

## Early integration of pastoralism and millet cultivation in Bronze Age Eurasia

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Mobile pastoralists are thought to have facilitated the first trans-Eurasian dispersals of domesticated plants during the Early Bronze Age (ca. 2500–2300 BC). Problematically, the earliest seeds of wheat, barley and millet in Inner Asia were recovered from human mortuary contexts and do not inform on local cultivation or subsistence use, while contemporaneous evidence for the use and management of domesticated livestock in the region remains ambiguous. We analysed mitochondrial DNA and multi-stable isotopic ratios ( $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$  and  $\delta^{18}\text{O}$ ) of faunal remains from key pastoralist sites in the Dzhungar Mountains of southeastern Kazakhstan. At ca 2700 BC, Near Eastern domesticated sheep and goat were present at the settlement of Dali, which were also winter foddered with the region's earliest cultivated millet spreading from its centre of domestication in northern China. In the following centuries, millet cultivation and caprine management became increasingly intertwined at the nearby site of Begash. Cattle, on the other hand, received low levels of millet fodder at the sites for millennia. By primarily examining livestock dietary intake, this study reveals that the initial transmission of millet across the mountains of Inner Asia coincided with a substantial connection between pastoralism and plant cultivation, suggesting that pastoralist livestock herding was integral for the westward dispersal of millet from farming societies in China.