

Yak milk consumption among Mongol Empire elites

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Yaks graze in modern day Mongolia. Credit: Alicia Ventresca-Miller

For the first time, researchers have pinpointed a date when elite Mongol Empire people were drinking yak milk, according to a study co-led by a University of Michigan researcher.



By analyzing proteins found within ancient dental calculus, an international team of researchers provides direct evidence for consumption of <u>milk</u> from multiple ruminants, including yak. In addition, they discovered milk and <u>blood proteins</u> associated with both horses and ruminants. The team's results are published in *Communications Biology*.

The study presents novel protein findings from an <u>elite</u> Mongol Era cemetery with exceptional preservation in the permafrost. This is the first example of yak milk recovered from an archaeological context.

Previous research indicates that milk has been a critical resource in Mongolia for more than 5,000 years. While the consumption of cattle, sheep, goat and even horse milk have securely been dated, until now, when people began drinking milk from yaks has been difficult to determine. Understanding when and where humans domesticated this iconic species has been limited to rarely recovered yak remains and artistic depictions of yaks. However, whether these are wild or domestic is unclear.

The discovery of an elite Mongol era cemetery in northern Mongolia was surprising to the researchers.

"Our most important finding was an elite woman buried with a birchbark hat called a bogtog and silk robes depicting a golden five-clawed dragon. Our proteomic analyses concluded that she drank yak milk during her lifetime," said Alicia Ventresca-Miller, U-M assistant professor of anthropology. "This helped us verify the long-term use of this iconic animal in the region and its ties to elite rulers."

Located along a high-elevation ridgeline covered in mist, the location bears the name "Khorig," meaning taboo. It may be that this cemetery was considered elite, as the researchers recovered evidence of



connections to the ruling elite, including a five-clawed dragon depicted on a Cizhou vessel and traditional robe, or deel.

"Ceramic vessels were turned into lanterns made of <u>dairy products</u>, which revealed long-standing religious ideas and the daily life of the elites of the Mongol empire," said J. Bayarsaikhan, a researcher at the Max Planck Institute for the Science of Human History and the National Museum of Mongolia.

Archaeologists have spent years collecting and conserving pieces of silk and leather strewn across the surface near the burials. Unfortunately, over the past few decades the permafrost has begun to melt and the sites have been heavily looted.

"The degree of looting that we are seeing is unprecedented. Nearly every burial that we can locate on the surface has recently been destroyed by looting activity," said Julia Clark of Nomad Science.

Archaeologists have long suspected that this area was important, and it remains one of the primary areas of yak herding in the present day. While much was lost to looters, what remained of the burials was still well preserved within the permafrost.

An international team of researchers used proteomic analysis of dental calculus to identify the diets of Mongol era elites. They found proteins associated with milk, blood and other tissues that had been consumed by different individuals.

"What is really exciting is that between cows and yaks, there is only a single difference in the <u>amino acid sequence</u> in the most commonly recovered milk <u>protein</u>, and in this case, we were able to recover the part which is specific to yak, Bos mutus," said study co-lead and paleoproteomics specialist Shevan Wilkin of the University of Zurich



and Max Planck Institute for the Science of Human History.

Due to the incredible preservation made possible through the permafrost <u>environmental conditions</u>, the team was able to identify intriguing proteins recovered for the first time from archaeological samples. These included horse milk curd proteins as well as caprine and equine blood proteins that had not been previously recovered from dental calculus.

More information: Ventresca Miller, A.R., Wilkin, S., Bayarsaikhan, J. et al. Permafrost preservation reveals proteomic evidence for yak milk consumption in the 13th century. *Communications Biology* (2023). DOI: 10.1038/s42003-023-04723-3, www.nature.com/articles/s42003-023-04723-3

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