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Short communication

Revisiting the emergence of pastoralism in the Altai Mountains through interactions between local hunter-gatherer and Afanasievo communities

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ABSTRACT

The Altai Mountains represent a critical region for the earliest trans-Eurasian dispersals of bovid domesticates. However, settlement data from Altaic hunter-gatherer communities and incoming pastoralists remain rare, which precludes understanding the subsistence transitions and associated cultural dynamics underlying the spread of pastoralism to Inner Asia. Here, we report new radiocarbon dates and analysis of archaeological deposits, suggesting previously unrecognized inter-community interactions in the Altai Mountains. We have launched the Rise of Altai Mountain Pastoralism Project (RAMPP) to examine the emergence of livestock herding in the Russian Altai by focusing on new excavations and biomolecular methods on ancient faunal remains.

1. Introduction

One of the most important archaeological phenomena underlying the spread of domesticated sheep, goats, and cattle to Inner Asia and beyond is the Afanasievo cultural horizon (ca. 3300–2500 BCE) – believed by scholars to have emerged after "western steppe" migrants reached the Altai Mountains (Narasimhan et al., 2019; Poliakov et al., 2019; Stepanova, 2012). Newcomers to the region may have sparked complex cultural interactions and subsistence transformations, perhaps displacing hunter-gatherer societies. However, fragmentary information about ancient Altaic hunter-gatherers obscures how local groups embraced or rejected domesticates and new bio-cultural logics (e.g., dairying and wool technology). Diverse ideas from archaeologists about the emergence of the Afanasievo culture and its decline can be found in the Russian literature (e.g., Abdulganeev et al., 1982; Gryaznov and Vadetskaya, 1968; Kiryushin and Kiryushin, 2005; Molodin, 2002; Pogozheva, 2006; Tsyb, 1984; Vadetskaya, 1986), but this wide range of thinking on the topic remains relatively unknown to the global archaeological community. The possibility of indigenous Neolithic communities in the Altai influencing the development of the Afanasievo culture through social interactions with incoming "western steppe herders" remains the only plausible theory of those downplaying the migration hypothesis. Human paleogenomic research supports a substantial movement of people from the western steppes to the Altai region during the mid-late fourth millennium BCE (Allentoft et al., 2015; de Damgaard et al., 2018; Haak et al., 2015; Jeong et al., 2020; Mathieson et al., 2015; Narasimhan et al., 2019; Wang et al., 2021).

We aim to understand the cultural mosaic from which herding transitions unfolded in the Altai Mountains as local communities encountered new people and technologies. Here, we report new radiocarbon dates and analyses of material culture from the stratified Ust'-Biyke-I site to help establish the chronology and behavioral variability of mid to late Holocene Altaic hunter-gatherers (Fig. 1). We contextualize these results to our forthcoming research at the Afanasievo settlement Nizhnyaya Sooru and on the paleogenomics of domesticated sheep in the Altai and neighboring regions, under the aegis of the recently started Rise of Altai Mountain Pastoralism Project (RAMPP).

2. Ust'-Biyke-I: a key hunter-gatherer site

Located along the Biyke river in the Katun' river basin in the Altai Republic (Russia) (Fig. 1), Ust'-Biyke-I was first documented by pedestrian survey in 1989 (Kungurov and Tishkin, 1993). In 1996, V.P. Semibratov led a team that opened an 8 × 2 m trench and identified six

