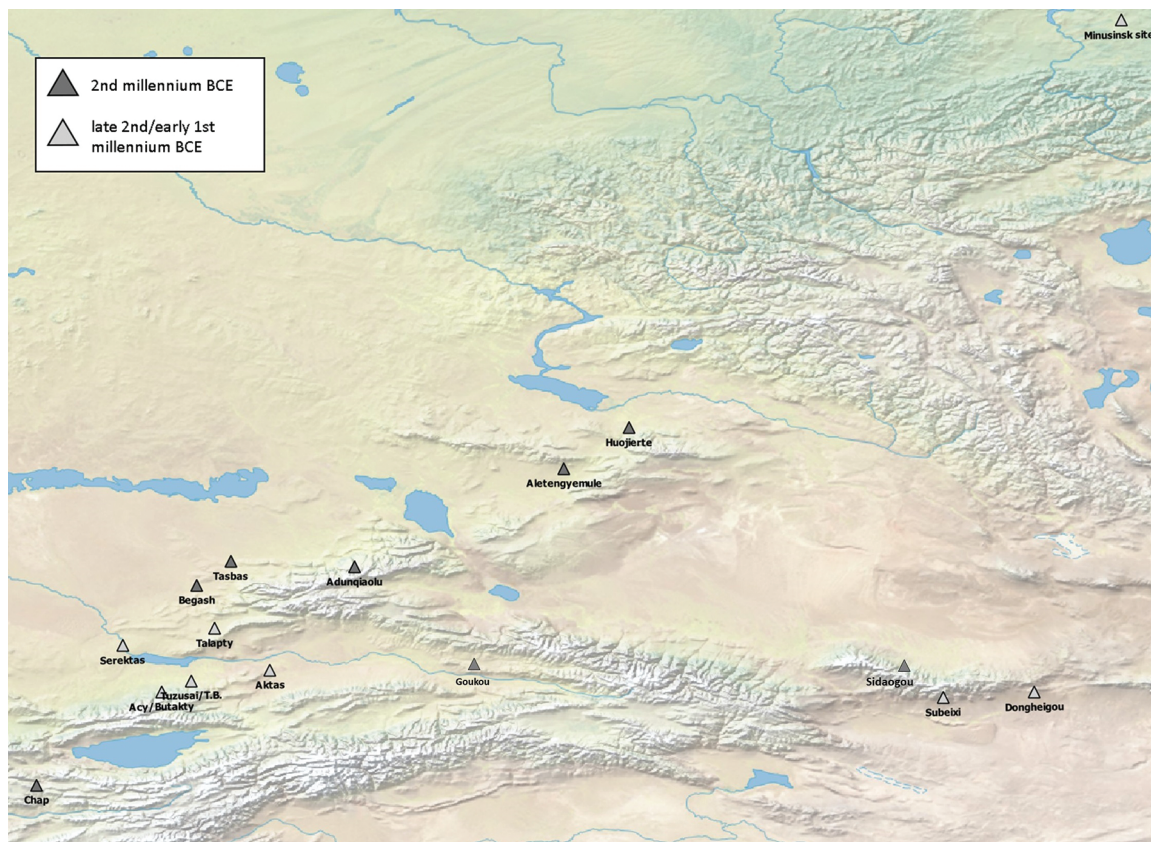


Figure 3. Select examples of archaeological sites that represent nonportable house constructions, which were likely agropastoral farmsteads, dating to the second millennium BC and late second and first millennia BC farming villages.

farmsteads were the basic unit of occupation across most of Central Asia, likely from the third millennium BC onward (SI 1).

Material Culture Evidence for Economy

Many scholars have noted that material culture is not a useful indicator for identifying mobile pastoralists, but one of the leading lines of evidence used to argue for nomads in Central Asia is the presence of riding tack in burials. To the contrary, Di Cosmo (1994) provided a synthesis of first millennium BC farming implements from across Xinjiang and parts of Central Asia. He also noted that people may have used only wooden tools. Rare examples of wooden shovels or spades, preserved by desert conditions, have been recovered from first millennium BC contexts in Xinjiang (Zhang et al. 2018), and wooden farming tools are used in parts of Central Asia even today. Lisitsina (1981) similarly argued that *Tamarix* wood for making farming implements would have been plentiful around rivers or well-watered areas of early farming sites in the Kopet Dag of southern Turkmenistan. Interestingly, even in the areas of southern Central Asia where we know farming was the basis of the economy, farming implements are not prominent among the archaeological remains. It is also important to keep in mind that Central Asians of these time periods knew how to move dirt without stone or metal tools, as evidenced by the thousands of

large burial mounds across the region. Despite the fact that farming tools are not archaeologically abundant in Central Asia, they have been recovered from some sites across this broader region. In western Xinjiang, notably, at several sites in Aksu and Shufu, stone farming tools are well attested back to the mid-first millennium BC (An 1992; Li et al. 2017). Stone hoes are also present at sites in western Xinjiang and may date to even earlier periods (Agapob and Kaderaev 1979:163; Wang et al. 2010; Xinjiang and Xibei 2009). Akishev (1970; fig. 2) noted similar stone hoes in southern Semirech'ye, along with irrigation canals and grinding stones. Occasionally, farming tools have been recovered from burials (see Moshkova 1995:144), and in some cases from northern Central Asia, such as the stone hoe from Kurgan I of the Bajkara cemetery (Parzinger et al. 2003).

Second millennium BC sites across Ferghana provide better evidence for farming tools, although the evidence is still not overly abundant (Lhuillier 2016). Zadneprovsky (1962:76) specifically referenced 30 different finds of sickles from across the region, which he argues date to the second millennium BC. Some of the sickles that he mentioned consist of mandibles with hafted microliths and some consist of crescent stone knives, similar to forms found in Xinjiang. Interestingly, both stone hoes and bronze sickles from Xinjiang and Ferghana look identical (Lhuillier 2016; Zadneprovsky 1962). Korobkova (1981) discussed hafted sickle blades across a large area of Eurasia, including sites in

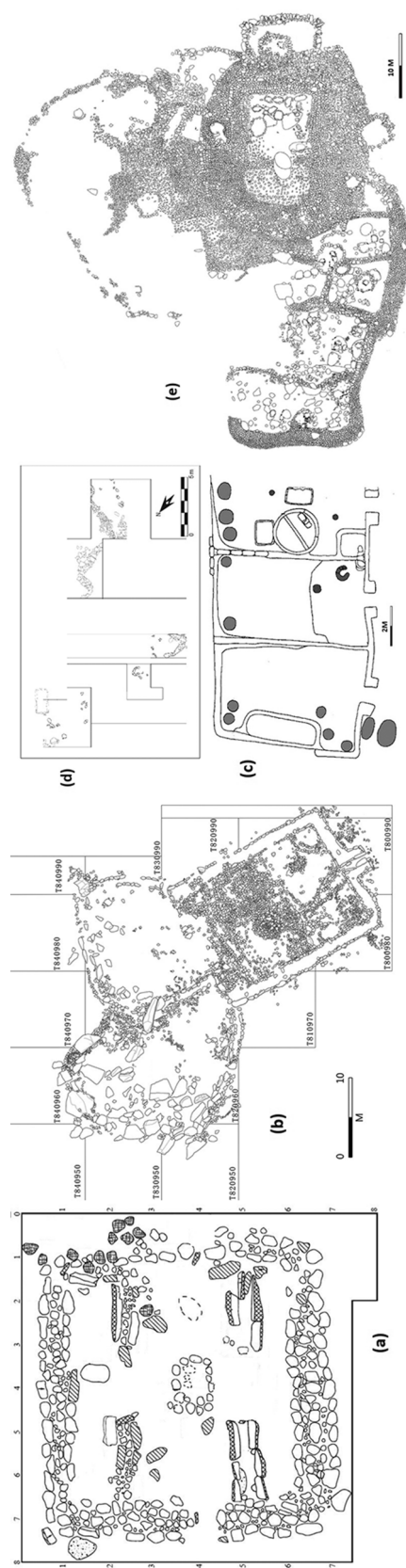


Figure 4. A few examples of Bronze and Iron Age houses. *a*, Biluut, Mongolian Altai (ca. 2000 BC; Fitzhugh, Kortum, and Bayarasaikhan 2012); *b*, stone-wall foundations of Bronze Age Adunqiaolu, Xinjiang (Jia et al. 2017); *c*, first millennium BC Subeixi site in Xinjiang (Xinjiang et al. 2002); *d*, late third and second millennium BC Begash, Kazakhstan (Frachetti and Mar'yashev 2007); and *e*, stone-wall foundations from a complex-roomed structure at the Dongheigou (Shirenzigou; Wang et al. 2010).



Figure 5. From Bokovenko (1995:281) of the Boyar petroglyphs from the Minusinsk Basin (*top, lower right*) and a petroglyph from Tsagaan Asga (*bottom left*; Jacobson-Tepfer 2015).

southern Central Asia. Polished stone hoes and grinding stones were recovered from the site of Banjiegou (1500–500 BC) in eastern Xinjiang, and at other sites in that region, stone hoes and stone choppers were reported (Jia and Betts 2010). However, as noted by Ventresca Miller et al. (2014*b*), sickles are not concrete evidence of farming and may instead have been used to cut and harvest fodder for livestock.

Sickles composed of microliths mounted along a wooden structure were in use in the Zerafshan and parts of the Pamir Mountains by at least the early third millennium BC (Litvinsky

et al. 1962; Razzokov 2008). Korobkova (1981) reconstructed and experimented with Central Asian hafted sickles. Second millennium BC microliths have been recovered from sites in the mountain foothills of northern Tajikistan, in some cases in large numbers. While microliths are less prominent in archaeological sites in Semirech'ye, they are still readily found in second millennium BC contexts. These stones have never been examined for use wear or hafting residue.

Grinding stones are abundant in Central Asia, with a diversity of forms in most archaeological sites across the region from the

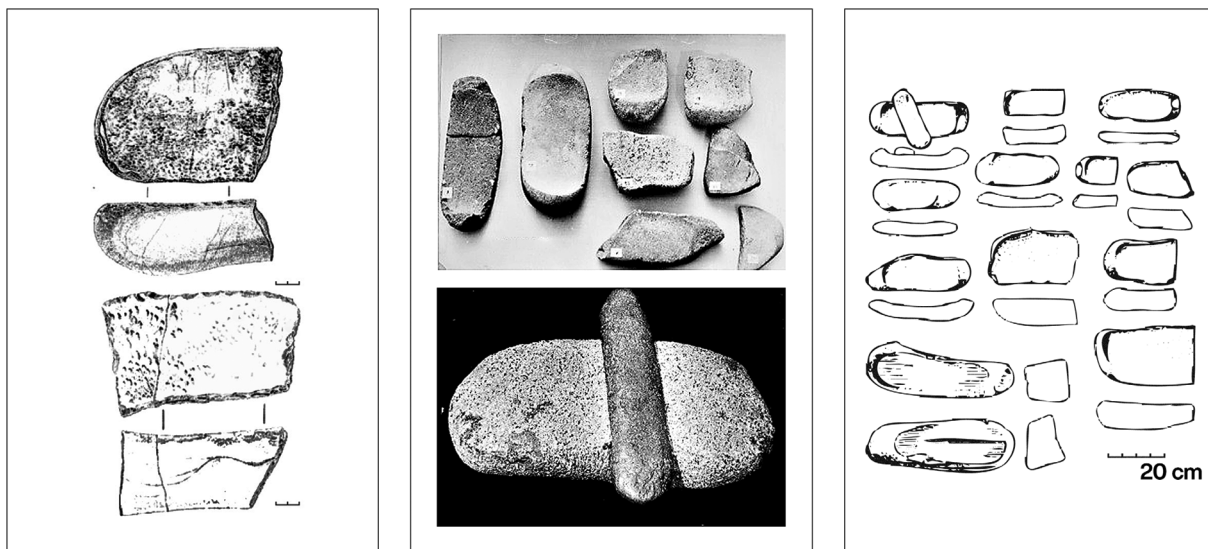


Figure 6. *Left*, illustration of saddle quern fragments from Begash in eastern Kazakhstan (Frachetti 2004), late third millennium BC, with clear flattened sides from extensive use. *Right*, illustrations of a collection of second millennium BC saddle querns from Ferghana, similar in shape and form to varieties found farther north in Central Asia (Zadneprovsky 1962:275). *Top middle*, examples of the saddle quern grinding stones from the site of Talapty (Frachetti 2004:448). *Bottom middle*, saddle quern Butakty in the Tien Shan Mountains, dating to the late second millennium BC; many grinding stones were recovered from the site from (Frachetti 2004:447).

second millennium BC through to historical periods (Litvinsky 1962). Despite their abundance, and the presence of typical grain-processing forms and sizes, many scholars have tried to discuss away their presence as pigment grinders or as implements for wild grain processing (Bokovenko 2006). The prevalence of saddle-quern-style grinding stones is a particularly important sign that they were used for grain processing and not pigment grinding—this form relies on the weight of a person to press two stones against each other and grind grain between them (Litvinsky 1989; Vainshtein 1980). Farther south, in the Amu and Syr Darya regions, stone mortars and pestles are often included in female graves (Yablonsky 1995:227), which has led archaeologists to link bread making to a gendered division of labor. There are many grinding stone shapes and sizes in eastern Kazakhstan, dating to the second millennium BC (Agapob and Kaderbaev 1979), and the diversity of forms increases in the first millennium BC when farming saw greater investment. These first millennium BC stones, furthermore, testify to the prominent role of grain consumption in diets.

Nonportable Material Culture

In addition to farming tools, grinding stones, sedentary architecture, and irrigation structures, other types of archaeological remains support the likelihood of reduced mobility in eastern Central Asia in the second and first millennia BC. As described above, material culture recovered from sites of this time frame does not resemble the material remains of mobile pastoral sites described in the ethnographic record. This is most evident in the densities of sherds at some of these sites, which are generally not consistent with short-term seasonal occupation. Some scholars have noted that the diversity of forms of cooking and storage vessels in eastern Central Asia is not typical of mobile peoples (Chang 2018). During the first millennium BC, the diversity of ceramic cooking vessels greatly increased at many eastern Central Asian sites, and large storage vessels are also attested at some sites. At this time, massive Scythian bronze cauldrons are associated with Iron Age nomads stretching from Ferghana to the Altai. Several of these three-legged cauldrons have been recovered from Semirech'ye (Agapob and Kaderbaev 1979), notably, from the Issyk region. Gorbunova (1986:47) described examples from Ferghana that were 64 cm in diameter and stood on three legs; he noted that these vessels illustrate how interconnected the peoples of Semirech'ye and Ferghana were, both culturally and economically. Farther north, examples of bronze cauldrons come from northeastern Kazakhstan (Bernshtam 1951) and the Minusinsk Basin (Bokovenko (1995). Likewise, the Andronovo-type ceramic vessel is generally large (up to 8 L) and bulky; it is not comparable with portable and expediently produced ceramic vessels found at truly mobile sites in other parts of Eurasia. Pots should not be used as indicators of either mobility or sedentism, but it is important to reiterate that these vessels do not support arguments for nomadism.

Evidence for specialized craft production (defined by individuals who devote their livelihood to a specific craft as opposed

to food production) in eastern Central Asia from the late second millennium BC onward furthermore contradicts the possibility that all of these populations were mobile. For example, advanced metallurgy is often associated with mobile steppe populations in Central Asia, but would most likely have been incompatible with high mobility (Koryakova 2002:110; cf. Park 2017). In addition, certain fighting animal motifs that appear on metal artifacts have been associated with nomads. However, if we accept that the animal motifs are part of a broader agropastoral cultural system in Eurasia, there is little reason to argue for a pastoralist interpretation. Instead, it seems more likely that sedentary populations built metal smelting furnaces/oven sites and remained near metal ore deposits until wood or other resources ran out. Taldysai is one first millennium BC example of such a metallurgical center. Presumably, these metal ore deposits were highly valued and would have been protected year-round.

Certain aspects of textile production provide examples of an activity that is not highly compatible with nomadic pastoralism. The textile industry that existed in Semirech'ye during the first millennium BC relied on both plant and animal fiber and used both plain weaves and twills (Doumani et al. 2017). While it is possible to produce basic plain weave textiles using portable foot looms, which were historically used across the more remote regions of Central Asia and Tibet, complex warp-weighted twill patterns require large upright standing looms. It is unlikely that these looms would have been relocated with seasonal herd movements throughout the year. To clearly argue that these twills were produced locally and not imported, archaeological loom weights would be needed. While a few loom weight assemblages have been recovered from burials (Barbarunova 1995:124; Parzinger et al. 2003:30–31), most loom weights were likely either unworked stone or unfired clay.

Zooarchaeology

Some scholars have suggested that the abundance of cattle bones at sites in the foothills may be indicative of sedentary herding. Others have pointed out that absolute numbers of horse bones remain low in eastern Central Asian foothill homestead sites until the late second millennium BC; fewer horses also implies a reduced potential for human mobility (Frachetti 2012, Taylor et al. 2018a). However, proportions of horse remains in zooarchaeological assemblages are constant across the more densely populated Sariarka uplands through the second and first millennium BC, indicating a complex picture of pastoral exploitation strategies that would have varied by ecoregion (Haruda 2018).

A model for agropastoral economies emerging from the analysis of cementum annulations in caprine (sheep/goat) teeth from the site of Tuzusai suggests that prehistoric populations with mixed economies occupied the same location year-round, with a seasonal spike due to fall slaughter (Schmaus, Chang, and Tourtellotte 2018). A comparable data set from Tasbas in the second and first millennia BC displays a similar pattern of year-round deposition with a seasonal spike in the fall (Schmaus, Doumani Dupuy, and Frachetti 2020). Begash, in the second

millennium BC, displays a somewhat more complex pattern but still has deposition in all seasons. The patterns suggest that these sites were not just seasonal encampments, but rather places used regularly by people who were part of a mixed economic system.

Geometric morphometrics, an analytical method that uses more advanced mathematical techniques than traditional metric analyses, revealed that sheep populations across central and southeastern Kazakhstan were separate landraces and likely not from a contiguous and connected uniform population (Haruda 2018). Thus, shepherds moved flocks in local pathways, even within the same region. Shepherds from Kent, Serektas, and Turgen (described above) had different landraces of sheep, despite their locations within the open steppe (Kent) and in Inner Asian mountain area along the foothills of the Tian Shan. These local evolutionary pathways are more indicative of agropastoral movement strategies around a sedentary hub than they are of fully mobile lifeways. The year-round occupation of sites, such as Begash, Tasbas, and Tuzusai, is also loosely suggested by a close study of the small herbaceous wild seeds in the archaeobotanical assemblages of herd animal dung (Spengler et al. 2014). Plotting out the fruiting seasons for the wild plants in this dung shows that herd animals were consuming these plants through the summer and into the fall, complementing other data that suggest the sites cannot be winter encampments, despite their locations at lower elevations in the foothills. These new approaches to previously recovered zooarchaeological data reveal cases of limited spatial mobility and year-round occupation of many areas in eastern Central Asia.

Written Sources

Traditionally, archaeological interpretations in early Central Asia volley between text-driven and text-dismissive. However, many historical accounts feature an overriding rhetoric geared toward defining Central Asians as monolithic “others,” in keeping with dominant political agendas. Yet many of these sources also provide data that challenge the assumption of nomadism for all of Central Asia (Hartog 1988; cf. Di Cosmo 1994). Greek and Roman historians repeatedly distinguished the peoples beyond their borders as simple and lacking the key trappings and practices of civility. However, Greek chroniclers described a host of different groups under the broad rubric of “Scythian” as having varied subsistence strategies, including agriculture and viticulture (Herodotus 1920 [ca. 450 BC]:book 4; Strabo 1924 [7 BC–AD 23]:11.8). Chinese scribes of the late first millennium BC similarly describe the peoples of Central Asia as engaging in a variety of settled and agricultural lifeways. Those in Ferghana, for instance, had armies of mounted archers on sturdy horses, but they also lived in walled towns and maintained vineyards with massive stores of grape wine and grains (Sima Qian 1959 [91 BC]:ch. 110; see also Hulsewé 1979). These sources also describe numerous farming villages across the far eastern stretches of the Tian Shan, in addition to a large city with surrounding farmlands and pasturelands in the Turpan Basin. The texts provide ample examples of the same popu-

lations harvesting crops and trading agricultural products with neighboring groups (Di Cosmo 1994).

Discussion

Two Millennia of Political Agendas

The idea that all peoples of eastern Central Asia during the second and first millennia BC (what culture historians have called the Andronovo Complex and later Saka and Wusun groups) were nomadic is tied deeply into the ancient historical sources “othering” the peoples who lived on the periphery of China (e.g., *Shiji*), Persia (e.g., the Behistun Rock), and Southern Europe (e.g., *The Histories*; see Hartog 1988 and Gray 1995). The drawing of distinctions between settled populations and those living outside of literate societies was a political tactic to illustrate differences between the “civilized” Greeks or Han and the others. This narrative was later revitalized in academic literature, by historians and archaeologists alike, in early works that perpetuated a categorical divide between “the steppe and the sown” and classified the steppe pastoralists as incapable of sowing fields (Peake and Fleure 1928).

Similar political agendas have been continually resurrected over the past two millennia and continue to play out in archaeology. These political agendas were prominent in Soviet-period scholarship, which depicted a bifurcated social development. Following Marxist ideology, much of the archaeological scholarship of the Soviet period described a linear progression of Central Asian societies from mixed agropastoral (in the second millennium BC) to highly specialized nomads in the first millennium BC (e.g., Khazanov 1984). Accordingly, most Soviet-period archaeologists accepted that eastern Central Asian Bronze Age peoples had mixed farming and herding economies (Akishev 1969, 1972, 1977; Latinin 1958; Yablonsky 1995).

