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A Bayesian chronology for early domestic horse use in the Eastern Steppe

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ABSTRACT

Archaeological horse remains from Mongolia's late Bronze Age Deer Stone-Khirigsuur (DSK) culture present some of the oldest direct radiocarbon dates for horses in northeast Asia, hinting at an important link between late Bronze Age social developments and the adoption or innovation of horse transport in the region. However, wide error ranges and imprecision associated with calibrated radiocarbon dates obscure the chronology of early domestic horse use in Mongolia and make it difficult to evaluate the role of processes like environmental change, economic interactions, or technological development in the formation of mobile pastoral societies. Using a large sample of new and published radiocarbon dates, this study presents a Bayesian chronological model for the initiation of domestic horse sacrifice at DSK culture sites in Mongolia. Results reveal the rapid spread of horse ritual over a large portion of the Eastern Steppe circa 1200 BCE, concurrent with the first appearance of draught horses in China during the late Shang dynasty. These results suggest that key late Bronze Age cultural transformations – specifically the adoption of mobile pastoralism and early horseback riding – took place during a period of climate amelioration, and may be linked to the expansion of horses into other areas of East Asia.

1. Introduction

Researchers studying eastern Eurasia have considered a wide range of potential processes to explain the formation of mobile pastoral groups in the region. Models prioritizing the causative role of sedentary agricultural societies have greatly influenced academic discourse (e.g. Chang and Koster, 1986:105; Lattimore, 1940:58–61; Lees and Bates, 1974). However, recent years several detailed regional studies indicate that across most of the eastern Eurasian steppe, hunting and gathering directly preceded the first herding groups, with little influence from sedentary states (e.g. Clark, 2014:26; Frachetti, 2008:20–21; Janz, 2012:185; Wright, 2006:285). Other models for nomadic origins prioritize the negative pressures of climate deterioration or resource scarcity (Kradin, 2015:75). For example, Khazanov (1984:93) linked the development of highly mobile nomadic societies in eastern Eurasia with a prolonged period of drought and climate deterioration – which he argues would have prompted herders to seek new ways to subsist in a more challenging environment. The innovation or adoption of horseback riding has also been connected with the emergence of migratory herding societies in interior Asia during the late Bronze and early Iron Age (e.g. Beardsley, 1953). However, as these different social, technological and environmental processes took place at different times and scales in prehistoric Eurasia, assessing the relationship between horseback riding, incipient mobile pastoralism, and other hypothesized causes requires a precise and reliable chronological framework for domestic horse use.

1.1. The horse in pastoral societies

Horses provide critical subsistence advantages in arid and cold environments that may have made them particularly valuable to early pastoral groups in eastern Eurasia. From their initial

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domestication in western Central Asia ca. 3500 BCE, horses provided meat, milk and secondary products (Olsen, 2006; Outram et al., 2009) that may have been essential to the success of pastoral peoples, along with important vitamins and nutrients that are rare in other domestic livestock (Levine, 1998:94). Horses can subsist on lower quality forage than other ruminants (Mitchell, 2015:43–44), and are able to use their hooves to access winter pastures that have been frozen or crusted over, improving herd survival for co-pastured livestock (Anthony and Brown, 2011). For these reasons, some have suggested that domestic horses were essential to the development of Inner Asian pastoralism during the late Holocene (Beardsley 1953; Levine, 1998).

Beyond their function as a basic livestock animal, horses also had key implications for nomadic life as a form of transport. The movement of any given herd is limited in some respects by the speed of its slowest animal, but horseback riders can move 2–3 times as far per day as those moving on foot alone (Anthony et al., 1991).The increased efficiency of movement provided by mounted riding more than doubles the number of sheep that can be effectively controlled by a single herder working with dogs (Anthony et al., 2006:149). Improved travel speed would have enabled pastoralists to tend larger herds at farther distances from camp, much as it did among reindeer herders of northern Finland following the introduction of the snowmobile (Müller-Wille and Pelto, 1971). In the Mongolian steppe, where rain is highly seasonal and pastures are easily overgrazed, the added efficiency of movement and herd control might have dramatically expanded the scale of viable herding activities. Consequently, characterizing the chronology horse transport is fundamental to an understanding of pastoral herding in eastern Eurasia.

1.2. Horse use and early pastoralism in Mongolia

While the specific chronology of pastoralism in Mongolia remains ambiguous, a variety of archaeological evidence indicates that mobile herding groups flourished in the region during the late Bronze Age. In some areas of Mongolia, people practiced mixed hunting, agriculture, and perhaps domestic livestock breeding as far back as the Neolithic (Allard and Erdenebaatar, 2005:547-8; Honeychurch, 2015:110). Burials containing possibly domestic livestock and linked with a pastoral economy, such as those of the Afanasievo and Chemurchek cultures, have been found in some regions of Mongolia as early as the third millennium BCE (Eregzen, 2016:18–49; Janz et al., 2017:54–56; Kovalev and Erdenebaatar, 2010), suggesting that pastoral lifeways in the region could have great antiquity.