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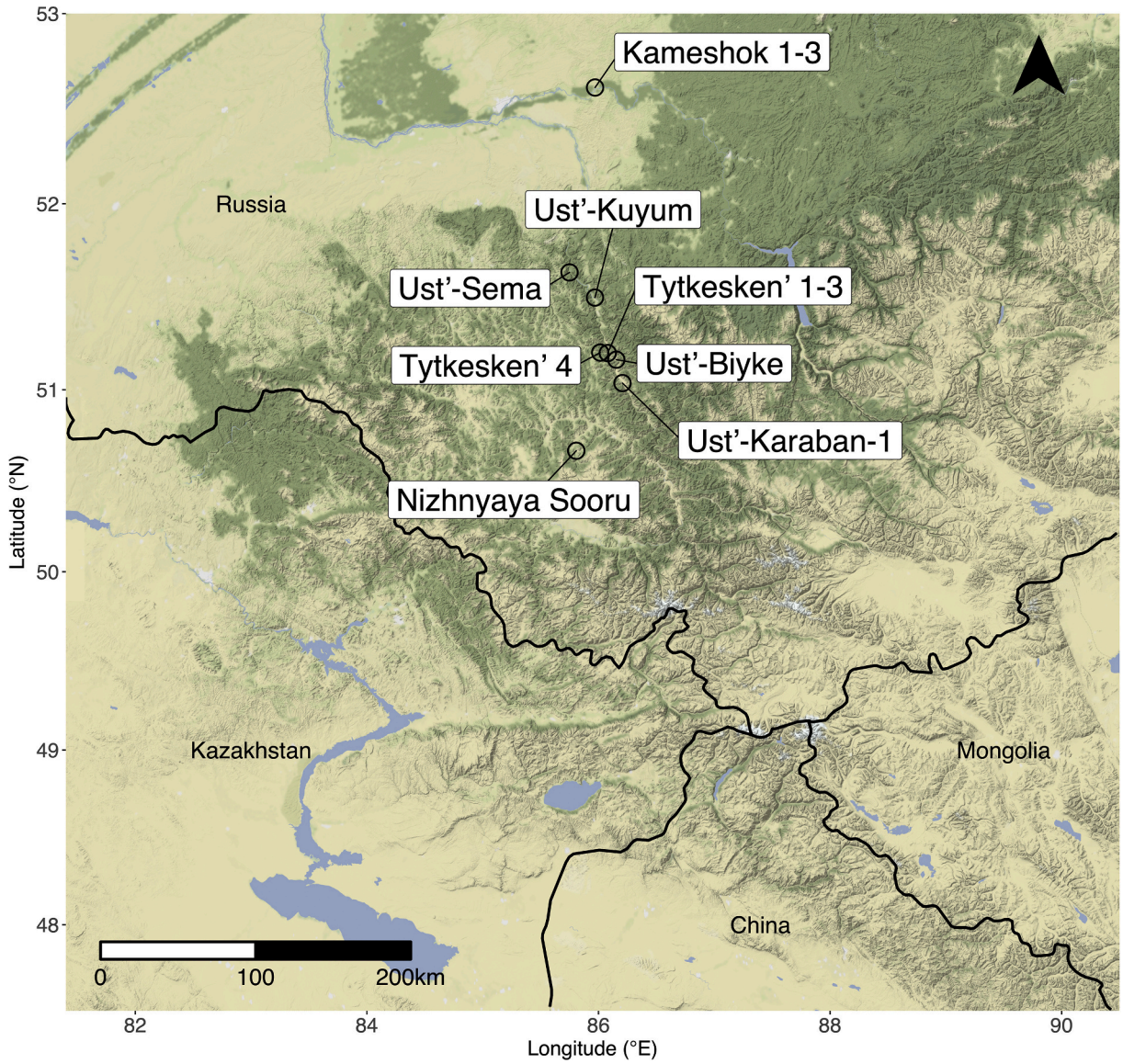

Fig. 1. Map of the Altai Mountains showing mentioned sites. Map tiles by stamen Design, under CC BY 3.0. Data by OpenStreetMap, under ODbL. R code and site locations available at https://github.com/trhermes/Ust-Biyke-R-Map.

stratigraphic layers (Table 1), documenting a substantial time depth of hunter-gatherer occupations, followed by cultural deposits linked to early herders in the region (Semibratov and Majchikov, 1997). The upper portion of Layer 2 yielded 25 ceramic fragments broadly exhibiting decorative styles and technological attributes of both Neolithic hunter-gatherers and Eneolithic Afanasievo communities (Fig. 2) (Semibratov and Stepanova, 2006). An absence of stratigraphic separation within Layer 2 between cultural deposits containing ceramics and those below exclusively containing lithics was likely due to substantial bioturbation caused by burrowing rodents. Moreover, the fact that Layer

Table 1
Stratigraphic layers identified at Ust'-Biyke.