Over the past few decades, however, the view of a pastoral-dominated economy has been transplanted onto the Bronze Age, possibly in response to the romanticization of the mythical nomadic ideal. The nomadic bias has been furthermore promoted by a heavy focus on horse-riding equipment and animal art ornaments recovered from burial mound excavations. These tombs tend to contain the remains of elite individuals, possibly military or political leaders, or wealthy herd owners, who may not have engaged in farming. Archaeologists have a tendency to look at modern mobile pastoralists as a window into the past (cf. Myadar 2011), but they often overlook how dependent modern pastoralists are on market economies and modern technology. The focus on only the pastoral aspects of how ethnoarchaeology feeds into the series of two-millennium-old political agendas. Most recently, by embracing a romanticized nomadic ideal, the Kazakh government is attempting to develop a national identity that breaks from Soviet imperialism; hence, the tactics of Soviet politicians and archaeologists have been appropriated for modern nationalistic agendas (Chang 2018; Kohl 1998). Rather than being an elite member of an agropastoral society with permanent villages, the Issyk Golden Man has become an icon of a powerful

nomadic society and a powerful modern nation through rhetoric and imagery (Carney and Moran 2000; Golden 2011a; Khazanov 2006; Kohl 1998). Therefore, there have been more than two millennia of compounding propaganda-based narratives surrounding the nomads of Central Asian prehistory.

Arguments Used to Support Nomadic Models

It is also important to look at the arguments used to support the idea that prehistoric Central Asian populations were nomadic. In some cases, these arguments can be turned around to better suit the models that we present in this paper. For example, evidence for increased social hierarchy, population density, and craft specialization has been used to suggest that nomadic confederacies or polities were forming in the first millennium BC (Kuzmina 2008). These arguments revolve around the idea that extensive mobility leads to increased trade over long distances. However, while there is strong evidence for long-distance exchange, there is currently no direct evidence for human or livestock mobility at the interregional scale. If these assumptions are set aside, the arguments about hierarchy, population density, and craft specialization actually provide a strong foundation for discussing a diversified agropastoral model. Anywhere else in the world, demographic increases and changes in political structure would be interpreted as indications of greater grain surplus and irrigated farming, but in Central Asia, where a specialized pastoral economy is assumed, they become criteria for discussing mobile polities or noncentric political structures. There are no examples of high population densities among specialized mobile pastoral groups in the historical records, and it seems unlikely that there would have been higher population densities in Central Asia in the deeper past (although Sintashta sites, such as Arkaim, provide tantalizing possibilities).

Another prominent circular argument in Central Asian archaeology is the association of handmade ceramics with pastoralism—the implication is that people who did not use pottery wheels must be nomadic (e.g., Frachetti and Maksudov 2014; Hiebert 1994; Masson and Sarianidi 1972; Moshkova 1995; P'yankova 1994; Rouse and Cerasetti 2014; Vinogradova and Kuz'mina 1996; Yablonsky 1995). When handmade ceramics are recovered from urban sites, they are used to argue for social interactions between sedentary and nomadic people. In some cases, mining and metallurgy are linked to mobile pastoralists and steppe populations through the presence of Andronovo-style handmade ceramics at mining sites (Boroffka, Cierny, and Lutz 2002). Interestingly, Gorbunova (1986) pointed out that both handmade and wheel-made ceramics were used at sedentary farming sites across Central Asia. Meanwhile, other scholars have linked a lack of visible archaeology to mobile pastoralism, in some cases drawing conclusions on the basis of surface finds (e.g., d'Alpoim Guedes and Hein 2018)—suggesting that an absence of evidence is *evidence of absence*. Yet other scholars suggest that a lack of urban architecture equates with nomadism (Hermes et al. 2018), while some present urban-like architecture as an oddity at sites presumed to be nomadic (Rogers 2017).

Scholarly literature on the paleoeconomy of Central Asia produced over the past few decades has largely relied on a simplistic transplantation of modern ethnographic studies onto the archaeological record. In addition to being culturally distinct from prehistoric populations, it is generally accepted that modern mobile herders in the mountains of eastern Central Asia are genetically and culturally unrelated or only share limited ancestry (Damgaard et al. 2018; Golden 2011a); their Turkic-speaking ancestors moved into the region as recently as the second half of the first millennium AD. The Inner Asia Mountain Corridor (Frachetti 2012; Kuzmina 2008) reshaped economies during the late third and second millennia BC; among other aspects of economy, this corridor brought farming knowledge and domesticated crops into the mountain foothills, along with peoples that culture historians have referred to as Indo-Iranian from southwest Asia (Spengler et al. 2014). The expansion of Turkic (often pastoral) populations under the Karluk and Qarakhanid Empires, and with the upheaval of farming systems and abandonment of irrigation constructions during the Mongol conquests, likely contributed to the formation of the modern economies of Central Asia (Golden 2011a:38). The collapse of market and political centers with the Mongolian advances and the loss of Islamic states, as well as decentralization of political control before Timur, and the disrepair of public works irrigation projects may all have contributed to a reduced focus on farming in Central Asia during the past millennium. But these changes must be recognized as relatively recent transformations, and there is no compelling reason for understanding them as extending into earlier time periods.

Conclusion

In this paper, we discuss some of the archaeological evidence for this economic system, highlighting the widespread presence of sedentary architectural structures (farmsteads and villages) and abundant grinding stones, in addition to farming implements, storage pits, irrigation canals, twills made with nonportable upright looms, and bulky nonportable bronze and ceramic cooking cauldrons. In linking these archaeological data to recently accrued information emerging from the application of archaeological scientific methods, including isotope evidence, phytolith and macrobotanical data attesting to farming and grain processing practices, and seasonality estimates from zooarchaeological and macrobotanical studies, we can piece together a much more detailed and complex image of life in eastern Central Asia during the second and first millennia BC.

If we, as a scholarly community, accept that large parts of Central Eurasia in prehistory were occupied by low-investment agropastoralists, then we need to relook at many of the interlocking aspects of the archaeological record. Because of the complex ring of circular arguments at the base of Eurasian archaeology, the ramifications of a revision of the economic model reach far beyond Central Asia. For example, Central Asia has long been presented as the major exception to an otherwise fairly global trend of agricultural intensification and grain

surplus being prerequisites for political and social complexity and the formation of elaborate hierarchical social orders, increases in population density, and advanced craft specialization, which ultimately lead to the formation of polities, empires, or states. Social theorists have extensively discussed the nature of political organization and the formation of polities and eventual empires across Central Asia in the perceived absence of grain surpluses (e.g., Atwood 2014; Kradin 2014; Sneath 2007). As Spengler et al. (2016, 2017) recently proposed, irrigated farming and economic diversification may lie at the root of first millennium BC changes in social orders, population demographics, and material culture across the arable zones of Central Asia. If this is the case, it has major implications for how we conceive of the formation and operation of the polities and empires that emerged in this region.

The perspective we offer, of a complex and dynamic economy across Central Asia through time, has been constructed through the research and efforts of dozens of scholars over the past century and is a tribute to the growing popularity of this region in robust multidisciplinary endeavors. The archaeological record of Central Asia has received significant attention over the past decade. In clarifying previous models of economy in Central Asia, we are not suggesting that earlier research lacked rigor, just that new data and modern scientific methods are illustrating a more holistic—and revised—image of the past. These data, generated by introducing novel scientific methods and new interpretations into this part of the world, are locating Central Asian archaeology within a global context, allowing for comparative discussions of social processes and a better understanding of the strong role that Central Asian people played in shaping Eurasian cultures.

Acknowledgments

Funding and support for this project were provided by the Max Planck Institute for the Science of Human History. Additional funding was provided to Dr. Spengler from the Institute for the Study of the Ancient World and by European Research Council grant number 851102 FEDD to Dr. Miller by European Research Council grant 615040, and to Dr. Motuzaite-Matuzeviciute from the European Social Fund (09.3.3-LMT-K-712).

Comments

Jan Bemann

Institute for Advanced Study, Gerda Henkel Stiftung Member,
1 Einstein Drive, Princeton, New Jersey, USA (jbemann@ias.edu).
<https://orcid.org/0000-0002-1813-2680>. 8 III 20

The title of the paper of Spengler et al. is completely misleading. It covers not Central Asia but only “the Inner Asian Mountain Corridor . . . an area largely demarcated by its agriculturally rich river valleys and mountain foothills” during the second and

the first millennium BCE. It is not about “Nomadic Narratives,” but is rather about the scientific results of settlement data of selected sites. And I do not intend to start a discussion about which part of our past is not imagined.

Several international teams assisted by the authors have achieved excellent results in the Inner Asian Mountain Corridor (IAMC)—a term coined by Michael Frachetti—over the past decades, and archaeological sciences helped a lot to get a much better understanding of the economy and mobility of the people in this region. Across the foothill zone of the IAMC, a mixed agropastoral economy existed during the second and first millennium BCE, and irrigation is more widespread and begins earlier than previously believed, which is corroborated and furthermore substantiated by the latest studies of some of the authors and others (Doumain Dupuy et al. 2019; Li 2020; Motuzaite Matuzeviciute et al. 2019).

A major difficulty is that a definition of “nomads” or “nomadic economy” is not given at the outset. Apparently, the authors include also forms of transhumance, which is misleading. A widely accepted definition, based on years of interdisciplinary research in the DFG Collaborative Research Center (SFB) 586, is given here for your orientation: “Nomads are groups of people who migrate as groups (not only individuals or parts of groups) over a significant part of the year in order to make a living (mostly through mobile livestock rearing), and who interact with sedentary groups (agriculturalists and urbanites) in manifold ways. Representation and self-representation as ‘nomads’ may outlast the abandonment of mobile livestock rearing as an essential pursuit for generations (‘post-nomadism’). . . . It is impossible to construct universal commonalities of nomadism: there is no ‘ideal type’ of ‘the nomad’” (Paul 2013:18). One should keep this in mind if one discusses the economy and mobility of people in several divergent regions.

The article contains a number of inaccuracies and inconsistencies that affect the core message about the IAMC. I will focus on three interconnected topics: geography, ecotopes, and economy. Evidently, the Spengler team has difficulties locating rivers and regions outside their central area of knowledge. The large Siberian rivers Ob and Yenisei are not connected with the southern Altai, and the Minusinsk Basin is north of the Western Sayan mountain range and not in the southern Altai. What do the authors mean by the southern Russian Steppe? This is not an established geographical term. Errors result from these misjudgments. The settlements in the Ob river region belong to the forest steppe zone, a completely different ecotope, and Abdulganev (1997) presents no information about the economy of these sites. But if the authors take a look at the well-researched and extensively published settlement of Chicha situated in the same forest steppe zone, and showing a similar settlement structure than the ones mapped by Abdulganev, they could read that agriculture was not practiced at all, but first fishing, hunting, and horse herding and later mainly livestock management. Of course, this has nothing to do with the IAMC. The same is true for the Dzhetysay fortifications at the lower Syrdarya, again a completely different ecotope with a long and well-known history of

irrigation and farming. Why do the authors mention the geoglyphs of Kazakhstan in a paragraph about villages and fortification? And how can these monuments prove “power consolidation, territorialism, and limited mobility”? No arguments are offered.

I agree with the authors that pottery production, wheel-turned or handmade, has nothing to do with nomadism, but one should be consequent and not use the size or storage capacity of a container as an indicator of sedentism. It is well-known that nomadic communities could transport an assembled yurt/ger on a wagon, which means that it was no problem at all to move a bronze cauldron from one place to another. Nikolaus Boroffka did not use the handmade pottery as an argument for nomadic population at the settlement at the mining area of Karnab-Sichkonchi. His argument is that because of the fragile construction of the excavated buildings, the mining at this site was a seasonal occupation (Parzinger and Boroffka 2003). And again this has nothing to do with nomadism or sedentism; seasonal mining or iron production is documented at many ancient sites worldwide. Tin mining plays an outstanding role for the Bronze Age economy in Central Asia and beyond but remains unnoticed by Spengler and his team. Besides the already-mentioned production sites in the Zeravshan valley, the extensive mining areas in the eastern part of Kazakhstan are important. At Askaraly II, a settlement with permanent structures was excavated, and it seems that the inhabitants practiced herding and agriculture (Stöllner et al. 2011). Again, pottery is not used as an argument for or against nomadism.

Spengler and his team also fail to write a single word about climate change and how it may have affected settlement patterns and the economy. The introduction of nomadic pastoralism is often seen in connection with climate change. Furthermore, Spengler et al. chose to date by millennia or millennium halves. This classification ignores cultural changes, which rarely occur exactly at the end of a millennium.

The Spengler team claims to get rid of plain nomadic narratives. It is therefore particularly disappointing that they repeat one of the oldest clichés themselves: the Mongols as destroyers of the economic and political system of Central Asia.

The authors’ statement “recent studies have illustrated that people across Eurasia were not directly connected and that economic strategies followed unrelated developmental trajectories” is irritating, because the latest studies by the team of authors show impressively that the different groups interacted, and in this way, technological innovations and new crops were passed on. The distribution of tin and copper also requires intensive contacts.

The authors suggest also that results similar to those achieved by them have also been obtained in other parts of Eurasia. But the few noncontextualized examples outside the main study area are far from sufficient to convincingly demonstrate the existence of similar economies everywhere, across all ecotopes in Central Asia as well as in the IAMC. In the end, the impression remains that the authors regard the nomads in Central Asia as just an imagination. However, the resulting question “Where have all

the nomads gone, long time ago?” is not answered. The authors should in future publications enhance their sometimes sloppy *recherche* practices and avoid the blanket accusations against an older generation of archaeologists, without taking into account diverging views, the lack of technical possibilities, and political constraints.

Robin Bendrey

School of History, Classics, and Archaeology, University of Edinburgh, William Robertson Wing, Old Medical School, Teviot Place, Edinburgh EH8 9AG, United Kingdom (robin.bendrey@ed.ac.uk). 6 III 20

This is an important and timely paper that proposes a major revision to accepted notions of human settlement practices and economy in the second and first millennia BC of the Inner Asia uplands, an area that broadly equates to the Inner Asian Mountain Corridor as defined by Frachetti (2012). The article benefits from a wealth of archaeological investigation of the region’s archaeology in recent years, and pulls together a rich and very useful body of data from nine separate categories of evidence that the authors forward as evidence for the degree of residential mobility of past communities in this zone. As the authors argue, each of the nine data sets could be challenged independently, but together they do present a convincing and cogent case and should encourage us as an academic community to revisit our evidence and our interpretations.

From the case presented, botanical and isotopic evidence for agriculture is more substantial and extensive than the zooarchaeological evidence for seasonality of site use and occupation. This comment, starting from a position of broad agreement with Spengler and colleagues, will primarily focus on considering the animals and the environments they inhabited in the context of the discussion presented.

Spengler and colleagues point out that the economic models they present for the Inner Asia uplands should not be applied to all regions of the Eurasian Steppes, although they do want to encourage a wider revision. In the paper and the supporting information, they do highlight other areas where similar arguments are emerging; however, consideration should be given to the nature of the environmental parameters of the Inner Asian uplands, which may differ from other areas. Importantly, for supporting agriculture, precipitation tends to be greater at higher altitudes in the region (Kerven, Channon, and Behnke 1996). Also, the altitudinal variation around the sites in question potentially put into play a greater range of environments for animal herding within a relatively shorter distance than in the open steppe farther north. Thus, these areas may be more conducive to supporting settled low-investment agropastoral communities.

In general, the zooarchaeological evidence presented, although limited, does support the idea of geographically stable animal populations without much large-scale mobility. As the authors argue, interpretations of mobility are problematic to derive from species proportions in excavated zooarchaeological

assemblages. A high number of one taxon may just reflect the relative importance of that animal, rather than the degree of community mobility. For example, the relative proportion of horse may have little to do with mobility, but more with how much horse meat was actually eaten. The arguments for year-round occupation at Tuzusai, Tasbas, and Begash based on seasonal cementum annulations are probably the strongest data set discussed about seasonality of animal mobility/residency. The conclusions on the likely existence of separate sheep landraces based on populations studied from Kent, Serektas, and Turgen is a very exciting insight (Haruda et al. 2019). However, these data may speak more to breeding practices and levels of livestock exchange than to the levels of herd mobility, although the arguments for local herding are supported by the context presented. It would be useful to know the speed with which the morphological adaptations emerged.

To add another example, recently published evidence from Tsengel Khairkhan and Baga Turgen Gol in the Mongolian Altai does suggest some potential movement of first millennium BC horses at the interregional level (Bendrey et al. 2017). Through a consideration of the oxygen isotope compositions of tooth enamel from horses and employing the phenomenon that $\delta^{18}\text{O}$ values of precipitation vary predictably with latitude, it was possible to suggest some long-distance movements of horses and thus to suggest possible cultural contacts across relatively large distances. However, most horses appeared to be local to their region, in general support of the arguments described above. It is difficult to identify movements over shorter distances and time periods using average $\delta^{18}\text{O}$ values from enamel and this relatively small data set. Average $\delta^{18}\text{O}$ values cannot speak to a sequence of lifetime movements, as might be seen in a regular seasonal mobility pattern, but they can speak to the average location of the horse during the period of its life when the tooth was forming. The detail of seasonal mobility may in the future be resolved by finer-grained sequential sampling of teeth.

Finally, in developing seasonal-spatial models, we should also be cognizant that mountain ranges are characterized by marked altitudinal and seasonal variation in environmental variables, features that are exploited by mobile pastoral groups, as historically attested (e.g., Vainshtein 1980), but that also contribute to altitudinal clines in the composition of wild animal communities that change with the seasons (Haslett 1997; Lomolino 2001). Interpretations of wild animals in zooarchaeological assemblages might then feed into these debates. Goitered gazelles, for example, migrate seasonally across much of their range. In Central Asia, this can involve migrations over hundreds of kilometers and animals ascending into foothills and mountain valleys, mainly in spring, up to altitudes of 2000–3000 m asl in Kazakhstan and Mongolia (Heptner, Nasimovich, and Bannikov 1961:618–625; Mallon 2008). Gazelle bones identified at Begash (Frachetti 2012:16), for example, may not reflect human mobility (i.e., animals hunted a distance from these sites), but rather animals seasonally passing through.

Spengler and colleagues set out an alternative narrative for mixed agropastoral economies along the Inner Asian uplands

that challenges the previously accepted nomadic models. The article also highlights the power and potential of archaeological science approaches to investigate issues of past mobility, and in doing this it underlines that to maximize results, such studies need to be fully integrated and more widely applied. Undoubtedly, biomolecular approaches will increasingly make a vital contribution to debates on Eurasian nomadism (Honeychurch and Makarewicz 2016), and new research will identify local ecologies and diverse connections, movements, and adaptations. Perhaps most importantly, Spengler and colleagues remind us here to discard our assumptions and approach the archaeological record with an open mind.

Barbara Cerasetti

Dipartimento di Storia Culture Civiltà–Sezione Archeologia, Università di Bologna Piazza S. Giovanni in Monte, 2, 40124 Bologna, Italy (barbara.cerasetti@unibo.it). 5 III 20

The present contribution is part of a very topical discussion among archaeologists dealing with the concepts of “nomadism” and “sedentism” in Central Asia. As the authors themselves point out, this distinction was mainly used by the Soviet and post-Soviet scientific scholarships, whereas today there is a growing tendency to regard these two realities as interconnected and less easily distinguishable. New technologies that involve the analysis of macro- and microbotanical remains, stable carbon isotope values, and zooarchaeological material, in addition to the most traditional methodologies related to the archaeological evidence, are now crucial to understand the vast extraregional migrations, as well as the short-distance intraregional movements, that have shaped Eurasia over the millennia. To try to “complete” as much as possible this complex and multifaceted mosaic, with all the instruments at our disposal, it is due to the entire scientific community that, despite the enormous efforts, is still far from a final resolution.

Supported by an intense field survey, the most advanced technologies, and a solid bibliographical documentation, the authors propose to analyze a very large geographical area: eastern Central Asia from the second through the first millennia BC. Often, the authors move beyond the predetermined space-time boundaries, demonstrating that they have an increasingly clear idea of the complex scenario that characterized Central Asia during that prehistoric phase. Their main aim is to define a much more articulated social, human, and economic context, abandoning a simple subdivision into “nomadism” and “sedentism” and introducing terms such as “mobile pastoralism,” “mixed economic system,” and “short-distance movement,” which are best suited to contain such a fluid and multifaceted world.

Although it is necessary to appreciate the enormous contribution that the authors have made to the international scientific world, from my point of view, some of the topics in this paper are not properly used and some concepts reported by other scholars not perfectly interpreted. One of these is the lack of centrality that the authors give to the material culture as one of

the distinctive signs of a certain population and its own culture. Along with the original archaeological context, the material culture is decisive in the identification of the culture itself. Among archaeologists, it is universally accepted that any type of “de-contextualized” material, such as ceramic, archaeobotanical, or archaeozoological material, cannot be used as an exclusive indicator to define one population and its social, cultural, political, and economic peculiarities.

At the same time, it is definitely very important that the authors consider these same classes of material culture, together with architecture and hydraulic works, as valid evidence of an already-reduced mobility in eastern Central Asia in the second and first millennia BC. To try to define as much as possible the time when mobility, at different degrees of intensity both in space and over time, has given way to an increasing sedentism becomes crucial for the understanding of a wide range of historical, sociocultural, and economic phenomena at the base of later historical periods.

According to the authors, it is necessary to dispel the confusion made in the past, as it is not possible to draw a clear line between “nomadic” and “sedentary” worlds. We must abandon the idea of “pure nomadism” in favor of a much more fitting concept of “seminomadic agropastoralism.”