Nonetheless, a variety of important social transformations related to mobile herding appear to have occurred towards the end of the second millennium BCE (Allard and Erdenebaatar, 2005:548; Honeychurch, 2015:110). At this time, large kurgan-like mounds known as *khirigsuurs*, sometimes accompanied by anthropomorphic *deer stones* – tall standing stones decorated with weapons, tools, and often elaborate deer images were first constructed across the steppes of Mongolia, southern Tuva, eastern Kazakhstan, and northern Xinjiang (Bayarsaikhan, 2016; Fitzhugh, 2009:185; Volkov, 2002 [1981]). Together, these two types of monument are referred to as the Deer Stone-Khirigsuur (DSK) Complex (Fitzhugh, 2009). Faunal remains from a handful of late Bronze Age campsites indicate that DSK people had a dietary reliance on domestic sheep, goat, and cattle (Clark, 2014; Houle, 2010), and settlement studies suggest that DSK people built only ephemeral residential structures (Allard et al., 2007; Houle, 2010).

Small stone ritual structures surrounding deer stones and *khirigsuurs*, hereafter referred to as 'satellite' features, yield important insights into how animals were used in DSK society. At many DSK sites, stone circles containing charcoal and calcined bone fragments of sheep/goat and cattle are found around the monument perimeter, and attest to ritual burning and consumption of livestock like sheep/goat and cattle (Broderick et al., 2014). Significantly, inhumations of horse skulls, hooves, and neck bones, oriented to face east, are also found around the perimeter of DSK sites (Allard and Erdenebaatar, 2005; Fitzhugh, 2009). Skeletal remains from these partial horse burials provide insights into how the animals were used. Characteristic osteological changes to the skull indicate that many of these horses were bridled and heavily exerted, while demographic data from dentition suggest that adult male animals were buried in prominent ritual locations (Taylor et al., 2015; Taylor, 2016). Together, these data suggest an increasingly important role for horses in DSK society, concurrent with the adoption of mobile herding lifeways.

By at least the second millennium BCE, horse-drawn vehicles were employed in the western Central Asian steppes, likely by semi-nomadic, agropastoral people who may have practiced seasonal migrations (Khazanov 1984:93–94). Such vehicles may also have played an important role in Bronze Age life in Mongolia, as evidenced by a large corpus of petroglyphs showing 'chariots' (horses pulling wheeled vehicles) found on Mongolian rock art panels, and variously attributed to the 3rd through the 1st millennium BCE (Erdene-Ochir and Khodyakov, 2016: 23–30). By ca. 1200 BCE, horses and these light horse carts reached central China, appearing in oracle bone records and elite burials at the site of Yinxu in Henan province (Kelekna, 2009).

Other archaeological data demonstrate the emergence of mounted horseback riding during the late Bronze Age, prior to most estimates for the end of the DSK period (ca. 700 BCE, Fitzhugh, 2009). Horse tack convincingly linked to mounted riding was interred in the kurgan of Arzhan I, dating to ca. 800 BCE, and similar finds from sites of the "slab burial" culture in Mongolia (Honeychurch et al., 2009: 347). These dates also correspond closely to the first historical mentions of mounted warriors in classical histories from western Eurasia (Argent, 2011:31). If, as some suggest, nomadic peoples were among the first to adopt mounted riding (Mair, 2003:181), the emergence of horsemanship in East Asia must have occurred in the preceding decades or centuries – concurrent with the construction of deer stones and *khirigsuurs.*

1.3. DSK horse use in chronological context

Due to challenges with monument dating and aggregation, however, the exact relationships between the DSK complex, changes in horse transport, and processes of social or environmental change are difficult to distinguish. Although horse burials can be found in mounds surrounding both deer stones and *khirigsuurs,* the earliest deer stones appear to postdate the earliest *khirigsuurs* by at least a century (Fitzhugh, 2009:189; Honeychurch, 2015:117). Consequently, viable estimates for incipient horse use in DSK culture may fall across a relatively wide interval, between ca. 1500-1200 BCE (e.g. Fitzhugh, 2009; Honeychurch, 2015:112–121). The precise timing of DSK horse use within this interval has critical implications for the role of environmental change in early mobile pastoralism. For example, one influential hypothesis links the development of East Asian mobile herding societies with a prolonged period of drought during the second millennium BCE (Khazanov 1984). Some recent paleoclimate research appears to corroborate the existence of such an event on northern Mongolian plateau (Feng et al., 2013; Propokenko et al., 2007; Wang et al., 2011), but the wide range of estimates for DSK cultural activity makes it impossible to assess the impacts of this drought on DSK lifeways with any accuracy.