Stratigraphic layer	Depth (m)	Description	Cultural material
1	0–0.1	Turf	None
2	0.1–0.45	Dark humus sediment containing limestone debris. Numerous rodent burrows were present in lower portion of the layer that imparted an irregular boundary.	The upper portion of the layer contained ceramic sherds likely associated with the Afanasievo culture. The bottom portion of the layer contained lithics associated with the Mesolithic.
3	0.45–0.53	Grey sandy loam with carbonized organic material. The lower boundary was discrete.	None
4	0.53–0.65	Carbonized brown sandy loam with ash. The lower boundary was irregular.	Lithics associated with the Mesolithic. The human remains were recovered from this layer.
5	0.65–0.85	Light-grey sandy loam, not carbonized. The lower boundary was discrete.	None
6	0.85–2.20	Sand	None. The bottom of the human burial pit reached the upper portion of this layer.

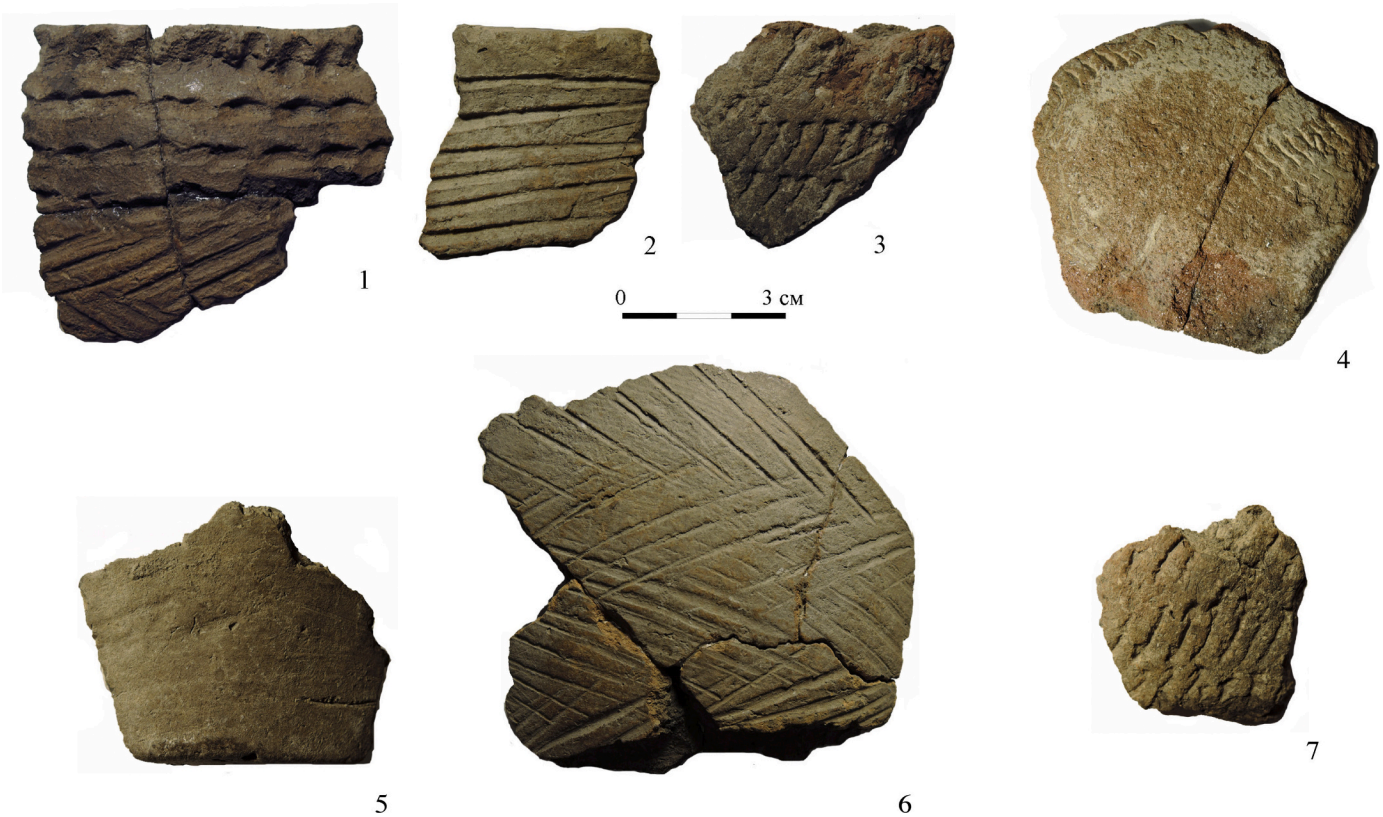

Fig. 2. Ceramics from Ust'-Biyke-I exhibiting Afanasievo and Neolithic Altaic characteristics.