Claudia Chang

Professor of Anthropology Emerita, Sweet Briar College, 508 Fellows Avenue, Syracuse, New York 13210, USA (cchang@sbc.edu). 17 II 20

The authors rigorously argue against a “nomadic model” for an explanation of these formative ancient economies and the rise of social complexity in eastern Central Asia during the second through first millennium BC. Through their fine-grained analyses of an array of impressive empirical and scientific studies, ranging from paleoethnobotany to isotope studies of ancient skeletal material defining dietary habits to material culture studies, their data are largely indicative of the importance of agropastoralism during these formative periods. Any reader familiar with this region and the nomadic model should be able to identify three basic arguments posited by Western researchers for increasing economic and social complexity during the Bronze and Iron Age periods of the Eurasian Steppe: (1) the grand-scale model for diffusionism based on inventions/introductions such as proto-Indo-European languages, metallurgy, and horse-riding across vast steppe areas (Anthony 2010); (2) small-scale mobility based on pastoralism and nonuniform institutional complexity (Frachetti 2012); and (3) the agropastoral sedentary or semisedentary economic system as it contributes to demographic growth, the rise of craft specialization, and the origins of hierarchy. These narratives denote problems of scale, often jumping from huge macroscale interpretations of vast geographic regions to small, localized, site-specific, or valley-specific data.

Eastern Central Asian archaeology is distributed across diverse landscapes that range from glacier-covered mountains,

large and small river valleys, alluvial fans, desert oases, lakes and marshes, and vast steppes. Each environmental and ecological setting provides a number of opportunities for ancient societies to mix and match economic decisions regarding the herding of animal domesticates, growing crops, or foraging/fishing. The ecological or economic basis for mobility is a central question but still avoids the issue of the social formations that arise out of such landscapes and their place within central nodes, peripheral places, and hinterlands.

The “middle-range” questions answered by the empirical studies and scientific data presented here strongly suggest that there is no need at this point in time to construct a large-scale narrative for eastern Central Asia. Nomadism is a misused label for mobility of various sorts, sometimes tied to economic systems like pastoralism and other times tied to social or political factors that underlie why people move. In this sense, the “nomadic” state, “nomadic” confederacy, or even the “nomads attached to sedentary” polities are really figures of speech.

Here I digress to further my point. Perhaps if we consider many of the sites mentioned in this paper as belonging to the borderlands, the places of refuge where outlying traditions and practices flourish and take on their own developmental trajectory, we might find a more satisfying set of explanations. Many sites mentioned in this paper, such as Begash, Tas Bas, Turgen, Tuzusai, and Aktas I, II, III, IV, and V (the ones I know best), are outlying peripheral places and belong to larger arenas, call them nomadic confederacies or loosely tied sociopolitical groupings within interaction spheres or “social fields.”

The mixing and matching of archaeological data, ranging from dietary information, ancient seeds and bones, types of settlements, and the eclectic range of material culture (stone hoes, bronze sickles, bronze and iron cauldrons, large grinding stones) indicate that the ancient people availed themselves of a range of flexible strategies, adapted to the intermixing of culture traditions, both in a local and regional sense, and were often innovative technologically speaking (metallurgy, pot-making, textiles, and architectural forms). The polymath nature of Central Asian borrowings, adaptations, and entanglements especially in these formative periods of panregional steppe traditions stand out in these data.

Here it might be useful to use eastern Central Asia as a contrastive example to the classical social evolutionary models explaining increasing social hierarchy and inequality in Mesopotamia, Anatolia, the Indus Valley, and China at the very same dynamic periods of time.

What was the balance or percentage of household labor divided between the dual pursuits of herding and farming? And was the division of labor gendered? Divided by household, stratification, or ethnicity? And did choosing one economic strategy, or a combination thereof, lead to more or less hierarchy or social inequality? Furthermore, the permutations with regard to mobility are infinite. So how may our shared archaeological imagination be harnessed in such a way so as to put forth a nuanced, not ecologically or economically deterministic, model for eastern Central Asian social evolution in these formative time periods?

Earlier models from both Soviet historical and ethnographic sources of people living in nomadic states, confederacies, and communities may point this generation of researchers in more nuanced directions. The Soviet researchers on historic and ethnographic Kazakh-Kyrgyz groups often understood social hierarchy among pastoral groups and the continuum between pure forest-steppe pastoral nomadism and settled agropastoralism (Khazanov 1994). Despite their adherence to Marxist historical science and thus evolutionary models, they were insightful about these small-scale societies and how they fit into larger sociopolitical groupings (hordes, confederacies, kingdoms, or empires). I am left asking this question, for those places where agropastoralism was the main economic strategy: Were these communities peripheral or centralized? Each contributor might view their specific data set in terms of these questions of the larger structures and nature of sociopolitical organization of the communities of eastern Central Asian within a broad regional context of core-states, semiperipheries, and peripheries. This may lead all of us working in these on the archaeology of these regions to discover a macroscale narrative that need not employ any specific “economic” or “catchall” term for the wonderful diversity and range of eastern Central Asian societies during the second through first millennium BC.

M. D. Frachetti

Department of Anthropology, Washington University in St. Louis,
CB 1114, 1 Brookings Drive, Saint Louis, Missouri 63130-4899,
USA (frachetti@wustl.edu). 1 VII 20

The last 10 to 15 years of research on Central Asian pastoralism have revealed many new discoveries and realizations, which Spengler and colleagues summarize in a concise and well-organized fashion. From the first publications clearly documenting farming among Iron Age pastoralists of the Eurasian Steppe in the early 2000s by Claudia Chang and Arlene Rosen, to the first publication of macrobotanical evidence for Bronze Age domestic grains at the pastoralist site Begash (Frachetti et al. 2010), a central goal in Eurasian archaeology has been elucidating the diversity and range of practices encompassed within “steppe pastoralism” across Central and Inner Asia. The authors carefully trace many new insights that move us closer to this goal, and I agree that scholars must carefully consider the now well-documented fact that prehistoric pastoralists of the steppes—and more specifically those living along the so-called Inner Asian Mountain Corridor (IAMC)—had engaged in farming alongside mobile herding as part of their economic subsistence strategy, by the third millennium BCE if not earlier (Hermes et al. 2019). I commend the authors for summarizing the important discoveries and progress the field has witnessed in archaeobotany, dietary isotope analysis, and mobility studies and niche construction that collectively expose the complex diversity of strategies that were incorporated in Eurasian pastoralism from the Bronze and Iron Ages, and surely set the stage for pastoralist strategies in more recent historical times. As

the authors express through their citations, my own work has been closely intertwined with much of the archaeological evidence presented here, and I am delighted to see a new cohort of scholars pushing the narrative forward and in new directions; however, I do not agree fully with the construction of their argument.

The premise of Spengler and colleagues’ article is threefold. First, they argue that the Eurasian Steppe region has long been defined by a broad-brush concept of “nomadism,” which they argue is semantically fraught and should—in many cases—be exchanged for a new term, “agropastoralism.” This, they argue, better summarizes the emerging evidence for farming alongside mobile herding from the Early Bronze Age. Nomadism, they contend, is little more than a moniker for a Eurasian past largely “imagined” by ancient chroniclers and centuries of travelers, ethnographers, historians, and—more recently—archaeologists. To support this claim, the authors outline a range of recently published archaeological data (largely post 2010) from Eurasia that documents the integration of grain farming, grain processing, grain eating, and various degrees and deployments of sedentism and irrigation among purportedly “nomadic” pastoralists of Eurasia. As such, they claim we should abandon the rubric of nomadism and view Eurasian Steppe communities as “agropastoralists.” Third and finally, they critique the use of nomadism in contemporary Eurasian scholarship, suggesting that scholars today use the term in a circular manner and, as such, any attribution of Eurasian societies as nomadic (from any epoch) reflects uncritical and presumptive scholarship that ignores the essential new data for farming throughout the past 5,000 years.

There are a few points of clarification concerning data from those sites where I directed excavations (addressed below), but my main question for the authors is simple: Why does the documentation of integrated farming, agricultural diet, and varied levels of sedentism or irrigation in Eurasian economies demand the abandonment of the term “nomadism,” when that term is understood by most scholars today to be broadly synonymous with “pastoralism” and pastoralists are frequently documented (worldwide) to practice farming and a wide range of mobility within their economic strategies? Indeed, the terms “mobile pastoralism” and “nomadism,” in the decades of scholarship since the 1950s at least, have unequivocally been used to describe a wide range of economic systems where farming and mobile herding regimes exist in complex social and economic integrations (e.g., Barth 1961:9; Bacon 1952; Evans-Pritchard 1940:16; Irons 1974). While pastoralists are notable for their social and economic focus on domesticated herds, the scholarly consensus is, and long has been, that “pure nomads” are extremely rare in the human record, if never really documented at all (Frachetti 2008:16; Salzman 1972:67). Thus, I fear that the authors’ portrayal of the term “nomadism” in Eurasian archaeology is highly idiosyncratic and serves more as a straw-man argument rather than a new revelation concerning ancient (or ethnographic) systems of nomadic (mobile) pastoralism.

In my view, there remains considerable value in the concept of (and term) “nomadism,” specifically because it offers an

important lens for understanding the long-term development of complex socioeconomic systems and political identities described by many communities (and often self-ascribed among marginalized populations) and provides an established heuristic framework for comparing the variation and breadth of diverse economic systems, many of which are adapted to extreme or restricted environments (Frachetti 2008).

A cursory survey of the last century of anthropological scholarship on pastoral nomadic variability reveals that the recent data from the steppe region are fully compatible with the concept of “nomadism” or the field’s more common (and flexible) nomenclature “mobile pastoralism.” In fact, because farming is so well documented among so many nomadic (mobile pastoralist) societies around the world and has clear documentation among many Eurasian nomadic societies in particular (e.g., Irons 1974), I am left confused as to why Spengler and colleagues promote such a narrow definition of “nomadism” to frame their critique. They state: “we use ‘nomadism’ to denote a population of people who regularly engage in population movements (possibly two or more times a year) and consume a diet heavy in dairy and meat products.” They use “agropastoral” to refer to mixed economic strategies, where all or most of the population remains stationary throughout the year and invests in significant farming activities.”

To accept their definition and support this rigid distinction between terms (and economic systems), one must simply turn a blind eye to the abundant and detailed scholarship that has established the long-standing and commonplace integration of farming within nomadic pastoralist strategies. Given limitations of space here, I remind the authors of a similar debate concerning semantics and typologies of pastoralism, now more than 50 years old (see Salzman 1972:67).

The rigid typological approach promoted by Spengler and colleagues has been tried before, separating populations according to their scale and frequency of mobility versus sedentism, their apparent reliance on herd animals versus farming (as modes of food producing and subsistence), their use of fixed architecture and land ownership, irrigation, technological investment, and more. Perhaps the most sophisticated and deeply researched argument of this nature was the encyclopedic synthesis of global nomadism by Anatoly Khazanov, *Nomads and the outside world*, which was first presented in English in 1984. Khazanov’s iconic book aims to delineate differences between “pure” nomads, transhumant pastoralists, tethered herders, and others, effectively establishing a typological rubric on the basis of factors not dissimilar to those cited by Spengler and colleagues.

Yet in his review of Khazanov’s book (published 35 years ago in *Current Anthropology*), Tim Ingold (1985) articulated in perfect clarity the potential pitfalls of such prescriptive typological approaches to pastoralism, stating “ultimately, as [Khazanov] frankly admits, the exercise is self-defeating, as every instance turns out to be exceptional or transitional and every boundary arbitrarily drawn . . . Khazanov’s attempt to enumerate “basic forms of pastoral nomadism [on the basis of

food producing] does little but add to the already confused terminological situation” (Ingold 1985:385).

In Eurasia, as elsewhere, the last 25 years or more has witnessed a move in the field toward a broad recognition that pastoralist societies are—almost by definition—highly variable in respect to their reliance on and scale of herding versus farming or mobility versus sedentism, with significant change evident even within a single generation and between neighbors of the same community.

Spengler and colleagues themselves cite much of this literature and even note that in Central Asian archaeology, Soviet scholars such as Elena Kuzmina, among many others, adamantly argued that steppe pastoralists were also farmers, even though their argument lacked strong archaeobotanical evidence at the time. Thus, I expect that few scholars of Central Eurasia were surprised when we published evidence for variable combinations of productive economic strategies and the development of complex sociopolitical strategies among pastoralists of the Eurasian Steppe, whether in prehistory or more recent times (Frachetti 2012).

Given my close scholarly relationship to much of the archaeological research that underlies the data outlined here, it is not surprising that I do not dispute the archaeological data that shows some prehistoric and historical steppe societies integrated grain farming, irrigation, and periods of sedentism into their pastoralist lifeway—especially along the IAMC. However, my usage and interpretation of this data leads me to a different conceptual understanding of nomadism than that offered by Spengler et al., since I see all of these practices as being fully compatible with a mobile pastoralist lifeway, and parsing this into further and finer terms pushes us back down the semantic rabbit hole that Ingold and many others have sought to extricate us from many years ago.

A final point: in their critique of scholarly uses of “nomadism” in recent publications, I was surprised to see Spengler and colleagues critically cite the work of scholars who have carried out years of research and decades of excavations at the very sites that provided much of the data for farming among Eurasian herders. Speaking for myself, it seems unlikely that after directing and publishing decades of research concerning the integration of grain farming in nomadic economies of the steppe zone, with Spengler and other members of our team, that I would simply forget its existence and resort to an uncritical use of “nomadism” in some blind fashion. Spengler and colleagues repeatedly cite a paper led by Hermes et al. (2018) suggesting that we used the term “nomads” to simplistically describe communities “not living in cities.” A close read, however, reveals far greater nuance in our attribution: the burials we categorized as “nomadic” were indeed from nonurban cemeteries, but more importantly, they were associated materially with medieval Turkic populations whose social and economic system is well documented as being different from that of sedentary, deltaic farmers, particularly in terms of their social understanding of land tenure, wealth distribution, and tribal political alliances. Perhaps more importantly, historic records from this period show that these populations, at least by

the tenth century CE, refer to themselves as different from urban folk. I direct readers to the more than 40 years of superb scholarship and knowledge of Turkic nomadic institutions by Peter Golden (and others) to support this.

The authors also state that the association between handmade ceramics and pastoralism is a circular attribution, citing Maksudov et al. 2019 and Rouse and Cerasetti (2014) as recent examples (other citations were from the 1990s). While true that handmade vessels are not universally indicative of pastoralists, it is also true that these authors make no such claim. Rather, in the case of medieval Tashbulak (Maksudov et al. 2019), a large fortified town located at 2,000 m elevation, the ceramic assemblage differs so greatly from that of lowland oasis cities, with less than 1% of the pottery being wheel thrown or glazed and the decorative painting and animal motifs being clearly linked to Turkic tribes, it is a fair and appropriate to describe the residents as part of a nomadic political structure—especially during the Qarakhanid period when these tribal communities self-ascribe as such. In the case of Rouse and Cerasetti (2014), their association of “handmade” vessels with pastoralists also reflects a well-contextualized case and I feel their association is perfectly justified in the context of urban/hinterland interaction between BMAC populations and mobile pastoralist communities. Indeed, this division has furthermore been documented genetically at BMAC sites in the region (Narasimhan et al. 2019). In particular, the genomes of individuals associated with handmade “steppe” pottery have been shown to be significantly different from the majority of BMAC samples, whose dominant ceramic forms are wheel thrown. Of course, interaction meant that both pottery types were not rigidly exclusive, but their assumptions and categorization are well documented. Indeed, genomic research shows that large regional communities in the Bronze Age were highly diversified with many genetic “outliers.” Perhaps this trend, documented across Central Asia, the IAMC, and the steppe, provides a better explanation for the range of economic practices witnessed across the region. Spengler and colleagues would do well to strive to provide better context for these studies, since Hermes, Rouse and Cerasetti, Doumani-Dupuy, and many others have, in fact, generously provided key archaeobotanical data to many of the authors here, unselfishly moving us all toward more intriguing explanations of the complex economy of Eurasian “pastoralists” and their influence on the social and economic milieu of the Bronze and Iron Ages.

Emily Hammer

Department of Near Eastern Languages and Civilizations, University of Pennsylvania, 255 South 36th Street, Williams Hall 847, Philadelphia, Pennsylvania 19104, USA (ehammer@sas.upenn.edu). 8 III 20

I applaud the authors’ multi-data set review, which illustrates an important methodological advance in the archaeology of subsistence economies. The paper is one of a number of new studies that move away from ethnographically and environmentally

driven assumptions about pastoralism and instead investigate ancient diet, seasonality, mobility, and landscape empirically by integrating numerous lines of evidence.

The authors argue that communities in the second–first millennium BCE in eastern Central Asia were partially or perhaps mostly sedentary agropastoralists, not highly mobile or specialized “nomadic pastoralists.” I am sympathetic to this argument because it parallels those emerging for the Middle East.

As the authors note, recent work on Iran, Anatolia, and other parts of the Middle East also relies on multi-data set reassessments to argue that evidence for long-distance pastoral mobility currently does not exist before the first millennia BCE–CE in most areas (Arbuckle and Hammer 2019; Hammer and Arbuckle 2017; Potts 2014). These authors argue that the circumstances enabling long-distance pastoral mobility and specialized pastoralism developed unevenly over many millennia and conclude that tethered, sedentary agropastoralism was the most common historical form of pastoralism. Similarities in enduring misconceptions about the nomadic nature of ancient pastoralism in the Middle East and Central Asia are not accidental: ethnographic studies that focused on particularly mobile, specialized, and autonomous pastoral tribes, especially those in Iran, influenced the scholarship of both regions as a source of analogies underpinning archaeological and historical conclusions (Sneath 2007).

Despite my enthusiasm for the authors’ general approach and sympathy for their conclusions, I have some concerns about how the argument is developed. These relate to (1) basic definitions, (2) the authors’ use of evidence that bears primarily on the existence of agriculture to support broader conclusions about the existence of diverse forms of agropastoralism, and (3) missed opportunities to engage directly with previous models of regional historical development.

1. The authors’ definition of “nomadism”—as highly mobile pastoralism in which communities’ diets depend on meat and dairy—seems unnecessarily polarizing. Scholars widely recognize that people labeled “nomads” in ethnographic and historical contexts frequently engaged in agriculture and other nonpastoral activities and exhibited varying degrees of mobility. I suggest it would be more constructive to abandon the term “nomadism” altogether; its conflation of mobility, tribalism, specialization, and other traits interferes with the authors’ important goal of examining what sorts of economies are evidenced.

The geographic scope of the authors’ claims is unclear because of inconsistencies between the definition of their area of focus (eastern Central Asia) and the span of the cited data (which frequently extends to western and southern Central Asia). Differences in these subregions during the time periods in question are not articulated. The citation of considerable southern Central Asian data confused me, since the authors identify those regions from the outset as ones that scholars already agree were characterized by sedentary farming from the third millennium BCE onward. As someone whose expertise lies elsewhere, the lack of geographic specificity made the paper challenging for me to follow and had me concerned about overgeneralization.

2. While I agree that Central Asian archaeology suffers from a “nomadic bias,” archaeologists cannot interrogate and address this bias through the presentation of data primarily on agriculture. I understand that the authors conceive of the paper as an attempt to even the scales in terms of the degree of focus on pastoralism and agriculture in Bronze and Iron Age Central Asia. But they also ambitiously frame their paper as moving beyond this rebalancing to propose new models. A defense of the authors’ “diversified agropastoral model” must rest equally on the presentation of data concerning pastoralism, agriculture, and their integration.

The Middle Eastern work cited above countered long-standing narratives about “nomadic pastoralism” by reconstructing historical pastoral practices and demonstrating spatiotemporal variability in pastoral systems. The authors do not follow this approach: in fact, the major animals, herd compositions, and other indicators of husbandry practices for different sites/regions at various times are not discussed. I acknowledge that the Middle East has a much larger body of zooarchaeological data for an area far smaller than Central Asia, but the nature of the authors’ summary gave the impression that pastoralism was an afterthought. Zooarchaeology is the penultimate of their nine categories of evidence and is only briefly addressed. The site table in supplementary section 2 helpfully indicates whether each site offers botanical or isotope data evidencing farming, but does not include presence/absence of faunal data.

At certain points, the authors’ focus on agriculture hindered their ability to discuss agropastoralism. For example, the discussion of irrigation systems only considers the benefits these systems have for farming; it does not discuss their use for the production of fodder (Çifçi and Greaves 2013; de Planhol 2010) or animal watering (Tapper 1997:300–301). These benefits of irrigation for pastoralism could be critical for maintaining herds close to a settlement throughout the year.

Given their argument, the authors would have done better to work equally toward better empirical descriptions of both farming *and* herding economies and their spatiotemporal variability. Each of the nine data sections notes some intra-regional and chronological diversity, but these variations are not linked up with one another for a comparative discussion of the characteristics of different sorts of evidenced agropastoral systems. In this, I feel the authors missed the most important opportunity they had to effectively use the assembled data to advance their argument.

3. The authors suggest that their findings will reshape broad conclusions about Central Asian history. However, they have not yet made substantive arguments for *how* historical conclusions will be reshaped. I would especially encourage the authors to comment on the compatibility of summarized data and conclusions with models of interaction in the “Inner Asian Mountain Corridor,” which are fundamentally based on the necessity and ubiquity of pastoral movement (Frachetti 2012; Frachetti et al. 2017). Do the authors believe that the scale of movement required by these models is evidenced?

These concerns aside, the paper offers an important review and will undoubtedly spark productive conversations. The

authors should be congratulated for synthesizing diverse evidence for the significance of agriculture and for limited mobility in second–first millennium BCE Central Asia.

Hongen Jiang

Department of Archaeology and Anthropology, School of Humanity, University of Chinese Academy of Sciences, 19 (A) Yuquan Road, Beijing 100049, People’s Republic of China (jianghongen@ucas.ac.cn). 9 II 20

Agropastoralism Served as the Best Choice of Human Subsistence in Ancient Arid Central Asia

What was the subsistence strategy of Central Asia people during the second and first millennium BC? There were always stereotypes in the written literatures depicting the ancient inhabitants of Central Asia. They were visualized as highly mobile nomads who lived in tents year-round, moved home in pursuit of grasses and water resources, fed prominently on meat and dairy products, and hardly knew cereal cultivation. This model had significant effects on the perception of archaeologists and historians.

By analyzing the archaeological sites and modern ethnological surveys in Central Asia, scholars gradually realized that the ancient people had stable campuses in wintertime that were constructed with stone and/or rammed earth like modern ones (Wang and Xi 2009). However, their subsistence strategies are still unclear. One reason was that less archaeobotanical work has been done, as plant remains were easily to be neglected. In this case, agricultural activities and plant consumption were rarely concerned.

During recent years, archaeobotany was paid more attention to. In the arid Central Asia, desiccated or carbonized macro plant remains, especially seeds of cereals and weeds, were discovered and collected by sieving or water flotation methods (Frachetti et al. 2010; Spengler et al. 2014). Furthermore, microbotanical remains like phytolith and starch grains were also identified from archaeological sediments or funeral objects. Both macro and micro plant remains supplied direct evidences of cereal farming, plant consumption, and crop processing (Jiang et al. 2013). In addition, stable isotopes like C and N extracted from the collagen of human and animal bones also offered indirect evidences of cereal food consuming and livestock husbandry (Wang et al. 2019).

On this issue, Spengler et al. perfectly revealed the paleo-economy in the foothills of eastern Central Asia during the second and first millennia BC. A detailed review was given based on multidisciplinary studies in recent decades, and nine categories of evidences were summarized. Four of them belonged to bioarchaeology, namely, macro and micro plant remains, stable carbon isotope, as well as zooarchaeological studies. Plus the other five sorts of evidences, they concluded that instead of highly moving nomadism, the ancient people in eastern Central Asia once engaged in a mixed economic system of farming, herding, and craft production, that is, a sedentary and agropastoral lifestyle.

According to the macrobotanical data of cereal and chaff remains, crops were deduced to be cultivated locally. Chaff phytoliths of different cereals were also examined by the authors to testify to the abovementioned corollary. The stable isotope studies showed human diet including C_4 plants consumption like millets (e.g., *Panicum miliaceum* and/or *Setaria italica*). Together with the findings of irrigation canals, field plots, grinding stones, and farming tools, all the evidences supported local agricultural activities instead of cereal exchange or trade with other communities.

Apart from farming, sedentary is another important character of the agropastoral lifestyle. On this issue, Spengler et al. summarized the relative evidences, including irrigation structures, farming village settlements, loom weaving, bronze cauldrons, and more. Furthermore, multicrop species, which were ripe or sown at various seasons throughout the year, also suggested a nonmovable feature of paleoeconomy. The discovery of fruit remains like grapes, a perennial woody vine, needed to be watered occasionally and pruned into a considerable shape, also suggested a sedentary horticulture (Jiang et al. 2009; Spengler, Chang, and Tourtellotte 2013).

In most parts of the world, people cannot live on only animal products and generally need grown foods. Agriculture and pasturing are not always contradicted, but are compatible in the arid Central Asia. Due to the hostile environment, extensive cultivation is not enough to supply surplus foods, while animal feeding can turn wild grass into digestible meat. In these cases, agropastoralism with the integration of farming and herding became the best choice for the indigenous people of Central Asia. As the population was scant, and the commercial economy was not well developed at that time, it was not necessary to keep their herds in a large scale or to proceed to transhumance several hundred kilometers away according to season circle. As illustrated by Spengler et al. and other authors (e.g., Wang and Xi 2009), the local communities preferred a small-scale mobility with limited ranges. The aged, children, and pregnant women lived in their permanent houses to take care of farmlands and (frail) animals. The dynamic men (and women) tended to graze flocks outside from spring to autumn, but came home occasionally to help with cereal sowing, watering, harvesting, and so forth. They went home during winter, kept their animals within a limited number, stall feeding or grazed around settlements.

To date, archaeobotanical work in Xinjiang neighboring Central Asia has been conducted by the team of comment author Professor Hongen Jiang. Their published papers in the past 15 years outline many discoveries of crops, fruits, and weeds with reliable data. It is noted that agriculture has been proved as a common component of the paleoeconomy in Xinjiang in the prehistoric period. Among the funeral objects discovered in the first millennium BC, Yanghai and South Aisikexiaer cemeteries and Subeixi settlement, located in the Turpan-Hami Basin of the eastern Tianshan Mountains, different cereals with chaffs, grapevine, wooden shovel, rammed earth foundation, and a rich number of painted potteries suggested a sedentary agricultural lifestyle, while the pervasive existence of faunal bones like sheep/goat, cattle and horse, and portable wooden utensils indicated a

pastoral lifestyle (Gong et al. 2011; Zhang et al. 2019). In these cases, the abovementioned people definitely led a life of agropastoralism. In addition, the existence of wild gazelle bones and possibly hunting tools, including arrows/bows, boomerangs, and stone balls, also suggested the possibility of hunting during herding or farming practices (Dong 2016; Lv and Zhang 2019). The choices of multiresources dominated by agropastoral subsistence pattern contributed to the appearance and development of polities, cities, and states in the eastern Tianshan Mountains in the late first millennium BC.

Nikolay Kradin

Institute of History, Archaeology and Ethnology, Far East Branch of the Russian Academy of Sciences, Vladivostok, Russia (kradin@mail.ru). 7 III 20

At present, in the prehistory of pastoral nomads, the true revolution that is first of all related to archaeological science takes place (Chang 2018; Honeychurch and Makarewicz 2016; Spengler et al. 2016). A few years ago, the insightful Nicola Di Cosmo wrote that the three most common misconceptions of steppe nomads are as follows: (1) hard separation of the world of pastoral nomads and world of settled agrarian civilizations (from his point of view, the nomads were familiar with the agriculture since the earliest times), (2) an erroneous concept of the synchrony of the processes of rise and fall of nomadic empires and neighboring agricultural civilizations, and (3) dominating among many scholars of the stereotypes with respect to nomads as only the robbers and destroyers of the sedentary civilizations (2015).

To be sure, he is right and this article confirms actually these three theses. Robert N. Spengler and coauthors raise correctly the question of necessity for changes in concepts of the mobile pastoral nomads. In support, they give large-scale information among which are macro- and microbotanical data, zooarchaeological remains, stable carbon isotope, different tools of material culture, and historical and ethnological instantiation. The quantity of examples looks impressive. They confirm reliably the conclusions of the present article. These are the sinking results and novel ideas for discussion in future.

Nevertheless, I should like to bring to mind certain previous works that have discussed similar matters. First, many anthropologists have long before written that the nomads had the rudiments of farming and gathering (Kosarev 1991:48–53; Markov 1976:159, 162–167, 209–210, 215–216, 243; Masanov 2011:290–295). Second, the Soviet archaeologist Svetlana Pletneva has noted the concept according to which the poor cattle-breeders have accumulated around the winter sites of their chiefs or khaans. In summer, the rich men have come away with the herds to new pastures while the poor men were occupied with farming (1982). This concept was actively criticized by the anthropologists insofar as it has not considered the ecological features of arid steppes and deserts. Third, it should be borne in mind that there was the practice to

divide the Eurasian Steppes into western and eastern Eurasia (Golden 2003) or into the steppes of East Europe and Central and Inner Asia (Drompp 1989). In the steppes from Pannonia to the Caspian Sea, the nomads and farmers have lived side by side or even together. The steppe territories are suitable both for pastoralism and agriculture (Gavriliuk 1999). In spite of the existing division into the settled *Transoxiana* and nomadic *Moghulistan*, the pastoralists and farmers were parts of the common economic system in the Central Asia. They have supplemented each other (Chang 2018; Golden 2011b). Inner Asia is of particular interest. Here, the bipolar regional structure has arisen between the nomadic north and agrarian south (China). With the exception of the Ordos, to which both parties had pretensions, the development of agriculture in this region was possible in Inner Mongolia. In the Mongolian steppes and Transbaikalia, agriculture could exist where average annual precipitation could reach 200–400 mm and where the extensive river network has existed.

For me, as an Inner Asian archaeologist, it is interesting to get to know to what extent the conclusions of Spengler et al. about Central Asia are applicable to Inner Asia. We do not have information about agriculture in the Bronze Age. In the Iron Age, for example, the farmers lived in the settlements and towns of the Xiongnu Empire (Davydova 1968; Hayashi 1984; Kradin 2014). Agricultural products were available at the seasonal sites of Xiongnu (Wright, Honeychurch, and Amartuvshin 2009). The importance of agricultural products in the nutrition system of certain groups of nomads is indirectly confirmed by developed tooth caries (Erdene 2011). During the Middle Ages, there are reliable archaeological evidences of agriculture in the Uighur khaganate (Bemmann et al. 2014). According to the *Secret History of Mongols* (Rachewiltz 2004:152, 177), the early Mongols were also acquainted with agriculture. Now, the primary task is to understand how agriculture was arranged among the pastoral groups and whether the quantity of grains was sufficient for livelihood through the calendar year.

In Inner Asia, it was frequently convenient to capture Chinese farmers and craftsmen. There is a large bulk of data in Chinese annals about thousands of people who were captured by nomads (Kradin 2014:117–128). Chinese deserters have also existed. This strategy was universal, from Xiongnu to Mongols. This leads us to a very important problem: steppe urbanization, which was not considered in Spengler et al.'s paper. Of nomadic empires, the permanent demand for specialized handicrafts that would provide production of armament and prestige goods was characteristic. This activity could be only provided by way of sedentariness and establishment of specialized settlements and urban centers.

For this reason, the gradual increase in the quantity of settlements and towns was observed in Inner Asia. In the Xiongnu Empire, there were the settlements of different sizes including not large fortresses and towns protected by earth walls (Hayashi 1984). The best-known site is Ivolga town, the residents of which who were occupied with agriculture and handicrafts (Kradin 2014:88–96). The Xianbei have had settlements where the

population was occupied with fishery as well as agriculture and handicrafts (Kradin 2017:170). The capital of Rouran was termed as Momochan (Kradin 2005). Turks had an anti-urban doctrine. Uighurs had forts, towns, and the large capital city Karabalgasun. Its area reached more than 30 sq. km (Hüttel and Erdenebat 2009). Farmers have constituted almost 80% of the Khitan Empire's population (Wittfogel and Chia-Sheng 1949:58). In the country, there were five capitals and many towns of different ranks and different purposes including forbidden cities near the vaults of emperors and residencies of elite and near-border fortresses (Kradin 2018; Steinhardt 1997). In the Mongolian Empire, there were the towns of several types: (1) imperial metropolitan city capitals—Karakorum or Kharkhorin, Dadu, and Shangdu, (2) regional administrative centers, and (3) seasonal palaces and manors (Bemmann, Erdenebat, and Pohl 2010; Kradin 2018). After the empire's dissolution, several monasteries were built and one of them was at the location of the first capital, Karakorum. In the seventeenth century, when Mongols were subordinate to the Manchus, the extensive construction of monasteries caused by expansion of the Buddhism among nomads began. It has served as the opportunity for sedentariness and urbanization. By and by, the whole network of the town centers in various variants was created, and they included the true towns, settlements by the monasteries, residencies of khans, and stations on caravan tracks (Tkachev 2009). In such a way, these towns were integral parts of the nomadic empire structure. It is interesting what role was taken by the towns in the politics of the Central Asia.

It is also important to remind readers why settled people had a poor understanding and distorted image of nomads. Their perceptions of the world were absolutely different. The border for farmers and townspeople is a barrier dividing them from the “foreigners,” or potential enemies. The border for nomads is a zone of interaction with the surrounding community. The trade neighbors rely on robbery and war, which can become regular activities but are more often a method of coercion with the purpose of beginning or renewing exchanges (Legrand 2011). A perception of this not only will allow us to understand an individuality of the socioeconomic and cultural ways of adaptation of pastoral nomads to the external world but also to understand their contribution to world history.

Sabine Reinhold

Eurasia-Department, German Archaeological Institute, Im Dol 2-6, D-14195 Berlin, Germany (sabine.reinhold@dainst.de). 4 IV 20

All archaeology of Iron Age Eurasia concerns warrior nomads, dangerous squads like “Scythians” with graves of lavish gold, armor, and equestrian equipment, highly mobile riders in permanent conflict with each other or with sedentary populations they overrun at high speeds from Northeast China to the periphery of Europe. All Iron Age archaeology in Eurasia? The authors of this valuable compilation on the economy of Central

Asia's Iron Age societies are successfully deconstructing the paradigmatic and monolithic image of a nomadic population permanently on the move and highly dependent on pastoral products. Their collection of evidence for agriculture from direct archaeobotanical findings of cultivated crops via indirect indicators for agriculture from stable isotope analysis, archaeology, zoology, and written sources presents a diversified and multifaceted perspective of the economies during the late second and first millennium BC. It is an agricultural view of a debate that, for decades, has been circling around mobility, migrations, moving herds, exchanging elite goods, and the possible cultural and sociopolitical structure resulting from it (e.g., Frachetti 2012; Kradin 2014; Sneath 2007). It is indeed a categorically different perspective, shifting the focus in the economic settings of Central Asian societies into fields that are difficult to move and worth being protected.

The archaeological and bioarchaeological data the authors draw from is impressive and convincing, particularly the botanical evidence for sophisticated farming practices with crops that have different growing seasons and fruits with delayed repay, or with indications of irrigation. But how might these agropastoral farming economies have looked? At what scales did they operate, in what proportions, and in what sorts of territories? The data presented to answer such questions reads rather like a checklist for "they are farmers, that is, they are sedentary" or vice versa. The authors maneuver themselves in an oppositional construct quite similar to that, which they dismiss as paradigmatic for its weak theoretical basis, its ignorance of the evidence, and a too-lenient reliance on direct ethnographic analogies. That is certainly not intended, but a lack of analytical coherence leaves the individual parts of the nine lines of argument rather fragmented. Why, for instance, are the agricultural tools not discussed based on the settlements, where the archaeobotanical record originates? Are all sites where respective tools, architecture, or massive debris layers were found indications for the same kind of permanent settlements? Permanent for what shares of the communities? What about winter settlements (Shulga 2012)? Given the high diversity in ecotones and cultural variances, there must have been a multitude of local approaches to cover livelihoods. The scenarios for agricultural and pastoral shares—for example, by season, by workloads, in land use, by gender relations, or by specialized part of the society—might have been highly diverse. But perhaps not, and foothill or steppe communities executed their procurement of food in similar ways within their respective areas. Choosing a regional comparative and not a categorized outline of the archaeological evidence would have made the lines of argument more comprehensive and animated. That also could have allowed for the integration of a sociopolitical perspective, exploring regional particularities and overall trends in the formations and transformation of economies in Central Asia and beyond, probably including even total mobile, that is, nomadic, groups.

Much is written about "the people" involved—but who are these people? The rather vague chronological and cultural contextualization of the archaeological sources and the repeated

statements of the agropastoral nature of their economy present the populations in this vast area as a totality not unlike the former "nomadic" paradigm. Moreover, it obscures the tremendous transformations that affected Central Asia and the entire steppe zone during the Scythia expansion. The expansive nature of this phenomenon is outlined by the traditional perspectives focusing on materials from the burial sphere (westward Otchir-Goryaeva 2012; eastward Shulga 2010). Its foundation within large-scale migration of considerable numbers of people is meanwhile questioned among others by ancient DNA studies (Damgaard et al. 2018). The social disruptions, however, which the formation of an ideological system as represented in the "Scythian" or "Saka-style" elite graves undoubtedly must have had strong effects on local communities and transregional networks. It must have similarly affected the subsistence systems of the populations in the steppe, the foothills, and the mountains all over Eurasia, each in a different way and with a different degree of intensity. In an early publication, the leading author of this paper illustrated the entanglement of the agricultural, pastoral, and productive segments of society in relation to an emerging elite taking on a "Scythian" way of representation in the best-studied area of the region (Spengler et al. 2017). Following this line of thought—that is, evaluating at a local or regional scale the shifting integration of different social actors in one or more sociopolitical structures based on an extended spectrum of economic components—can help to overcome a rather paralyzing classification of vast populations into either "nomadic" or "agropastoral." Models from cultural anthropology and ethnology such as those suggested by Potts (2014), or in a more formalized and structural concept by Kreutzmann (2012 and citations therein), can help to position the respective case studies in a relational set of similar or dissimilar trajectories, both economic and sociopolitical.

These critical words should not obscure the fact that the paper offers highly valuable arguments in deconstructing the paradigmatic notion of the Iron Age Central Asian populations—and not only them—as highly mobile warrior nomads. This image, which has been passed on for generations of archaeologists in both the East and West (Simpson and Pankova 2017), rests in a poor debate on the social totality of South Siberian and Central Asian societies. The elements highlighted in the outstanding elite burials are part of a social display that emphasized a probably very narrow aspect of the diverse lifeways that can be expected in ancient Central Asia. The authors present this diversity at length and thus open up new perspectives for the understanding of the gilded elites as well.

Lynne M. Rouse

German Archaeological Institute, Eurasia Department (Berlin), Im Dol 2-6, Haus II, 14195 Berlin, Germany (lmrouse@wustl.edu). 6 III 20

In this summary of agricultural evidence in prehistoric Central Eurasia, the authors rightly call out some previous archaeological

interpretations that display circular logic, the misuse of proxy data, and a degree of “nomadic bias.” But in addressing the relationships between agriculture, pastoralism, and broad sociocultural developments in the region, I see a missed opportunity by the authors to use their impressive panregional data set, subregional specializations, and collective knowledge toward breaking down overgeneralizations with deep epistemological and methodological roots. In planting a flag against “nomadic bias” in Central Eurasian archaeology, this analysis counters with an equally overgeneralized “agricultural bias” that addresses subsistence, yet fails to engage with many of the sociocultural concepts wrapped up in nomadism. Terminological and chronological ambiguities linger in the discussion, leading to a dismissal of proposed models for the sociopolitical integration of agricultural and pastoral communities in Central Eurasian prehistory. The result is a flattening of local and temporal socioeconomic variations that many scholars, including the authors themselves, agree characterizes this diverse region.

Data from the second–first millennia BC across Central Eurasia (an area confusingly referred to in the paper by several different labels) is compiled to argue that a portion of the population depended on agropastoralism—the emphasis here being on evidence of agriculture and sedentism. As described in the paper, however, regional scholarship has long acknowledged the various degrees to which farming was part of locally adapted economies (Akishev 1970; Bernshtam 1941; Chang 2018; Jia, Betts, and Wu 2011; Kuz'mina 2008; Zadneprovsky 1962). More significant, then, are questions of timing and the socioeconomic impact of changes in agricultural intensification, organization, and scale across Central Eurasia—although surprisingly, given the potential of the compiled data set, no chronologically or subregionally nuanced reconstructions are offered. There is also an unexplained glossing over of the major socioeconomic transition from Bronze to Iron Age, which falls squarely within the period in question at roughly the beginning of the first millennium BC. This socioeconomic transition vitally intersects with the present analysis, as it witnessed a move from small-scale, localized, mixed agropastoral economies toward more specialized pastoral and agricultural spheres integrated through a materialized sociopolitical hierarchy (Chang 2018; Hanks 2010; Hanks and Linduff 2009; Kohl 2007; Koryakova and Epimakhov 2010; Kuz'mina 2008; Parzinger 2006). The complexity and variety of these socioeconomic arrangements underwrite several recently proposed models incorporating both agricultural and nomadic populations in uniquely Central Eurasian political/cultural formations (Brite et al. 2017; Chang 2018; Frachetti 2012; Honeychurch 2015; Rogers 2015; Rouse 2020). I would thus rather have seen the authors engage more critically with some of these models, since they address their call to “grapple with the growing evidence for sedentism and farming.” For example, the discussion might have evaluated subregional patterns (or lack thereof) useful for better defining the relationships these models postulate between agricultural commoners and nomadic elites comprising first millennium BC “nomadic polities” (Brite et al. 2017; Chang 2018).

Overall, conflating terminology designed to distinguish economic practices from sociocultural interpretations risks pulling this analysis into the very trap of proxy associations that the authors rally against. Many scholars have gone to lengths to disentangle subsistence practices from sociocultural organization through the use of terms such as “mobile herder,” “mobile pastoralism,” “shepherding,” “‘pure’ pastoralism,” “cultivation,” “(specialized) nomadism, and “(mixed) agropastoral(ism)” (Bacon 1954; Hammer and Arbuckle 2017; Khazanov 1994; Potts 2014:40–46; Shishlina and Hiebert 1998). It is therefore concerning that, except for the last two, these and other terms appear in the text without definition. Whether the authors agree with the distinction, some have separated “(mobile) pastoralism” from “(specialized) nomadism” (Chang 2018; Frachetti 2008:15–17; Hiebert 1994:134–136; Humphrey and Sneath 1999; Khazanov 2009; Kohl 2007:158–163) to describe different socioeconomic systems evidenced in the Central Eurasian Bronze and Iron Ages. Relatedly, chronocultural labels such as *Andronovo*, *Saka*, and *Wusun* are used (and questioned) without clear explanation that the first is associated with Bronze Age mixed agropastoralism and that the latter two are associated with Iron Age specialized nomadism (Kohl 2007). The analysis here might have dealt with these terms, which are the subject of intense interregional debates among archaeologists who find similar material culture (ceramics, burial structures, metal objects) associated with different patterns in the relative proportion of farming and herding strategies. Numerous citations in the text mischaracterize or invert scholars' arguments about mobile pastoralism and related archaeological evidence (e.g., Boroffka, Cierny, and Lutz 2002; Brite 2016; Doumani and Frachetti 2012; Hermes et al. 2018; Negus Cleary 2013; Rouse and Cerasetti 2014; Vinogradova and Kuz'mina 1996). By ignoring the archaeological contexts provided therein, handmade ceramics, copper/tin mining, or nonurban architecture indeed appear insufficient evidence for mobile groups; but by this logic, isolated data points marking the presence of grains, sickles, or stone/mudbrick architecture are equally ambiguous to constructing arguments for agropastoralism.