2 abuts the turf of the modern surface of the site suggests that the integrity of the uppermost cultural deposits may have been disrupted from erosion and subsequent human activity. Layers 2 and 4 contained cultural material broadly associated with the middle and late Mesolithic, respectively (Fig. 3) (Tishkin and Gorbunov, 2005).

Human remains (two mandible fragments, several ribs and unidentified limb bones) with ochre residues were also found in a pit measuring 1.8 m long and 0.85 m wide that was dug from the top portion of layer 2 through layer 4, reaching the top portion of layer 6. Ochre was not observed in the surrounding burial context. The incomplete skeletal inventory of one individual suggests a secondary burial or the primary burial of a dismembered corpse. In either case, the ochre that caused visible residue on the bones must have been applied elsewhere from the identified burial pit. The lithics found in association with the human remains were broadly identified as having Mesolithic-Eneolithic characteristics (Fig. 3A) (Tishkin and Gorbunov, 2005).

2.1. Radiocarbon dating

We obtained one AMS ^{14}C determination measured on faunal bone collagen each from layers 2 and 4, the most defined cultural horizons, in addition to one measurement on human bone collagen from the burial (Table 2). The calibrated radiocarbon dates confirmed the periodization of layers 2 and 4 to the late and middle Mesolithic, respectively. Surprisingly, the radiocarbon date of the human was contemporaneous with the Afanasievo cultural horizon.

2.2. Mesolithic traditions

The middle and late Mesolithic assemblages recovered at Ust'-Biyke-I consist of more than 800 and 1000 artifacts, respectively, which were manufactured from pebble flint. Overall, the tool types largely consist of microblades knapped from volumetric and narrow-faced cores; end-scrapers, unifacial and bifacial blades, burins, points, and arrowheads were less common (Fig. 3B,C).

Differences in the toolsets between the middle and late Mesolithic layers are nuanced. In the lower Mesolithic layer, bifacial arrowheads are relatively rare, while in the upper layer they are more common and co-occur with bifacial knives, bone tools, and fishing tools, including a lithic hook. The persistence of this techno-complex at the site suggests behavioral continuity from the upper Paleolithic into the Mesolithic, with a possible shift in resource exploitation by the seventh millennium BCE.

Taxonomic identification of the highly fragmented faunal skeletal remains based on morphology was limited to large or medium mammal. Hunted ungulates may have included horses (*Equus* sp.), aurochs (*Bos primigenius*), elk (*Alces alces*), wapiti (*Cervus canadensis*), red deer (*Cervus elaphus*), Siberian ibex (*Capra sibirica*), argali (*Ovis ammon*), wild boar (*Sus scrofa*), and musk deer (*Moschus* sp.).

2.3. Eneolithic transitions

The subsequent occupation of Ust'-Biyke-I during the late fourth millennium BCE hints at cultural dynamism between local Altaic communities and incoming pastoralists. Our dating of the human remains shows this individual was contemporaneous with the Afanasievo horizon (Table 2). The cultural context of the human burial suggests that this individual was not a member of an Afanasievo community, who were exclusively interred in stone kurgans (Stepanova, 2012). While previous research generally characterized Afanasievo communities as culturally conservative and insular (Gryaznov and Vadetskaya, 1968; Pogozheva, 2006; Stepanova, 2012), the presence of Afanasievo material culture in association with Neolithic lithics at Ust'-Biyke-I suggests communication and exchange between herding and foraging communities as