Without doubt, long-standing socioeconomic models of Central Eurasian prehistory should be revisited as new analytical methods and data sets emerge. The hypotheses of twentieth-century archaeology in the region, and the accumulating farming-related evidence in certain prehistoric settings, leads me to agree with the overall sentiment that shifting relationships with agriculture in the early first millennium BC likely relate to major sociocultural and political-economic transformations. To disentangle cause from effect, however, and to disarm any real or perceived “nomadic bias” in previous research, we must do more than replace one uniform narrative with another. The integrated, multiproxy approach modeled here is an example of forwarding archaeological science and research collaboration in a region where knowledge and interpretations remain highly localized. The analysis itself, however, does not move beyond subsistence arguments and only superficially deals with recent Eurasian models of social complexity that specifically

address the political and cultural interplay of agricultural and pastoral pursuits in the Bronze and Iron Ages. In light of this, I remain skeptical of the argument that “demonstrating . . . agropastoralism calls into question the foundation of studies relating to Central Asian social complexity, craft specialization, population demographics, and economy more broadly.” To my mind, the more interesting question is not *whether* agriculture was part of the system, but *how* its variable articulation with pastoralism through prehistory ultimately contributed to the diverse societies of Central Eurasia.

Karen S. Robinson

Institute for the Study of the Ancient World, New York University,
15 East 84th Street, New York, New York 10028, USA (karen
.robinson@nyu.edu). 5 III 20

This article is a welcome contribution to the study of mobile pastoralists in Bronze and Iron Age Eurasia. The authors, most of whom are specialists in scientific studies of archaeological remains, bring their varied expertise to the remains of peoples who lived in eastern Central Asia to demonstrate that many of those people were less mobile, if not in fact settled, than past scholarship has assumed.

They argue against an image shaped by the horse-riding military elites of the Iron Age steppe, who until recently have been the most visible component of their societies to ancient peoples who wrote about them, and consequently to archaeologists of the nineteenth and twentieth centuries. As stated, this segment of the population was described by the mid-to late-first millennium BCE historians Herodotus, Strabo, and Sima Qian. However, even earlier the Assyrians (eighth–seventh century BCE) wrote that they employed steppe horse riders as mercenaries and noted the raids by them on their cities (Farkas 1975:18–19; Stark 2012:108).¹ These warrior elites continued to act as mercenaries to both the Achaemenids (550–330 BCE) and Alexander the Great (336–323 BCE) while also raiding them (Stark 2012:112–113). Even earlier, the late-ninth-century BCE Chinese wrote about warlike foreigners with chariots attacking settled populations (Bunker 1997:14). One might ask how this reputation gave rise to the romantic notion of the horse-riding nomad, which the modern Kazakhs are not alone to revere, but also as manifest in recent museum exhibitions (e.g., Simpson and Pankova 2017). The relatively recent history of Turkic populations in Central and West Asia and the Mongol conquests cited by the authors as increasing pastoralism in the region likely also contributed to the power of the image of marauding mounted elites. The authors note that the mobile-pastoral model applied to the first millennium BCE has been used in recent decades to explain and develop research projects in the second millennium BCE, coloring interpretations of data

and accounts of cultural practice. This model has facilitated overlooking even ancient authors’ references to agriculture among these groups and caused misinterpretation of “archaeological sites recorded . . . [that] would be construed as sedentary and agropastoral if they were recovered anywhere else in the world.”

The authors propose the following terminology: “nomadism,” for groups “who regularly engage in population movements (possibly two or more times a year) and consume a diet heavy in dairy and meat products” and “agropastoral,” referring “to mixed economic strategies, where all or most of the population remains stationary throughout the year and invests in significant farming activities.” Although I have no argument with “agropastoral,” I prefer “mobile pastoralists” for those who cannot be proved to fall into the former category because the word “nomad” retains the connotation of marauding outsiders, biasing the interpretations of their archaeological remains and explanations of their place in the history of Bronze and Iron Age Eurasia.

Many of the categories of data that the authors consider to support their thesis are results of new tools and specialties in archaeology. The various types of evidence, together with the perspective of landscape archaeology, have changed the discourse about Central Asia and the steppes broadly, as this article exemplifies for the subregion discussed.² However, in discussing mobility and isotopes, they state that in the Kazakh Altai, horses had greater mobility than humans. This is literally true for the samples tested, but the cultural setting needs to be considered. The humans were buried locally, but the horses were brought to the burial, likely by individuals from other groups who were beholden to the buried individual in some sociopolitical way (Francfort et al. 2006:122–123; Gerling 2015:224). Broad-brush statements by the authors, in cases such as this, do need to be nuanced in further research and reporting.

In their enthusiasm to prove their case, the authors sometimes insist on the appearance of one or another of their criteria as necessary to prove settled living, such as permanent structures.³ There are other models, such as that in late Bronze Age Khanuy Valley, Mongolia, where there are not archaeological traces of permanent structures, but winter camps that were inhabited for three-quarters of the year and where the annual movement was 7–8 km. Although this is not permanent in the sense of year-round settlement, and these sites have no traces of agriculture (Houle 2016:67–68), the long stay in winter camps and short distances of movement are certainly more “settled” than “nomadic.” Such cases speak for the use of “mobile pastoralist” rather than “nomad.”

The authors say that “certain fighting animal motifs that appear on metal artifacts . . . are part of a broader agropastoral cultural system in Eurasia” and thus cannot mark nomads. The authors do not state what metal objects, what time period, or

1. See Hanks (2012) for a discussion of the development of mounted warfare.

2. For isotopic work in similar landscapes of the South Caucasus, see Chazin et al. (2019) and Nugent (2019).

3. For possible mobile pastoralist permanent winter structures in the Pazyryk culture, see Robinson (2012:86).

whose work they have in mind, but at least in the mid-first millennium BCE, combat between wild and/or mythic animals occurred not only on metal objects but also on organic materials in the Altai (Rudenko 1970:79, pl. 110F, pl. 170), and it is only in the fourth–third century that we see any domestic animals represented (Rubinson 2003; Rudenko 1970, pl. 65, pl. 154). Importantly, the animals that are the basis of the economy of mobile or agropastoralists are not depicted in their decorative programs.

It is essential to keep in mind that the agropastoralists and mobile pastoralists in the Iron Age were linked, as Claudia Chang (2018:108) makes clear. That underscores the point the authors make, based on their convincing arguments that “large parts of Central Eurasia in prehistory were occupied by low-investment agropastoralists,” that “we need to relook at many of the interlocking aspects of the archaeological record.” This work and article are an important contribution to removing the “nomadic bias” from the study of Eurasia.

Reply

We were delighted to see such a rich diversity of scholarly thought from across Eurasian archaeology represented by the responders. As we emphasize in our paper, Central Asia is today, and was in the past, an environmentally and culturally diverse place. It is only fitting that the archaeology of this region be represented by a diverse array of intellectual approaches and scientific backgrounds. The informed discussions engaged in by 11 of the top scholars in Central Asian archaeology add insight to our paper, which was compiled, in turn, by 11 archaeologists with specializations in various areas of the archaeological sciences. We are excited to see how far the field of Central Asian archaeology has advanced over the past decade, and we are particularly pleased to see responses from so many scholars who have devoted their careers to understanding the prehistory of this often overlooked part of the world. Many of the responses are from scholars who have served as our mentors, colleagues, and close friends.

We are united by the recognition that Central Asia was the crossroads of the ancient world, genetically and culturally. Yet it has received far less archaeological attention than the rest of Eurasia. Over the past few decades, considerable scholarship has led to many large-scale revisions in our understanding of the prehistory of this enigmatic region, of which our discussion of paleoeconomy in the mountain foothill zone during the second and first millennia BC is just one. Nonetheless, it is not a trivial revision, as it is tied into many interlocked prominent arguments of sociopolitical development, innovation, and cultural dispersal. While some of the responders disagree with semantics or details in our narrative (which we address below), it is clear that all archaeologists working in Central Eurasia need to develop a new understanding of paleoeconomy using empirical data, rigorous archaeological scrutiny, and detailed case studies.

A few of the responders appear to see our critiques as being in opposition to an earlier generation of scholarship or to specific camps of scholars. This is not how we envisage the scientific endeavor. We present converging lines of data that bring together the archaeological and biological sciences into one emerging narrative. It is also clear that a few of the responders saw a dichotomy between modern scientific data and arguments based solely on material culture. We seek to break down this dichotomy, as none of the scholarly approaches that we present in this paper can stand alone. Each data set has its own flaws and potentials. Instead, archaeologists need to collaborate more closely with lab specialists, and all scholars need to build their narratives as a group. Additionally, a major goal of this paper was to link modern scientific data from the past decade with conclusions drawn from pre-1991 scholarship, notably by Akishev, Gorbunova, Litvinskiy, Zadneprovsky, and others. We feel that there is considerable merit in revisiting this earlier scholarship, which has often been ignored in later interpretations. Notably, the arguments that push nomadic narratives back to the Bronze Age are new in the literature, and there are plenty of earlier discussions of prehistoric sedentary agropastoralism. Kradin, in his highly informative response, presents additional pertinent scholarship from Soviet-trained archaeologists, specifically Markov, Kosarev, and Masanov. Kradin also echoes us in heralding Di Cosmo (1994) for illustrating much of this more than three decades ago. We would also like to point out that Chang (2018) has been breaking down the nomadic bias for much of her tenure working in Kazakhstan.

Ongoing Research in Central Asian Archaeology

A number of the responders pointed out supporting research that has been published since the submission of our paper, and we are keen to showcase those publications. The fact that new articles on Central Asian archaeology are being published at such a fast rate speaks highly of the state of research in this part of the world. In his response, Bendrey referenced new stable oxygen isotopic research on horse remains from Tsengel Khairkhan and Baga Turgen Gol in the Mongolian Altai, which appears to show that most horses were locally raised, with a few representing long-distance movements (Bendrey et al. 2017). Within the last year, two papers were published regarding mobile dairy pastoralism and grain cultivation on the eastern steppe of Mongolia. The first of these papers demonstrated that western steppe populations introduced ruminant dairying to the Mongolian steppe by 3000 BC (Jeong et al. 2018; Wilkin et al. 2020a). The second publication noted that millet cultivation, as part of an agropastoral economy, became widespread during the Xiongnu period (ca. 200 BC–AD 100; Wilkin et al. 2020b). In addition, analysis of cementum annulations from Begash and Tasbas recently demonstrated that people and their animals were using those places throughout the year, rather than as seasonal campsites (Schmaus, Doumani Dupuy, and Frachetti 2020). Additionally, a broader overview of northern Central Asia demonstrates that agropastoralists have been engineering ecosystems,

both intentionally and unintentionally, for millennia (Ventresca Miller et al. 2020b).

Hammer, in her comments, noted the need for a greater integration of data concerning pastoralism with agriculture and other linked aspects of the broader economy. We acknowledge this lack of integration, which is unfortunately hampered by a lack of an integrated deployment of archaeological scientific techniques at many sites, particularly relating to the recovery of archaeobotanical and zooarchaeological material. Our goal in the paper, as stated at the outset, was to demonstrate that both agriculture and pastoralism played important roles in the economy for prehistoric populations in Central Asia. We did not seek to present a coherent model of economy; we feel that such a model is currently beyond the reach of available data for Central Asian archaeology. Likewise, any such model would be complex, given the regional ecological variation that we emphasize, and dynamic aspects of economy over time. Instead, we present a single building block in a century-long discussion regarding the nature of paleoeconomy in Central Asia.

As we point out in our argument, there are a handful of sites, such as Tuzusai (Chang 2018) and Tasbas (Doumani et al. 2015), that have fairly complete archaeological archives, allowing for investigations of seasonality and land use. However, since the submission of our original paper in 2018, additional zooarchaeological research in this region has been published, which further expands the data beyond basic presence/absence tables. For example, at the high-altitude site of Chap 1, Kyrgyzstan, zooarchaeological analysis was supported by ZooMS (zooarchaeology by mass spectrometry), suggesting that wool-based pastoralist strategies were likely part of a complex agropastoral lifeway (Ananyevskaya et al. 2021; Taylor et al. 2018b). Further developing this model, at the nearby site of Aigyrzhal-2, relatively few animal bones were recovered, but evidence for cereal processing was identified (Motuzaite Matuzeviciute et al. 2017). Additionally, the integration of isotopic data into previous analyses of zooarchaeological remains at the urbanized locale of Kent indicates that foddering was a component of the pastoral strategy, while at the Turgen encampment multiple livestock management strategies were used (Ventresca Miller et al. 2020a). Taken together, all of these findings indicate the need for more lab-based zooarchaeological analyses to better understand the integration of pastoral and agricultural practices. New research agendas have sought to use emerging biomolecular techniques to learn from highly fragmented faunal assemblages typical of many Central and East Asian archaeological sites, and to understand changes in domestic livestock use over time—including the emergence of dairy pastoralism in some regions, such as Mongolia (Taylor, Wang, and Hart 2020; Wilkin et al. 2020a).

Perennial Concerns in Research Initiatives

While we recognize broad inconsistencies in semantics among scholars, such as the use of the term “nomadism,” we do not wish to reduce this discussion to a purely terminological one. That

being said, it is worth pointing out that the responders do not have a unified definition of nomadism. Some use it as equivalent to mobile pastoralism and others use it to encompass all diverse economic practices that have occurred in the past. The lack of unification among the responders represents a sampling of the diversity in thought present among Central Asian archaeologists at large. On the extreme end, the repeated emphasis of Eurasian Steppe pastoralism in Frachetti’s response draws attention away from the ecological diversity of the mountain foothills and the economic diversity of the ancient inhabitants of the region. Conflating farming of crops with long growing seasons, high water demands, and complex economic scheduling systems under one banner of “nomadism” hinders discussions and does not advance scholarship. Likewise, we recognize the importance of the use of ethnohistoric analogies in the interpretation of the archaeological record, and many of us have elsewhere presented in-depth summaries of ethnographic studies as they apply to Central Asian paleoeconomy (Spengler 2015; Wilkin et al. 2020a).

Nonetheless, overestimating the weight of these ethnographic studies over the contributions of scientifically generated data or to override archaeological evidence, rather than to complement it, is problematic. Frachetti claims that our use of the term “nomadism” is idiosyncratic and a straw man—citing a number of the classic ethnographers of the 1950s and 1960s. While we will not entertain this discussion in full, it is worth pointing out that Salzman switched from the term “multiresource nomadism” (Salzman 1972) to “multiresource pastoralism” (Salzman 2004)—recognizing that much of what he was describing ethnographically was not nomadism. Likewise, Salzman was discussing low-investment forms of grain cultivation, notably of short-growing-season millets, as a complement to an economy expressly focused on livestock, whether mobile or sedentary (see Spengler 2015). Ultimately, what we are describing for Central Asian archaeology is not all synonymous with Salzman’s multiresource pastoralism. While it is true that many highly divergent definitions have been presented, Dyson-Hudson and Dyson-Hudson (1980) clearly define pastoral nomadism as “people who are principally dependent for their subsistence on livestock, and for whom special mobility is regularly employed as a survival strategy” (15). We see nothing idiosyncratic about this definition, and we reiterate that it does not define the economic systems archaeologically identified in many areas of Central Asia.

There is growing evidence for a mixed agropastoral economy in Central Asia, and diversity in economy across differing ecological settings through time. Isotopic and archaeobotanical data demonstrate that cultivated grains played an important role in the diet for many of the best-studied populations, and these grains represent a mix of long- and short-generation as well as drought-resistant and water-demanding crops. Ultimately, we completely agree with the Hammer’s statement that it “would be more constructive to abandon the term ‘nomadism’ altogether.” We also agree with Robinson’s comment that there is too much baggage attached to the term to use it in scholarship, as it is often used synonymously with “marauding outsiders.” Additionally, we think that Hammer is accurate in pointing out that

the misconceptions in both Central and southwest Asian archaeology are not accidental; here she specifically references the overemphasis on ethnographic studies in shaping archaeological interpretations. Much of these misconceptions arise from a romanticized image of the past and an imagined narrative.

We find the variation in commenter reactions to our argument to be emblematic of broader division across the field. For example, Rouse criticizes the way we use Culture Historic designations (i.e., Saka, Wusun, and Andronovo), whereas Bemmann criticizes our lack of using them at all. Obviously, we chose not to use established Culture Historic frameworks intentionally to remove the data from previously established narratives. As another example, Frachetti claims that the links between hand-made ceramics and nomadic economies were not made by the scholars we cite, whereas Rouse acknowledges that they were made by those scholars but feels that they were taken out of context. While we would rather avoid such detailed debates and focus on the broader narrative and future directions of the field, we think that it is worth briefly addressing claims of misrepresented archaeological interpretations or ignored contexts. Within archaeology, these are nontrivial accusations. As Frachetti and Rouse note, context is always essential in archaeology, and we will briefly look at the examples of the cited references that both responders claim were taken out of context.

In the paper, we chose not to emphasize scholarly cases of nomadic biases in an attempt to avoid singling out specific scholars, but rather assumed that the claims of nomadic biases would be evident to anyone familiar with Central Asian archaeology and its published oeuvre. We provide just a few well-cited examples here. Frachetti, in his response, points out that the discovery of millet and wheat at Begash, published 10 years ago, set in motion changes in the way that the field looks at Central Asian prehistory. While there is truth in this, as we noted above, many earlier scholars, such as Di Cosmo (1994), had already claimed that farming was an important aspect of the paleoeconomy. Contra to these earlier scholars, Frachetti et al. (2010) did not interpret those grains as economically significant, an argument that Frachetti (2014, 2015) elaborated on further with the seeds-for-the-soul model. Domesticated grains were recovered from 62.5% (five out of eight samples) of the contexts from the earliest phase at Begash. Given the small sample sizes, this is a high measure of ubiquity. A look at the archaeological contexts and the ubiquity of grains would evidently suggest that they played a more important role than a ritual exotic. As another example of nomadic biases, Frachetti et al. (2017) plot out all known archaeological sites of the Silk Road and interpret the entirety of the Central Asian mountain zone as a nomadic ecology. They ultimately conclude that “centuries of seasonal nomadic herding [shaped] discrete routes of connectivity across the mountains of Asia” (Frachetti et al. 2017:193). The assessment that nomads formed the Silk Road ignores the historical evidence of political regimes controlling economic systems and the construction of caravanserais and villages by various imperial entities. This study also assumes that all rich highly arable river valleys were used primarily by nomads.

The influence of the highly polarized steppe and sown narrative continues to direct scholarship. Hermes et al. (2018) identify isotopic evidence for a diverse array of economic behaviors, much of which relied on varying intensities of farming. This diverse array of agricultural and pastoral behaviors is nonetheless terminologically characterized as either “nomadic” or “urban.” Likewise, Maksudov et al. (2019:285) identify an urban archaeological site in the mountains and disregard contextual evidence to interpret it as a unique case of “nomadic highland urbanism.” Rouse and Cerasetti (2014, 2018; Rouse et al. 2019) identified a sedentary type ceramic kiln with agricultural grains inside and, despite the archaeological context, interpret it as an example of mobile pastoralists mimicking the behaviors of sedentary people. Ultimately, they conclude that the “local community of Late Bronze Age mobile pastoralists whose subsistence strategy was largely independent from that of urban agricultural communities, while at the same time, the ceramic production and trade between the two communities were very much intertwined” (Rouse and Cerasetti 2014:47). While it is not our intention to single out these authors, given the responses of Frachetti and Rouse, we feel that it is instructive to provide a few examples of the ways preconceived ideas of economy have influenced recent interpretations and overridden archaeological context or scientific data. While we could expand this list of examples much further, we chose not to provide such example in our paper in an attempt to avoid constructing divisions in the small community of Central Asian archaeology. We feel that it is better to invite all archaeologists in Central Asia to participate in a revision of the narratives of Central Asian paleoeconomy, rather than claiming specific flaws in any individual’s scholarship.

A more significant concern should be the public understanding of Central Asian prehistory and the popular image of the people at the center of the ancient world. A short skimming of the history or prehistory section of any library or bookstore would provide dozens of scholarly and popular books about highly specialized warrior nomads, empires based on pastoralism and a limited breadth of economy, and the development of social complexity without grains surplus. The depiction of a unified Scythian empire of the steppe raiding neighboring agricultural communities is burned into the public imagination. The archaeology and ethnography of Central Asia has been used to direct political agendas for roughly two and a half millennia, from Classical and ancient Chinese accounts of the uncivilized populations on their peripheries to the linear developmental models of social complexity constructed to further Soviet political programs. Post-Soviet nations continue to embrace embellished images of powerful warrior nomads in campaigns of nationalism. As archaeologists working in Central Asia, it is important that we work to break down tropes, disentangle colonialism/imperialism from archaeology, and redirect the popular image of this part of the world. Likewise, we need to provide interpretations of paleoeconomy based on scientific data, so our colleagues can better use our assessments in comparative archaeological approaches.

Developing a New Narrative in Central Asian Archaeology

Chang, in her response, argues that many of the sites discussed in our paper and, indeed, much of the archaeological research conducted across Central Asia over the past few decades has focused on ecologically marginal zones in the mountains and on the steppe. There are probably several factors for this trend in scholarship, most notably there has been an expressed research agenda for finding “ancient nomads.” Over the past few decades, archaeological research has largely drifted from large urban centers to the slopes of high-elevation mountains and arid deserts or dry-grass steppe where mobile subsistence strategies are perhaps more likely (e.g., Frachetti 2007). In addition to ideological interest, there are practical reasons for this focus in research: (1) heavy sedimentation in the river valleys obscures sites, and (2) heavy wind deflation on the colluvial fans, arid steppe, and deserts makes archaeological sites readily visible on the surface and in many cases represent palimpsests of occupation. These research agendas leave many of the richest agricultural lands in Central Asia underexplored by modern methods in the archaeological sciences. It is reasonable to assume that this visibility has significantly overstated the human occupation in these wind-deflated landscapes, and a research agenda focusing on the rich floodplains and alluvial sediments of the mountains may prove highly informative.

One of the factors that makes research in Central Asia so fascinating is the extreme ecological diversity and the ability to study human adaptation on challenging landscapes. We were pleased to see that many of the commenters agreed with our points about environmental variation being a factor in economic decision-making. In her response, Hammer rightly points out that our research moves away from “environmentally driven assumptions about pastoralism and instead investigates ancient diet, seasonality, mobility, and landscape empirically by integrating numerous lines of evidence.” By integrating archaeological methods, we can better understand how humans adapted to climate change, how they impacted the environment around them, and how they responded to dynamic and unpredictable ecosystems. Likewise, Central Asian archaeology provides comparative analogies for exploring the development of complex social systems, made even more informative in this part of the world, as dense human populations on the scales seen in south, east, and southwest Asia were not supported. Assuming that people adapted to ecological constraints by developing a highly specialized mobile pastoral economy undermines all of these research initiatives. If, instead of assuming the nature of economy, archaeologists investigate how herding and farming practices could have been integrated, we will get much closer to an understanding of how Central Asia fits into a broader human narrative.

Most of the responders recognize that our paper provides a strong critique of traditional interpretations of paleoeconomy in Central Asia. Notably, Reinhold, in her response, clearly states, “It is indeed a categorically different perspective,” and it opens up a vibrant array of new research questions. As Reinhold fur-

thermore states, “How might these agropastoral farming economies have looked?” and “At what scales did they operate, in what proportions, and in what sorts of territories?” These are the questions that we, as a field, should be asking moving forward. Many of the responders claimed that they would have liked to have seen more discussion regarding various additional points, such as Bemmman’s claim that the lack of discussion of climate change was a weakness. Many of these points lay far outside the goal of our paper. However, some of the points raised by the responders represent areas that need more research. For example, we found Hammer’s response particularly appealing in its request for a greater discussion regarding how these conclusions will change the field moving forward. She specifically asks us to engage in a critique of mobility models as presented by Frachetti (2012) and Frachetti et al. (2017). Although at present we do not believe that the data are robust enough to support or refute such models, we are eager to see how the field progresses in this regard.

Given that the data we present point to novel research directions, we will use our remaining space to suggest future research agendas that could build on the discussions presented here. In our paper, we narrowed our focus down to the second and first millennia BC, as there are now robust data to discuss this period. However, as increasingly more evidence comes out relating to even earlier iterations of farming in Central Asia, we will all have to work together to interpret these new data from the third millennium BC. Notably, domesticated cereal grains from Tongtian Cave push back the earliest domesticated grains in northern Central Asia by several centuries (Zhou et al. 2020). These data now point to a synchronous introduction of farming and herding in the late fourth millennium BC. The identification of archaeobotanical remains of wheat as far east as the lower Yellow River by 2600 BC, suggests that agricultural crops were dispersing through the mountain valleys earlier than previously acknowledged (Long et al. 2018). Archaeobotanical evidence for local grain cultivation at the high-elevation (>2,000 m asl) site of Chap show cereal cultivation since the mid-third millennium BC. The Chap archaeobotanical assemblage contains both grains and cereal chaff, accompanied by weed seeds, indicating investment into field manuring and irrigation. The cultivation activities expressed by the archaeological record suggest a significant investment in farming (Motuzaite Matuzeviciute et al. 2019).

An additional line of inquiry may be to move this research agenda forward in time. Kradin, in his response, noted that the urbanization of the steppe, particularly starting with the Mongol Empire in the north, may have been tied into farming systems. He suggests that this integration of farming was tied to Chinese connections, a research topic that could be better explored with an integrated aDNA and isotopic study. Mongolia sits both geographically and culturally far from the area that we focused on in this paper, but we see it as an exciting research frontier. The one archaeobotanical study of a Mongolian period steppe urban site (admittedly Karakorum is anything but typical) provided the most diverse assemblage of exotic and cultivated plant remains ever recovered from a Central Eurasian archaeological context

(Rösch et al. 2010). Increasing archaeobotanical research in medieval periods in Central Asia is illustrating how rich the repertoire of cultivated crops was, including everything from apricots to melons (Spengler 2019). These data show that people were cultivating crops in the arid desert and at high elevations and pushing the boundaries of crop cultivation. These data also suggest that cultivation practices were intensified during the late medieval period, when the Qarakhanid Empire is sometimes said to have converted the economy to nomadism (cf. Spengler 2019). A better understanding of the nature of herding and farming at this time would allow for better comparative studies of cultural developments across Central Asian populations.

Additionally, we narrowed our discussion to the mountain foothill zone, as it is a rich biodiverse swath of land that connected the ancient world. However, there are rapidly growing data sets for other areas of Central Eurasia that need to be interpreted based on the archaeological and scientific data as opposed to ethnographic analogy. Kradin, in his response, remarks, “For me, as an Inner Asian archaeologist, it is interesting to get to know to what extent the conclusions of Spengler et al. about Central Asia are applicable to Inner Asia.” We are all as interested as Kradin in knowing what comes next for Inner Asian archaeology and what the next decade of scholarship will reveal. To discover when dairying became a major part of Central Asian subsistence strategies, palaeoproteomics is being employed to further explore the use of dairy pastoralism at multiple sites across the region (Wilkin et al. 2020a). Ancient populations in Central Asia have been deeply integrated with adjoining regions of Xinjiang, Mongolia, Siberia, the Trans-Urals, South Asia, West Asia, and beyond—and a coherent model of prehistory and history will need to cross political, linguistic, and academic boundaries to understand the interface between agriculture, pastoralism, and human societies. Forthcoming work incorporates archaeological and textual evidence to highlight how the Xiongnu Empire controlled landscapes outside of modern-day Mongolia and propelled interactions along the Silk Road (Miller, forthcoming). For example, isotopic analysis suggests that Mongolia’s first herders may have subsisted on a diet largely of domesticated livestock and wild resources, but that millet and domesticated plants became widespread by the time of the first empire, the Xiongnu (Wilkin et al. 2020b). This research will allow future scholars to contextualize the role of specialized pastoralism in the cases where it is observed archaeologically.

To this end, the response from Jiang is highly informative; he has spent the past few decades conducting detailed archaeobotanical analyses of desiccated burial remains from Xinjiang. The results of his studies present some of the best evidence that we have for interpreting what life looked like across the broader region. As he notes in his commentary, these desiccated burials, dating to the second and first millennia BC, contain preserved grains, agricultural food products, and farming tools. Additionally, they contain wool, plant-based and silk textiles, dairy products, and an impressive array of crafts. The populations of ancient Xinjiang share many cultural comparisons with their contemporary counterparts in the mountains of Central Asia and, argu-

ably, provide closer analogies than ethnographically documented populations from two to three millennia later in time. Recent publications by Li (2020) display the complexity of agricultural practices in Xinjiang through time, specifically examining the ways that ancient farmers adapted to the hyperarid ecology. He has identified water catchment systems and irrigation structures on the highly desiccated landscape, as well as gradual shifts in crop preferences over time. The ongoing research in arid Xinjiang needs to be better integrated with the work being conducted in the Central Asian mountains, as economically there were likely many parallels between these closely related populations.

Conclusions

As we discussed above, the majority of the responders are generally in agreement that there needs to be a reevaluation of paleoeconomy in Central Asia. It is clear that the field should let go of models of economic development that rely on assumptions of specialized economies, and instead develop a strong scientific foundation for understanding human adaptation and cultural practice. This is an exciting time to be an archaeologist working in Central Asia, as the story is changing almost as fast as we can write it. The rapid integration of modern methods in the archaeological sciences has revealed many unknown aspects of the prehistory of the people living at the center of the ancient world. Nonetheless, it is a difficult area of research to professionally engage with. There remain few senior academic positions for archaeologists working in this part of the world and access to data is often safeguarded. In this highly competitive scholarly atmosphere, it is imperative that we all work together to advance Central Asian archaeology. It is easy to fall into the trap of singling out scholars or groups of researchers or seeing revisions in the archaeological interpretations as personal attacks. Archaeology, like all science, will build on and revise the research of earlier generations. We are excited to see what directions the next generation of scholars will bring to the field.

—Robert N. Spengler III, Alicia Ventresca Miller,
Tekla Schmaus, Giedrė Motuzaitė Matuzevičiūtė,
Bryan K. Miller, Shevan Wilkin,
William Timothy Treall Taylor, Yuqi Li,
Patrick Roberts, and Nicole Boivin

References Cited

- Abdulganeev, M. T. 1997. The most ancient settlements of the most ancient Altai. *Izvestiya Laboratorii Arkheologii* 2 [In Russian.]
- Agapov, P., and M. Kaderbaev. 1979. *Treasures of ancient Kazakhstan*. Alma-Ata: Zhalyln. [In Russian.]
- Akishev, K. A. 1969. Winter settlements and dwellings of the ancient Wusun. *Proceedings of the Academy of Sciences of the Kazakh SSR, Series AN Public* 1:39–46. [In Russian.]
- . 1970. Origins of sedentism and farming of the ancient Wusun of Semirech'ye. In *About the ancient cultures of Kazakhstan*. Pp. 69–77. Alma-Ata: Nauka. [In Russian.]
- . 1972. Problems of the origin of nomadism in the arid zone of ancient Kazakhstan. In *Search and excavations in Kazakhstan*. Pp. 31–46. Alma-Ata: Nauka. [In Russian.]

- . 1977. Semirechiye and South Kazakhstan, history of the Kazakhs SSR, vol. 1. Alma-Ata: Nauka. [In Russian.]
- An, Zhimin. 1992. The Bronze Age in eastern parts of Central Asia. In *History of civilizations of Central Asia*, vol. 1 of *The dawn of civilization: earliest times to 700 B.C.* A. H. Dani and V. M. Masson, eds. Pp. 319–336. Paris: UNESCO.
- Ananyevskaya, E., A. K. Aytqaly, A. Z. Beisenov, E. A. Dmitriev, A. Garbaras, I. A. Kukushkin, V. G. Loman, et al. 2018. 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. *Archaeological Research in Asia* 15:157–173.
- Ananyevskaya, E., M. Buckley, M. P. Chowdhury, K. Tabaldiev, and G. M. Matuzeviciūtė. 2021. Specialized wool production economy of prehistoric farmstead of Chap I in the highlands of Central Tian Shan (Kyrgyzstan). *International Journal of Osteoarchaeology* 31:18–28.
- Anthony, David W. 2010. *The horse, the wheel, and language: how Bronze-Age riders from the Eurasian Steppes shaped the modern world*. Princeton, NJ: Princeton University Press. [CC]
- Arbuckle, Benjamin S., and Emily Hammer. 2019. The rise of pastoralism in the ancient Near East. *Journal of Archaeological Research* 27:391–445. [EH]
- Askarov, A., V. Volkov, and N. Ser Odjav. 1992. Pastoral and nomadic tribes at the beginning of the first millennium B.C. In *History of civilizations of Central Asia*, vol. 1 of *The dawn of civilization: earliest times to 700 B.C.* A. H. Dani and V. M. Masson, eds. Pp. 450–463. Paris: UNESCO.
- Atwood, C. P. 2014. Banner, Ootog, Thousand: Appanage communities as the basic unit of traditional Mongolian society. *Mongolian Studies* 34:1–76.
- Bacon, Elizabeth E. 1954. Types of pastoral nomadism in Central and Southwest Asia. *Southwestern Journal of Anthropology* 10(1):44–68. [LMR]
- Baipakov, Karl M. 2008. The city and steppe in antiquity: sedentism and agriculture in the Saka and Wusun of Semirech'ye. *Izvestia* 1:3–25. [In Russian.]
- Baipakov, Karl M., and A. N. Maryashev. 2001. New data on the study of settlements of the Early Iron Age in Zhetysay: news of the Ministry of Education and Science. Pp. 71–72. Almaty: National Academy of Sciences of the Republic of Kazakhstan.
- Baipakov, Karl M., and Zh. K. Taimagambetov. 2006. *Arkheologia Kazakhstana*. Almaty: Kazak Universiteti.
- Barbarunova, Zoya A. 1995. Early Sarmatian culture. In *Nomads of the Eurasian Steppe in the Early Iron Age*. Jeannine Davis-Kimball, Vladimir A. Bashilov, and Leonid T. Yablonsky, eds. Pp. 121–136. Berkeley, CA: Zinat.
- Barfield, T. J. 1989. *The perilous frontier*. Cambridge, MA: Blackwell.
- Baumer, C. 2012. *The history of Central Asia: the age of steppe warriors*, vol. 1. London: Tauris.
- Becker, Fabian, and Jens Schneeweiß. 2016. Zur absoluten Chronologie der westsibirischen Spätbronze- und frühen Eisenzeit. Die Überprüfung der Besiedlungsphasen in Čiča mit Bayes'scher Statistik. *Prähistorische Zeitschrift* 91:431–470. [JB]
- Beckwith, Christopher I. 2009. *Empires of the Silk Road: a history of Central Eurasia from the Bronze Age to the present*. Princeton, NJ: Princeton University Press.
- Bemmann, J., U. Erdenebat, and E. Pohl, eds. 2010. *Mongolian-German Karakorum Expedition*. Vol. 1. Excavations in the Craftsmen Quarter at the Main Road. Wiesbaden: Reichert. [NK]
- Bemmann, J., E. Lehnndorff, R. Klinger, S. Linzen, L. Munkhbayar, O. Oczipka, H. Piezonka, and S. Reichert. 2014. Biomarkers in archaeology: land use around the Uyghur capital Karabalgasun, Orkhon Valley, Mongolia. *Prähistorische Zeitschrift* 89:337–370. [NK]
- Bendrey, R., S. Lepetz, A. Zazzo, M. Balasse, T. Turbat, P. H. Giscard, D. Vella, et al. 2017. Nomads, horses and mobility: an assessment of geographic origins of Iron Age horses found at Tsengel Khaikhan and Baga Turgen Gol (Mongolian Altai) based on oxygen isotope compositions of tooth enamel. In *Archaeology of the Near East*, vol. 9. M. Mashkour and M. Beech, eds. Pp. 262–272. Oxford: Oxbow.
- Benecke, N. 2003. Iron Age economy of the Inner Asian steppe. *Eurasia Antiqua* 9:63–81.
- Bernshtam, A. N. 1941. *Archaeological report on Northern Kazakhstan*. Kirgizia: Frunze.
- . 1951. Items found at the Lake Borovoy, Kazakhstan. *Collection of the Museum of Anthropology and Ethnography* 13:216–229. [In Russian.]
- Bokovenko, Nikolai A. 1995. Scythian culture in the Altai Mountains. In *Nomads of the Eurasian Steppe in the Early Iron Age*. Jeannine Davis-Kimball, Vladimir A. Bashilov, and Leonid T. Yablonsky, eds. Pp. 285–298. Berkeley, CA: Zinat.
- . 2006. The emergence of the Tagar culture. *Antiquity* 80:860–879.
- Boroffka, N., J. Cierny, and J. Lutz. 2002. Bronze Age tin from Central Asia: preliminary notes. In *Ancient interactions: East and West in Eurasia*. K. Boyle, C. Renfrew, and M. Levine, eds. Pp. 136–160. Cambridge: McDonald Institute for Archaeological Research.
- Bunker, Emma. 1997. Introduction. In *Ancient bronzes of the Eastern Eurasian Steppes from the Arthur M. Sackler collections*. Trudy S. Kawami with John Stevenson, eds. Pp. 7–17. New York: Arthur M. Sackler Foundation. [KSR]
- Carney, Christopher P., and John P. Moran. 2000. Imagining communities in Central Asia: nationalism and interstate affect in the Post-Soviet era. *Asian Affairs: An American Review* 26(4):179–198.
- Chang, Claudia. 2018. *Rethinking prehistoric Central Asia: shepherds, farmers, and nomads*. New York: Routledge.
- Chang, Claudia, and Rebecca Beardmore. 2015. The tale of a mud brick: lessons from Tuzusai and de-assembling an Iron Age site on the Talgar alluvial fan in southeastern Kazakhstan. In *Incomplete archaeologies: assembling knowledge in the past and present*. Emily Miller Bonney, Kathryn J. Franklin, and James A. Johnson, eds. Pp. 84–97. Oxford: Oxbow.
- Chang, C., N. Benecke, F. P. Grigoriev, A. M. Rosen, and P. A. Tourtellotte. 2003. Iron Age society and chronology in south-east Kazakhstan. *Antiquity* 77(296): 298–312.
- Chang, C., P. Tourtellotte, K. M. Baipakov, and F. P. Grigoriev. 2002. *The evolution of steppe communities from Bronze Age through Medieval periods in Southeastern Kazakhstan (Zhetysay)*. Sweet Briar, VA: Sweet Briar College.
- Chazin, Hannah, Gwyneth W. Gordon, and Kelly J. Knudson. 2019. Isotopic perspectives on pastoralist mobility in the Late Bronze Age South Caucasus. *Journal of Anthropological Archaeology* 54:48–67. [KSR]
- Chernikov, S. S. 1960. On the term early nomads. In *Brief reports and field studies of the Institute of the History of Material Culture*, vol. 80. Pp. 17–21. Moscow: KSIIMK. [In Russian.]
- Çifci, Ali, and Alan M. Greaves. 2013. Urartian irrigation systems: a critical review. *Ancient Near Eastern Studies* 50:191–214. [EH]
- d'Alpoim Guedes, Jade, and Anke Hein. 2018. Landscapes of prehistoric north-western Sichuan: from early agriculture to pastoralist lifestyles. *Journal of Field Archaeology* 43(2):121–135.
- Damgaard, Peter de Barros, Nina Marchi, Simon Rasmussen, Michaël Peyrot, Gabriel Renaud, Thorfinn Korneliussen, J. Víctor Moreno-Mayar, et al. 2018. 137 ancient human genomes from across the Eurasian Steppes. *Nature* 557:369–374.
- Davydova, Antonina V. 1968. The Ivolga Gorodischche (a monument of the Hiung-nu culture in the Trans-Baikal Region). *Acta Archaeologica Hungaricae* 20:209–245. [NK]
- de Planhol, Xavier. 2010. Le karez et la luzerne: une première révolution agricole en Iran. *Studia Iranica* 39(1):11–26. [EH]
- Di Cosmo, Nicola. 1994. Ancient Inner Asian nomads: their economic basis and its significance in Chinese history. *Journal of Asian Studies* 53(4):1092–1126.
- . 2015. China-Steppe relations in historical perspective. In *Complexity of interaction along the Eurasian Steppe Zone in the first Millennium CE*. J. Bemmann and M. Schmauder, eds. Pp. 49–72. Bonn: University of Bonn. [NK]
- Dodson, J., X. Li, X. Zhou, K. Zhao, N. Sun, and P. Atahan. 2013. Origins and spread of wheat in China. *Quaternary Science Reviews* 72:108–111.
- Dong, W. 2016. *Palaeodietary study on human and faunal remains from Bronze-Iron Age Hami Basin and its subsistence implication*. PhD dissertation, Lanzhou: Lanzhou University (in Chinese with English abstract). [HJ]
- Doumani, Paula N., Michael D. Frachetti, Rebecca Beardmore, Tekla M. Schmaus, Robert N. Spengler III, and Alexei N. Mar'yashev. 2015. Burial ritual, agriculture, and craft production among Bronze Age pastoralists at Tasbas (Kazakhstan). *Archaeological Research in Asia* 1–2:17–32.
- Doumani Dupuy, Paula N., and Michael D. Frachetti. 2017. Bronze Age textile evidence in ceramic impressions: weaving and pottery technology among mobile pastoralists of central Eurasia. *Antiquity* 86(332):368–382.
- Doumani Dupuy, Paula N., Peter Weiming Jia, Alison Betts, and Dexin Cong. 2019. Pots and potters of the Bronze Age of north-west Xinjiang. *Antiquity* 93(371):1231–1248. [JB]
- Drews, R. 2004. *Early riders: the beginnings of mounted warfare in Asia and Europe*. Abingdon, UK: Routledge.
- Drompp, Michael. 1989. Centrifugal forces in the Inner Asian “heartland”: history versus geography. *Journal of Asian History* 23(2):134–168. [NK]
- Dyson-Hudson, R., and N. Dyson-Hudson. 1980. Nomadic pastoralism. *Annual Review of Anthropology* 9:15–61.
- Erdene, M. 2011. Paleopatologiya hunnu Centralnoy Mongolii. In *Ancient Cultures of Mongolia and Baikalian Siberia. Materials of International Conference*. A. V. Kharinsky, ed. Pp. 398–403. Irkutsk: Irkutsk State Technical University Press. [NK]
- Evdokimov, V. V., and Victor Varfolomeev. 2002. *Bronze Age in central and northern Kazakhstan*. Karaganda: Karaganda Governmental University.
- Evtuhova, L. A. 1948. *Archaeological monuments of the Yenisei Kyrgyz (Khakas)*. Abakan, Russia: Khakass Scientific and Research Institute of Language, Literature and History. [In Russian.]