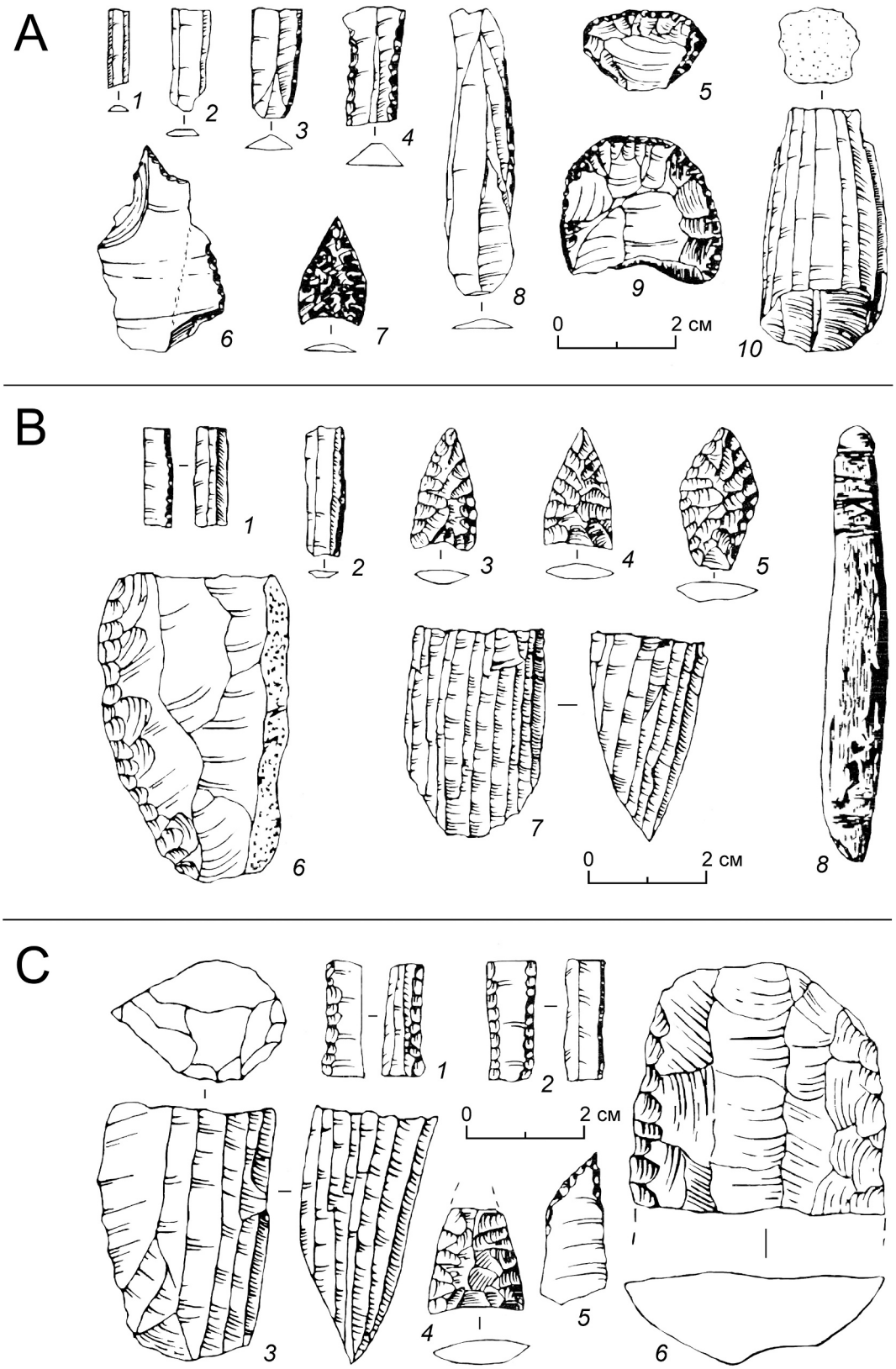

Fig. 3. Lithics from Ust'-Biyke-I. A) Burial: 1, 2 – microblades, 3, 4 – retouched bladelets; 5, 9 – end-scrapers; 6 – burin; 7 – arrowhead, 10 – microblade core. B) Final Mesolithic: 1, 2 – retouched bladelets; 3–5 – arrowheads; 6 – knife; 7 – microblade core; 8 – fishing tool. C) Middle Mesolithic: 1, 2 – retouched bladelets; 3 – microblade core; 4 – arrowhead; 5 – burin; 6 – retouched flake.