- Farkas, Ann. 1975. Introduction. From the lands of the Scythians: ancient treasures from the museums of the U.S.S.R., 3000 B.C.–100 B.C. *Metropolitan Museum of Art Bulletin* 32(5):8–31. [KSR]
- Fitzhugh, W., R. Kortum, and J. Bayarsaikhan. 2012. Mongolian-American Deer Stone Project Field Report 2011. Washington, DC: Smithsonian Institution.
- Frachetti, Michael. 2004. Bronze Age pastoral landscape of Eurasia and nature of social interaction in the mountain steppe zone of Eastern Kazakhstan. PhD dissertation, University of Pennsylvania, Philadelphia.
- . 2008. *Pastoralist landscapes and social interaction in Bronze Age Eurasia*. Berkeley: University of California Press.
- . 2012. Multi-regional emergence of mobile pastoralism and non-uniform institutional complexity across Eurasia. *Current Anthropology* 53(1):2–38.
- . 2014. Seeds for the soul: ideology and diffusion of domesticated grains across Inner Asia. In *Reconfiguring the Silk Road*. V. Mair and J. Hickman, eds. Pp. 41–54. Philadelphia: University of Pennsylvania Museum Press.
- . 2015. Nomadic mobility, migration, and environmental pressure in Eurasian prehistory. In *Mobility and ancient society in Asia and the Americas*. M. Frachetti and R. Spengler, eds. Pp. 7–16. New York, Springer.
- Frachetti, Michael D., and Farhod Maksudov. 2014. The landscape of ancient mobile pastoralism in the highlands of southeastern Uzbekistan, 2000 B.C.–A.D. 1400. *Journal of Field Archaeology* 39(3):195–212.
- Frachetti, Michael D., and Alexei N. Mar'yashev. 2007. Long-term occupation and seasonal settlement of eastern Eurasian pastoralists at Begash, Kazakhstan. *Journal of Field Archaeology* 32(3):221–242.
- Frachetti, Michael, C. Evan Smith, Cynthia M. Traub, and Tim Williams. 2017. Nomadic ecology shaped the highland geography of Asia's Silk Roads. *Nature* 543:193–198. [EH]
- Frachetti, M. D., R. N. Spengler, G. J. Fritz, and A. N. Mar'yashev. 2010. Earliest direct evidence for broomcorn millet and wheat in the central Eurasian Steppe region. *Antiquity* 84:993–1010. [HJ]
- Francfort, Henri-Paul, Giancarlo Ligabue, and Zainullah Samashev. 2006. The gold of the griffins: recent excavation of a frozen tomb in Kazakhstan. In *The golden deer of Eurasia: perspectives on the steppe nomads of the ancient world*. Joan Aruz, Ann Farkas and Elisabetta Valtz Fino, eds. Pp. 114–127. New York: Metropolitan Museum of Art/Yale University Press. [KSR]
- Gavriliuk, N. A. 1999. *History of economy of the steppes Scythia*. Kiev: Naukova Dumka. [In Russian]. [NK]
- Gerling, Claudia. 2015. *Prehistoric mobility and diet in the West Eurasian Steppes 3500–300 BC: an isotopic approach*. Berlin: De Gruyter.
- Golden, Peter. 2003. *Nomads and their neighbours in the Russian steppe*. Burlington: Variorum. [NK]
- . 2011a. *Central Asia in world history*. Oxford: Oxford University Press.
- . 2011b. *Studies on the peoples and cultures of the Eurasian Steppes*. Bucurest: Editura Academiei Române. [NK]
- Gong, Y., Y. Yang, D. K. Ferguson, D. Tao, W. Li, C. Wang, E. Lv, and H. Jiang. 2011. Investigation of ancient noodles, cakes, and millet at the Subeixi Site, Xinjiang, China. *Journal of Archaeological Science* 38:470–479. [HJ]
- Gorbunova, N. G. 1986. *The culture of Ancient Fergana: VI century B.C.–VI century A.D.* A. P. Andryushkin, trans. Oxford: BAR International Series.
- Gray, Vivienne. 1995. Herodotus and the rhetoric of otherness. *American Journal of Philology* 116(2):185–211.
- Grousset, René. 1970. *The empire of the steppes: history of Central Asia*. New Brunswick, NJ: Rutgers University Press.
- Gryaznov, M. 1969. *The ancient civilization of south Siberia*. London: Barrie & Jenkins.
- Hammer, E., and B. Arbuckle. 2017. 10,000 years of pastoralism in Anatolia: a review of evidence for variability in pastoral lifeways. *Nomadic Peoples* 21(2):214–267.
- Hanks, Bryan K. 2012. Mounted warfare and its sociopolitical implications. In *Nomads and networks: the ancient art and culture of Kazakhstan*. Sören Stark and Karen S. Robinson with Zainolla S. Samashev and Jennifer Y. Chi, eds. Pp. 93–105. Princeton, NJ: Institute for the Study of the Ancient World at New York University. [KSR]
- Hanks, Bryan K., and Kathryn M. Linduff, eds. 2009. *Social complexity in prehistoric Eurasia: monuments, metals, and mobility*. Cambridge: Cambridge University Press. [LMR]
- Hartog, F. 1988. *The mirror of Herodotus*. Berkeley: University of California Press.
- Haruda, A. 2018. Regional pastoral practice in central and southeastern Kazakhstan in the Final Bronze Age (1300–900 BCE). *Archaeological Research in Asia*. 15:146–156, <https://doi.org/10.1016/j.ara.2017.09.004>.
- Haruda, A. F., V. Varfolomeev, A. Goriachev, A. Yermolayeva, and A. K. Outram. 2019. A new zooarchaeological application for geometric morphometric methods: distinguishing *Ovis aries* morphotypes to address connectivity and mobility of prehistoric Central Asian pastoralists. *Journal of Archaeological Science* 107:50–57. [RB]
- Haslett, J. R. 1997. Mountain ecology: organism responses to environmental change, an introduction. *Global Ecology and Biogeography Letters* 6(1):3–6. [RB]
- Hauck, Markus, Gulzhan T. Artykbaeva, Tamara N. Zozulya, and Choimaa Dulamsuren. 2016. Pastoral livestock husbandry and rural livelihoods in the forest-steppe of east Kazakhstan. *Journal of Arid Environments* 133:102–111.
- Hayashi, Toshio. 1984. Agriculture and settlements in the Hsiung-nu. *Bulletin of the Ancient Orient Museum* 6:51–92. [NK]
- Heptner, V. G., A. A. Nasimovich, and A. G. Bannikov. 1961 (English translation 1988). *Mammals of the Soviet Union. I. Artiodactyla and Perissodactyla*. Washington, DC: Smithsonian Institution. [RB]
- Hermes, Taylor R., Michael D. Frachetti, Elissa A. Bullion, Farhod Maksudov, Samariddin Mustafokulov, and Cheryl A. Makarewicz. 2018. Urban and nomadic isotopic niches reveal dietary connectivities along Central Asia's Silk Roads. *Scientific Reports* 8(1):5177.
- Herodotus. 1920 [ca. 450 BC]. *The histories*. Cambridge, MA: Harvard University Press.
- Hiebert, F. T. 1994. *Origins of the Bronze Age oasis civilization in Central Asia*. Cambridge, MA: Harvard University Press.
- Honeychurch, William. 2015. *Inner Asia and the spatial politics of empire*. New York: Springer.
- Honeychurch, William, and Cheryl A. Makarewicz. 2016. The archaeology of pastoral nomadism. *Annual Review of Anthropology* 45:341–359. [NK]
- Houle, Jean-Luc. 2016. The killing season: ethnographic and zooarchaeological perspectives on residential mobility in Bronze Age Mongolia. In *People with animals: perspectives and studies in ethnozoarchaeology*. Lee G. Broderick, ed. Pp. 65–75. Oxford: Oxbow. [KSR]
- Hulsewé, A. P. 1979. *China in Central Asia: the early stage, 125 B.C.–A.D. 23: an annotated translation of chapters 61 and 96 of the history of the former Han Dynasty*. Leiden: Brill.
- Humphrey, Caroline, and David Sneath. 1999. *The end of nomadism? society, state, and the environment in Inner Asia*. Durham, NC: Duke University Press.
- Hüttel, H.-G., and U. Erdenebat. 2009. *Karabalgasun und Karakorum: zwei spaaatnomadische Stadtsiedlungen im Orchon-Tal*. Ulaanbaatar. [NK]
- Ingold, Tim. 1985. Khazanov on nomads: review of *Nomads and the outside world*, by Anatoly M. Khazanov. *Current Anthropology* 26:384–385.
- Jacobson-Tepfer, Esther. 2015. *The hunter, the stag, and the mother of animals: image, monument, and landscape in Ancient North Asia*. Oxford: Oxford University Press.
- Jeong, Choongwon, Shevan Wilkin, Tsend Amgalantugs, Abigail S. Bouwman, William Timothy Treal Taylor, Richard W. Hagan, Sabri Bromage, et al. 2018. Bronze Age population dynamics and the rise of dairy pastoralism on the Eastern Eurasian Steppe. *Proceedings of the National Academy of Sciences of the USA*. 115(48):E11248–E11255.
- Jia, Weiming. 2013. Report for the starch grain residue analysis of the Saensayi Cemetery. In *The Saensayi Cemetery of Xinjiang*. Pp. 224–235. Beijing: Wenwu Chubanshe [in Chinese].
- Jia, P., and A. Betts. 2010. A re-analysis of the Qiemu'erqieke (Shamirshak) Cemeteries, Xinjiang, China. *Journal of Indo-European Studies* 38:1–43.
- Jia, Peter W., Alison Betts, Dexin Cong, Xiaobing Jia, and Paula Doumani Dupuy. 2017. Adunqiaolu: new evidence for the Andronovo in Xinjiang, China. *Antiquity* 91(357):621–639.
- Jia, P. W. M., A. V. G. Betts, and Xinhua Wu. 2009. Prehistoric archaeology in the Zhunge'er (Junggar) Basin, Xinjiang China. *Journal of Eurasian Prehistory* 6:167–198.
- . 2011. New evidence for Bronze Age agricultural settlements in the Zhunge'er (Junggar). Basin, China. *Journal of Field Archaeology* 36(4):269–280.
- Jiang, H.-E., Y.-B. Zhang, X. Li, Y.-F. Yao, D. K. Ferguson, E.-G. Lu, and C.-S. Li. 2009. Evidence for early viticulture in China: proof of a grapevine (*Vitis vinifera* L., Vitaceae) in the Yanghai tombs, Xinjiang. *Journal of Archaeological Science* 36:1458–1465.
- Jiang, H., Y. Wu, H. Wang, D. K. Ferguson, and C. Li. 2013. Ancient plant use at the site of Yuerqou, Xinjiang, China: implications from desiccated and charred plant remains. *Vegetation History and Archaeobotany* 22:129–140. [HJ]
- Kerven, C., J. Channon, and R. Behnke. 1996. *Planning and policies on extensive livestock development in Central Asia* (Overseas Development Institute Working Paper 91). London: Overseas Development Institute. [RB]
- Khazanov, Anatoly. 1984. *Nomads and the outside world*. Cambridge: Cambridge University Press.

- . 1994. *Nomads and the outside world*. J. Crookenden, trans. Second ed. Madison: University of Wisconsin Press. [CC, LMR]
- . 2006. Nations and nationalism in Central Asia. In *The SAGE handbook of nations and nationalism*. Gerald Delanty and Krishan Kumar, eds. Pp. 450–460. London: SAGE.
- . 2009. Specific characteristics of Chalcolithic and Bronze Age pastoralism in the Near East. In *Nomads, tribes, and the state in the ancient Near East: cross-disciplinary perspectives*. J. Szuchman, ed. Pp. 119–127. Chicago: Oriental Institute of the University of Chicago. [LMR]
- Koryakova, Ludmila, and Andrej Vladimirovich Epimakhov. 2010. *The Urals and Western Siberia in the Bronze and Iron Ages*. Cambridge world archaeology. N. Yoffee, ed. Cambridge: Cambridge University Press. [LMR]
- Kohl, Philip L. 1998. Nationalism and archaeology: on the constructions of nations and the reconstructions of the remote past. *Annual Review of Anthropology* 27:223–246.
- Korobkova, G. F. 1981. Ancient reaping tools and their productivity in the light of experimental tracewear analysis. In *The Bronze Age civilization of Central Asia: recent Soviet discoveries*. Philip L. Kohl, ed. Pp. 350–358. New York: Sharpe.
- Koryakova, L. N. 2002. The social landscape of Central Eurasia in the Bronze and Iron Ages: tendencies, factors, and limits of transformation. In *Complex societies of Central Eurasia from the third to the first millennia BC*, vol. 1. K. Jones-Bley and G. B. Zdanovich, eds. Pp. 97–117. Washington, DC: Institute for the Study of Man.
- Kosarev, Mikhail V. 1991. *Ancient history of Western Siberia: man and environment*. Moscow: Nauka. [in Russian]. [NK]
- . 2005. From tribal confederation to empire: the evolution of the Rouran society. *Acta Orientalia Hungaricae* 58(2):149–169. [NK]
- . 2014. *Nomads of Inner Asia in transition*. Moscow: URSS.
- . 2017. Heterarchy and hierarchy among the ancient Mongolian nomads (revised version). In *Chiefdoms: yesterday and today*. R. L. Carneiro, L. E. Grinin, and A. V. Korotayev, eds. Pp. 155–176. New York: Werner. [NK]
- Kradin, Nikolay N., ed. 2018. *Towns of mediaeval empires of the Far East*. Moscow: Oriental. [in Russian]. [NK]
- Kreutzmann, Hermann. 2012. Pastoral practices in transition: animal husbandry in high Asian contexts. In *Pastoral practices in High Asia*. Agency of “development” effected by modernisation, resettlement and transformation. Advances in Asian Human-Environmental Research. Hermann Kreutzmann, ed. Pp. 1–29. Dordrecht: Springer, doi:10.1007/978-94-007-3846-1_1. [SR]
- Kuzmina, E. E. 2008. *The prehistory of the Silk Road: encounters with Asia*. Philadelphia: University of Pennsylvania Press.
- Latinin, B. A. 1958. About the southern borders of the Ecumen of the steppe cultures of the Bronze Age. *Soviet Archaeology* 3(47):46–53. [in Russian.]
- Legrand, Jacques. 2011. *Mongols et nomades: société, histoire, culture, textes, communications, articles 1973–2011*. Ulaanbaatar: Admon. [NK]
- Lhuillier, Johanna. 2016. Pottery from Burgut Kurgan and Kayrit Oasis, preliminary report for season 2015. *Studia Hercynia*. 2:112–121.
- Li, Yuqi. 2020. Agriculture and palaeoeconomy in prehistoric Xinjiang, China (3000–200 BC). *Vegetation History and Archaeobotany*. 30:287–303.
- Li, Y., M. J. Storozum, X. Wang, and W. Guo. 2017. Early irrigation and agropastoralism at Mohuchahangoukou (MGK), Xinjiang, China. *Archaeological Research in Asia* 12:23–32.
- Lightfoot, E., G. Motuzaitė Matuzevičiūtė, T. C. O’Connell, I. A. Kukushkin, V. Loman, V. Varfolomeev, X. Liu, and M. K. Jones. 2014. How “pastoral” is pastoralism? dietary diversity in Bronze Age communities in the Central Kazakhstan steppes. *Archaeometry*. 57(S1):232–249.
- Lisitsina, Gorislava N. 1981. The history of irrigation agriculture in Southern Turkmenia. In *The Bronze Age civilization of Central Asia: recent Soviet discoveries*. Philip L. Kohl, ed. Pp. 350–358. New York: Sharpe.
- Litvinsky, B. A. 1989. The ecology of ancient nomads of Soviet Central Asia and Kazakhstan. In *Ecology and empire: nomads in the cultural evolution of the Old World*. Gary Seaman, ed. Pp. 61–74. Los Angeles: Ethnographics/University of Southern California.
- Litvinsky, B. A., A. P. Oklabhikob, and V. A. Ranov. 1962. *Antiquities of Kairak-Kumov: the ancient history of northern Tajikistan*. Dushanbe: Publishing House of the Academy of Sciences of the Tajik SSR.
- Liu, X. 2010. *The Silk Road in world history*. Oxford: Oxford University Press.
- Lomolino, M. A. R. K. 2001. Elevation gradients of species-density: historical and prospective views. *Global Ecology and Biogeography* 10(1):3–13. [RB]
- Long, Tengwen, Christian Leipe, Guiyun Jin, Mayke Wagner, Rongzhen Guo, Oskar Schröder, and Pavel E. Tarasov. 2018. The early history of wheat in China from ¹⁴C dating and Bayesian chronological modelling. *Nature Plants* 4:272–279.
- Lv, E., and Y. Zhang. 2019. *Report of archaeological excavation at Yanghai Cemetery*. Beijing: Cultural Relics Press (in Chinese with English abstract). [HJ]
- Macklin, Mark G., Irina P. Panyushkina, Willem H. J. Toonen, Claudia Chang, Perry A. Tourtellotte, Geoff A. T. Duller, Hong Wang, and Maarten A. Prins. 2015. The influence of Late Pleistocene geomorphological inheritance and Holocene hydromorphic regimes on floodwater farming in the Talgar catchment, southeast Kazakhstan, Central Asia. *Quaternary Science Reviews* 129:85–95.
- Mallon, D. P. 2008. *Gazelle subgutturosa*. The IUCN Red List of Threatened Species. eT8976A12945246.
- Makarewicz, C. A. 2015. Winter is coming: seasonality of ancient pastoral nomadic practices revealed in the carbon (δ13C) and nitrogen (δ15N) isotopic record of Xiongnu caprines. *Archaeological and Anthropological Sciences* 9:405–418.
- Maksudov, F., E. A. Bullion, E. R. Henry, T. R. Hermes, A. M. Merkle, and M. D. Frachetti. 2019. Nomadic urbanism at Tashbulak: a new highland town of the Qarakhanids. In *Urban cultures of Central Asia from the Bronze Age to the Karakhanids: learnings and conclusions from new archaeological investigations and discoveries*. Vol. 12. Christoph Baumer and Mirko Novák, eds. Pp. 283–306. Wiesbaden: Harrassowitz.
- Margulan, A. 1979. *Begazy-Dandybaevskaya culture in Central Kazakhstan*. Kazakh: Science.
- Margulan, A. H., K. A. Akishev, M. K. Kadyrbaev, and A. M. Orazbaev. 1966. *Ancient cultures of Central Kazakhstan*. Nauka-Kazakstana: Alma-Ata.
- Markov, Gennedy E. 1976. *Nomads of Asia*. Moscow: Moscow State University Press. [in Russian]. [NK]
- Mar’yashev, A. N., and A. A. Goryachev. 1999. The Kulsau-type of the late and the final Bronze Age of Semirech’ye. In *History and archaeology of the Semirech’ye*. A. N. Mar’yashev, J. A. Motov, A. E. Rogochinski, and A. A. Goryachev, eds. Pp. 44–56. Almaty: Institute of Archaeology. [in Russian.]
- Masanov, Nurbulat E. 2011. *Nomadic civilization of Kazakhs*. 22nd ed. Almaty: Prins-S. [in Russian]. [NK]
- Masson, V. M., and V. I. Sarianidi. 1972. *Central Asia: Turkmenia before the Achaemenids*. R. Tringham, trans. New York: Praeger.
- Miller, B. K. Forthcoming. *Xiongnu: the world’s first nomadic empire*. Oxford: Oxford University Press.
- Miller, Naomi F., Robert N. Spengler III, and Michael Frachetti. 2016. Millet cultivation across Eurasia: origins, spread, and the influence of seasonal climate. *The Holocene* 26:1566–1575.
- Moshkova, Marina G. 1995. Middle Sarmatian culture. In *Nomads of the Eurasian Steppe in the Early Iron Age*. Jeannine Davis-Kimball, Vladimir A. Bashilov, and Leonid T. Yablonsky, eds. Pp. 137–148. Berkeley, CA: Zinat.
- Motuzaitė Matuzevičiūtė, G., A. V. Logvin, I. Shevina, A. M. Seitov, J. Feng, and L. Zhou. 2016. OSL dates for the ancient geometric earthworks of Kazakhstan. *Archaeological Research in Asia*. 7:1–9.
- Motuzaitė Matuzevičiūtė, G., R. C. Preece, S. Wang, L. Colominas, K. Ohnuma, S. Kume, A. Abdykanova, and M. K. Jones. 2015. Ecology and subsistence at the Mesolithic and Bronze Age site of Aigryzhul-2, Naryn valley, Kyrgyzstan. *Quaternary International* 437:35–49.
- Motuzaitė Matuzevičiūtė, Giedre, Kubatbek Tabaldiev, Taylor Hermes, Elina Ananyevskaya, Mindaugas Griekpedis, Elise Luneau, Inga Merkyte, and Lynne M. Rouse. 2019. High-altitude agro-pastoralism in the Kyrgyz Tien Shan: new excavations of the Chap farmstead (1065–825 cal b.c.). *Journal of Field Archaeology*, doi:10.1080/00934690.2019.1672128. [JB]
- Murphy, Eileen M., Rick Schulting, Nick Beer, Yuri Chistov, Alexey Kasparov, and Margarita Pshenitsyna. 2013. Iron Age pastoral nomadism and agriculture in the Eastern Eurasian Steppe: implications from dental palaeopathology and stable carbon and nitrogen isotopes. *Journal of Archaeological Science* 40:2547–2560.
- Myadar, Orhon. 2011. Imaginary nomads: deconstructing the representation of Mongolia as a land of nomads. *Inner Asia* 13:335–362.
- Nugent, Selin E. 2019. Pastoralism and emergent complex settlement in the Middle Bronze Age, Azerbaijan: isotopic analyses of mobility strategies in transformation. *American Journal of Physical Anthropology* 171(1):120–141. [KSR]
- Nurmukhanbetov, B., and G. R. Mukhtarova. 2011. Burial ground Issyk—necropolis Issyk—archaeological complex Esik-Rakhat—republican state historical-cultural reserve-museum “Issyk”: Saka culture of Saryarka in the context of studying ethno-sociocultural processes of steppe Eurasia. Pp. 54–57. Karaganda: Technology of Imaging.
- Nurmukhanbetov, B. N., G. A. Akhatov, and A. Zh. Bermagambetov. 2005. Archaeological researches in Issyk burial ground: report on archaeological