Table 2
New AMS radiocarbon dates from Ust'-Biyke-I, calibrated with OxCal v.4.4.2 and IntCal20 (Bronk Ramsey, 2017; Reimer et al., 2020). [1,2]Collagen extraction and pre-treatment followed a modified version of the method reported in Law and Hedges (1989). [1]Corrections to AMS measurements followed (Lysikov et al., 2018; Parkhomchuk and Rastigeev, 2011). [2]Corrections to the AMS measurements followed Donahue et al. (1990).

Context	ID	^{14}C age, years BP	±	$\delta^{13}C_{AMS}$ (‰)	Calibrated date BC (2σ)	Material
Layer 4	GV02107[1]	8854	127	not provided	8271–7606	faunal collagen
Layer 2	GV02106[1]	7503	100	not provided	6569–6087	faunal collagen
Burial	AA90660[2]	4485	50	−18.1	3361–3016	human collagen

pastoralist subsistence became more widespread in the Altai. This scenario may correspond to the dynamics giving rise to the Chemurchek culture in the Dzhungarian Basin and Mongolian Altai after contact with Afanasievo communities e.g., (Jeong et al., 2020; Wang et al., 2021).

3. Nizhnyaya Sooru: an Afanasievo settlement revisited

We will further examine cultural interactions between Afanasievo and Neolithic hunter-gatherers in the Altai with new excavation of the Nizhnyaya Sooru settlement, located along the Karakol River in the Altai Republic (Fig. 1). Recent genetic and radiocarbon analyses confirm the presence of domesticated sheep dating to 3300–2900 BCE and in direct association with a diverse lithic industry and Afanasievo ceramics (Hermes et al., 2020b). Since previous work at Nizhnyaya Sooru was limited to a test pit with an area of 2.4 m^2 of the upper strata (Larin et al., 1998), our more extensive excavation will yield a suite of in-situ material to document the rise of the Afanasievo horizon in relation to indigenous Neolithic communities, which has so far only been loosely hypothesized (cf. Kiryushin and Kiryushin, 2005).

4. Conclusions

More research is needed on indigenous hunter-gatherers in the Altai in order to understand the spread of pastoralism to Inner Asia. Ust'-Biyke-I demonstrates a long tradition of a diversified techno-complex that focused on the production of microblades from volumetric and narrow-faced cores. The technological similarity between the lithics at Ust'-Biyke-I and that from neighboring Mesolithic and Neolithic sites, such as Ust'-Karban-I, Ust'-Kuyum, Ust'-Sema, Kameshok-I–III, Tytkesken'-I–IV (Kiryushin et al., 2019; Kungurov, 2019), suggests a tight-knit and durable cultural network was in place when domesticated animals arrived in the region by 3300 BCE. This finding calls into question the uniformity that archaeologists have characterized the Afanasievo culture and supports recent synthesis of cultural dynamics characterizing Afanasievo communities in Mongolia (e.g., Honeychurch et al., 2021). Future work in the Altai Mountains and adjacent regions will undoubtedly reveal further complexities of hunter-gatherers participating in new food producing technologies, bio-cultural logics, and social signaling via material replication.

Our work on the deep histories of hunter-gatherers and arrival of early herding communities in the Altai focuses on how pre-existing cultural fabrics influenced the rise of pastoralism in Inner Asia at least by the Afanasievo horizon. We follow an iterative approach to revisit previously excavated archaeological materials before new excavations in order to elucidate interactions between early herders and indigenous communities in the Altai. We combine radiocarbon dating, digital analysis of material culture, and biomolecular methods on faunal skeletal remains, including collagen peptide mass fingerprinting to identify taxa (ZooMS), paleogenomics to reveal livestock dispersals and shifting adaptive pressures, and stable isotope analysis to reconstruct paleoenvironments and animal management strategies (Hermes et al., 2019, 2020a, 2020b). These combined scientific methods will provide important insights to the cultural and subsistence dynamics that so far remain under characterized in evolving narratives of Eurasian population histories and migrations inferred from human paleogenomic data (e.g., Jeong et al., 2020; Narasimhan et al., 2019; Wang et al. 2021).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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