- researches in 2004 on the state program "Cultural heritage." Pp 17–18. Almaty: Almaty.
- Otchir-Goryaeva, Mariya A. 2012. *Ancient horsemen of the Eurasian Steppe*. Moscow: Taus. [In Russian]. [SR]
- P'yankova, L. T. 1994. Central Asia in the Bronze Age: sedentary and nomadic cultures. *Antiquity* 68:355–372.
- Park, Hogeun, Peilei Fan, Ranjeet John, and Jiquan Chen. 2017. Urbanization on the Mongolian Plateau after economic reform: changes and causes. *Applied Geography* 86(2017):118–127.
- Parzinger, Hermann. 2006. *Die Frühen Völker Eurasiens*. Munich: Beck. [LMR]
- Parzinger, Hermann, and Nikolaus Boroffka. 2003. *Das Zinn der Bronzezeit in Mitteleuropa 1: die siedlungarchäologischen Forschungen im Umfeld der Zinnlagerstätten*. (Archäologie in Iran und Turan 5). Mainz, Germany: von Zabern. [JB]
- Parzinger, Hermann, Viktor Zajbert, Anatoli Nagler, and Alexander Plešakov. 2003. *Der große Kurgan von Bajkara: Studien zu einem skythischen Heiligtum*. Archäologie in Eurasien, vol. 16. Mainz, Germany: von Zabern.
- Paul, Jürgen. 2013. Nomads in history. In *Nomad aristocrats in a world of empires*. Jürgen Paul, ed. Pp. 17–22. Nomaden und Sesshafte 17 Wiesbaden: Reichert. [JB]
- Peake, Harold, and Herbert John Fleure. 1928. *The steppe and the sown*. New Haven, CT: Yale University Press.
- Pletneva, Svetlana A. 1982. *The mediaeval nomads*. Moscow: Nauka. [In Russian]. [NK]
- Potts, Daniel. 2014. *Nomadism in Iran: from antiquity to the modern era*. Oxford: Oxford University Press.
- Rachewiltz, Igor de. 2004. *The secret history of the Mongols. A Mongolian epic chronicle of the thirteenth century*, vols. 1–2. Leiden: Brill. [NK]
- Razzokov, A. 2008. *Sarazm*. Dushanbe: Institute of History, Archaeology, and Ethnography of the Academy of Sciences of Tajikistan.
- Robinson, S., C. Kerven, R. Behnke, K. Kushenov, and E. J. Milner-Gulland. 2017. Pastoralists as optimal foragers? reoccupation and site selection in the deserts of post-Soviet Kazakhstan. *Human Ecology* 45(1):5–21.
- Rogers, J. Daniel. 2015. Empire dynamics and Inner Asia. In *The complexity of interaction along the Eurasian Steppe Zone in the first millennium CE*. J. Bemmann and M. Schmauder, eds. Pp. 73–88. Bonn: Bonn University Press. [LMR]
- . 2017. Inner Asian polities and their built environment. *Archaeological Research in Asia* 11:1–14.
- Rosen, A. M., C. Chang, and F. P. Grigoriev. 2000. Paleoenvironments and economy of Iron Age Saka-Wusun agropastoralists in Southeastern Kazakhstan. *Antiquity* 74:611–623.
- Rouse, Lynne M. 2020. Silent partners: archaeological insights on mobility, interaction, and civilization in Central Asia's past. *Central Asian Survey* 39(3):398–419. [LMR]
- Rouse, Lynne M., and Barbara Cerasetti. 2014. Ojakly: a late Bronze Age mobile pastoralist site in the Murghab Region, Turkmenistan. *Journal of Field Archaeology* 39(1):32–50.
- . 2018. Mixing metaphors: sedentary-mobile interactions and local-global connections in prehistoric Turkmenistan. *Antiquity* 92(363):674–689.
- Rouse, L. M., K. M. Grillo, R. Piermartiri, E. Rotondaro, H. Cogo-Moreira, G. M. Bargossi, and B. Cerasetti. 2019. Not just "nomadic jars": the Late Bronze Age ceramic assemblage from the mobile pastoralist site of Ojakly, Murghab region, Turkmenistan. *Archaeological Research in Asia* 18:100–119.
- Rösch, M., E. Fischer, T. Märkle, and B. Oyuntuya. 2010. Medieval plant remains from Karakorum, Mongolia. In *Forschungen zur Archäologie Außereuropäischer Kulturen (Mongolian-German Karakorum Expedition)*. Jan Bemmann, Ulambayar Erdenebat, and Ernst Pohl, eds. Pp. 219–251. Bonn: Bonn Contributions to Asian Archaeology.
- Rubinson, Karen S. 2003. "Animal style" art and the image of the horse and rider. In *Èrân ud Anērân: studies presented to Boris Il'ich Maršak on the occasion of his 70th birthday*. Matteo Compareti, Paola Raffetta, and Gianroberto Scarcia, eds. Pp. 533–542. Venice: Cafoscara. [KSR]
- . 2012. Burial practices and social roles of Iron Age mobile pastoralists. In *Nomads and networks: the ancient art and culture of Kazakhstan*. Sören Stark, Karen S. Robinson, Zainolla S. Samashev, and Jennifer Y. Chi, eds. Pp. 77–90. Princeton, NJ: Institute for the Study of the Ancient World at New York University. [KSR]
- Rudenko, S. I. 1970. *Frozen tombs of Siberia: the Pazyryk burials of Iron Age horsemen*. M. W. Thompson, trans. Berkeley, CA: University of California Press.
- Salzman, P. C. 1972. Multi-resource nomadism in Iranian Baluchistan. In *Perspectives on nomadism*. W. Irons and N. Dyson-Hudson, eds. Pp. 60–68. Leiden: Brill.
- . 2004. *Pastoralists: equality, hierarchy, and the state*. Boulder, CO: Westview.
- Samashev, Z. 2012. The Berel kurgans: some results of investigations. In *Nomads and networks: the ancient art and culture of Kazakhstan*. S. Stark, K. S. Robinson, Z. Samashev, and J. Y. Chi, eds. Pp. 30–49. Princeton, NJ: Princeton University Press.
- Samashev, Z., S. Murgabaev, E. Oralbay, and E. Karev. 2012. New petroglyphs of Karatay and Tarbagatay. In *Proceedings of the branch of the A. Kh. Margulan Institute of Archeology in Astana*. Pp. 79–95. Astana, Kazakhstan: A. Kh. Margulan Institute of Archeology. [In Russian.]
- Schmaus, Tekla M., Claudia Chang, and Perry A. Tourtellotte. 2018. A model for pastoral mobility in Iron Age Kazakhstan. *Journal of Archaeological Science Reports* 17:137–143.
- Schmaus, Tekla M., P. N. Doumani Dupuy, and M. D. Frachetti. 2020. Variability in seasonal mobility patterns in Bronze and Iron Age Kazakhstan through cementum analysis. *Quaternary International* 545:102–110.
- Shishlina, Natalia M., and Fredrik T. Hiebert. 1998. The steppe and the sown: interactions between Bronze Age Eurasian nomads and agriculturalists. In *The Bronze Age and Early Iron Age peoples of Eastern Central Asia*. V. H. Mair, ed. Pp. 222–237. Washington DC: Institute for the Study of Man [LMR]
- Shulga, Petr. 2010. Xinjiang in the VIII–III centuries BC (sepulchral complexes, chronology and periodization). Barnaul: AltSTU. [In Russian]. [SR]
- . 2012. On ancient farming in the Altai mountains. In *Cultures of the Eurasian Steppe and their interaction with the ancient civilisations: materials of the international scientific conference dedicated to the 110th anniversary of the outstanding Russian archaeologist M. P. Gryaznov*, Vol. 2. Pp. 242–248. Saint Petersburg: Perifeiya. [In Russian]. [SR]
- Sima Qian, 1959. *Shiji [Records of the historian]*. Beijing: Zhonghua shuju.
- Simpson, S. J., and S. Pankova, eds. 2017. *The BP exhibition: Scythians: warriors of ancient Siberia*. London: Thames & Hudson.
- Sneath, D. 2007. *The headless state: aristocratic orders, kinship society, and misrepresentations of nomadic Inner Asia*. New York: Columbia University Press.
- Spengler III, Robert N. 2015. Agriculture in the Central Asian Bronze Age. *Journal of World Prehistory* 28(3):215–253.
- . 2019. *Fruit of the sands: Silk Road origins of the food we eat*. Berkeley: University of California Press.
- Spengler III, Robert N., Claudia Chang, and Perry A. Tourtellotte. 2013. Agricultural production in the Central Asian mountains: Tuzusai, Kazakhstan (410–150 BC). *Journal of Field Archaeology* 38(1):68–85.
- Spengler III, Robert N., Paula Doumani, and Michael Frachetti. 2014. Agriculture in the Piedmont of Eastern Central Asia: the Late Bronze Age at Tasbas, Kazakhstan. *Quaternary International* 348:147–157.
- Spengler III, Robert N., M. D. Frachetti, P. N. Doumani, L. M. Rouse, B. Cerasetti, E. Bullion, and A. N. Mar'yashev. 2014. Early agriculture and crop transmission among Bronze Age mobile pastoralists of Central Eurasia. *Proceedings of the Royal Society B* 281:2013382.
- Spengler III, Robert N., Naomi F. Miller, Reinder Neef, Perry A. Tourtellotte, and Claudia Chang. 2017. Linking agriculture and exchange to social developments of the Central Asian Iron Age. *Journal of Anthropological Archaeology* 48:295–308.
- Spengler III, Robert N., Natalia Ryabogina, Pavel Tarasov, and Mayke Wagner. 2016. The spread of agriculture into Northern Asia. *The Holocene* 26:1527–1540.
- Stark, Sören. 2012. Nomads and networks: elites and their connections to the outside world. In *Nomads and networks: the ancient art and culture of Kazakhstan*. Sören Stark, Karen S. Robinson, Zainolla S. Samashev, and Jennifer Y. Chi, eds. Pp. 107–138. Princeton, NJ: Institute for the Study of the Ancient World at New York University. [KSR]
- Steinhadt, Nancy. 1997. *Liao architecture*. Honolulu: University Hawaii Press. [NK]
- Stöllner, Thomas, Zeinolla Samashev, Sergej Berdenov, Jan Cierny, Monika Doll, Jennifer Garner, Anton Gontscharov, et al. 2011. Tin from Kazakhstan-Steppe tin for the West? Ü. Yalçın, ed. Pp. 231–252. Bochum: Deutsches Bergbau-Museum. [JB]
- Strabo. 1924 [7 BC–AD 23]. *The geography of Strabo*. Cambridge, MA: Harvard University Press.
- Svyatko, Svetlana V., Rick J. Schulting, James Mallory, Eileen M. Murphy, Paula J. Reimer, Valeriy I. Khartanovich, Yuri K. Chistov, and Mikhail V. Sablin. 2013. Stable isotope dietary analysis of prehistoric populations from

- the Minusinsk Basin, Southern Siberia, Russia. *Journal of Archaeological Science* 40(11):3936–3945.
- Taylor, William, Svetlana Shnaider, Aida Abdykanova, Antoine Fages, Frido Welker, Franziska Irmer, Andaine Seguin-Orlando, et al. 2018a. Early pastoral economies along the Ancient Silk Road: biomolecular evidence from the Alay Valley, Kyrgyzstan. *PLoS ONE* 13(10):e0205646.
- Taylor, William Timothy Treal, Burentogtokh Jargalan, K. Bryce Lowry, Julia Clark, Tumurbaatar Tuvshinjargal, and Jamsranjav Bayarsaikhan. 2018b. A Bayesian chronology for early domestic horse use in the Eastern Steppe. *Journal of Archaeological Science* 81:49–58.
- Taylor, William, Juan Wang, and Isaac Hart. 2020. Understanding the pre-history of domestic animals in East and Central Asia through scientific archaeozoology. *Journal of Archaeological Science: Reports* 32:102397.
- Tapper, Richard. 1997. Frontier nomads of Iran: a political and social history of the Shahsevan. Cambridge Middle East studies, 7. Cambridge: Cambridge University Press. [EH].
- Tkachev, Valentin N. 2009. *History of Mongolian architecture*. Moscow: ASV. [In Russian]. [NK]
- Vainshtein, Sevyar. 1980. *Nomads of South Siberia: the pastoral economies of Tuva*. Cambridge: Cambridge University Press.
- Varfolomeev, Victor. 2011. Kent: the city of the Bronze Age. In *New research in the era of independence/witness the millennia: archaeological science in Kazakhstan for the past 20 years (1991–2011)*. Pp. 85–97. Almaty: Kazakh Research Institute.
- Ventresca Miller, A. R., A. Haruda, V. Varfolomeev, A. Goryachev, and C. A. Makarewicz. 2020a. Close management of sheep in ancient Central Asia: evidence for foddering, transhumance, and extended lambing seasons during the Bronze and Iron Ages. *Science and Technology of Archaeological Research* 6(1):41–60.
- Ventresca Miller, A. R., and C. Makarewicz. 2019. Intensification in pastoralist cereal use coincides with the expansion of trans-regional networks in the Eurasian Steppe. *Nature: Scientific Reports* 9:8363.
- Ventresca Miller, A., C. Schuh, E. R. Usmanova, A. Logvin, I. Shevnina, and C. Makarewicz. 2018. Pastoralist mobility in Bronze Age landscapes of Northern Kazakhstan: 87Sr/86Sr and $\delta^{18}\text{O}$ analyses of human dentition from Bestamak and Lisakovsk. *Environmental Archaeology* 23(4):352–366.
- Ventresca Miller, A. R., R. Spengler, A. Haruda, B. Miller, S. Wilkin, A. Robinson, P. Roberts, and N. Boivin. 2020b. Ecosystem engineering among ancient pastoralists in northern Central Asia. *Frontiers in Earth Science* 8:168–179.
- Ventresca Miller, Alicia, Emma Usmanova, Viktor Logvin, Saule Kalieva, Irina Shevnina, Andrei Logvin, et al. 2014a. Subsistence and social change in central Eurasia: stable isotope analysis of populations spanning the Bronze Age transition. *Journal of Archaeological Science* 42:525–538.
- Ventresca Miller, A., E. R. Usmanova, I. Shevnina, A. Logvin, and A. Kolbina. 2014b. Dental health, diet, and social transformations in the Bronze Age: comparative analysis of pastoral populations in northern Kazakhstan. Special Issue, The Bridging Eurasia Research Initiative: modes of mobility and sustainability in the palaeoenvironmental and archaeological archives from Eurasia. *Quaternary International* 348:130–146.
- Vinogradova, N. M., and E. E. Kuz'mina. 1996. Contacts between the steppe and agricultural tribes of Central Asia in the Bronze Age. *Anthropology and Archeology of Eurasia* 34:29–54.
- Wang, T., D. Wei, X. Chang, Z. Yu, X. Zhang, C. Wang, Y. Hu, and B. T. Fuller. 2019. Tianshanbeilu and the isotopic millet road: reviewing the late Neolithic/Bronze Age radiation of human millet consumption from north China to Europe. *National Science Review* 6:1024–1039. [HJ]
- Wang, J., and L. Xi. 2009. Nomadic culture and settlement archaeology of the eastern Tianshan Mountain region. *Archaeology* 1:28–37. (In Chinese with English abstract). [HJ]
- Wang, Jianxin, Zhang Feng Zhang, Ren Meng Ren, Zhang Yuzhong Zhang, Taiwur Yakupian Fatkulla, and Yu Jianjun Yu. 2010. Results of the 2006 and 2007 excavations at the Dongheigou Site, Balikun County, Autonomous Region of Uygur Xinjiang. In *Bridging Eurasia*. Mayke Wagner and Wang Wei, eds. Pp. 145–186. Mainz, Germany: von Zabern.
- Wilkin, Shevan, William Taylor, Alicia Ventresca Miller, Bryan K. Miller, Richard Hagan, Franziska Irmer, Madeleine Bleasdale, et al. 2020a. Dairy pastoralism sustained Eastern Steppe populations for 5000 years. *Nature Ecology and Evolution* 4:346–355.
- Wilkin, Shevan, Tumurbaatar Tuvshinjargal, Alicia Ventresca Miller, Bryan K. Miller, Robert N. Spengler III, William Taylor, Ricardo Fernandes, et al. 2020b. Economic diversification supported the growth of Mongolia's Nomadic Empires. *Scientific Reports* 10:3916.
- Wilkens, Shevan. 2015. Staple economies and social integration in Northeast China. PhD dissertation, University of Pittsburgh, Pittsburgh, PA.
- Wittfogel, K. A., and Feng Chia-Sheng. 1949. *History of Chinese society. Liao (907–1125)*. Philadelphia: Transactions of the American Philosophical Society, n. s, 36. [NK]
- Wright, Joshua. 2007. Organizational principles of Khirigsuur monuments in the Lower Egiin Gol Valley. *Mongolia Journal of Anthropological Archaeology* 26:350–365.
- . 2016. Households without houses: mobility and mooring on the Eurasian Steppe. *Journal of Anthropological Research* 72(2):133–157.
- Wright, J., W. Honeychurch, and C. Amartuvshin. 2009. The Xiongnu settlements of Egiin Gol, Mongolia. *Antiquity* 83:372–387. [NK]
- Xinjiang Wenwu Kaogu Yanjiusuo, and Xibei Daxue wenhua yichan yu kaoguxue yanjiu zhongxin. 2009. Brief report on the 2006–2007 excavations of remains at Dongheigou, Balikun, Xinjiang. *Kaogu* 1:3–27.
- Xinjiang Wenwu Kaogu Yanjiusuo, and Tulufan Diqiu Bowuguan. 2002. The Subei settlement and cemetery in Shanshan, Xinjiang. *Kaogu* 6:42–57.
- Yablonsky, Leonid T. 1995. Written sources and the history of archaeological studies of the Saka in Central Asia. In *Nomads of the Eurasian Steppe in the Early Iron Age*. Jeannine Davis-Kimball, Vladimir A. Bashilov, and Leonid T. Yablonsky, eds. Pp. 193–200. Berkeley, CA: Zinat.
- Yang, R., Y. Yang, W. Li, Y. Aburesule, X. Hu, C. Wang, and H. Jiang. 2014. Investigation of cereal remains at the Xiaohe Cemetery in Xinjiang, China. *Journal of Archaeological Science* 49:42–47.
- Yu, Xifeng. 1999. Chawuhu Wenhua muzang chutu taorongqi nei cancun shiwu de yanjiu jian ding [Identification of the food residue in the pottery vessel unearthed from the Chawuhu Culture burials]. In *Daxing shizhu mudi fajue baogao* [The Chawuhu site in Xinjiang: excavation report of a large clan cemetery]. Xinjiang Wenwu Kaogu Yanjiusuo and Xinjiang Chawuhu, eds. Pp. 413–415. Beijing: Dongfang Chubanshe.
- Zadneprovsky, Yu. A. 1962. Ancient Farming Culture of Fergana. Moscow: Academy of Sciences of the USSR Institute of Archeology. [In Russian.]
- Zhang, G., Y. Wang, M. Spate, S. Wang, and H. Jiang. 2019. Investigation of the diverse plant uses at the South Aisikexiaer Cemetery (~2700–2400 years BP) in the Hami Basin of Xinjiang, Northwest China. *Archaeological and Anthropological Sciences* 11:699–711. [HJ]
- Zhang, Jianping, Houyuan Lu, Peter Weiming Jia, Rowan Flad, Naiqin Wu, and Alison Betts. 2017. Cultivation strategies at the ancient Luanzagangzi settlement on the easternmost Eurasian Steppe during the late Bronze Age. *Vegetation History and Archaeobotany* 26(5):505–512.
- Zhao, Keliang, Xiaoqiang Li, Xinying Zhou, John Dodson, and Ming Ji. 2013. Impact of agriculture on an oasis landscape during the late Holocene: palynological evidence from the Xintala site in Xinjiang, NW China. *Quaternary International* 311:81–86.
- Zhou, Xinying, Jianjun Yu, Hui Shen, Keliang Zhao, Ge Junyi, Yige Bao, Junchi Liu, Qingjiang Yang, Robert N. Spengler III, and Xiaoqiang Li. 2020. Redating the Trans-Eurasian crop exchange: 5200-year-old cereal grains from the eastern Altai Mountains. *Nature Plants* 6:78–87.