Researchers Find New Evidence of Early Horse Domestication

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Soil from a Copper Age site in northern Kazakhstan has yielded new evidence for domesticated horses up to 5,600 years ago. Researchers from the Carnegie Museum of Natural History and the University of Pittsburgh have discovered phosphorus-enriched soils inside what appear to be the remains of horse corrals beside pit houses; the soil matches what would be expected from earth once enriched by horse manure.

The Krasnyi Yar site was inhabited by people of the Botai culture of the Eurasian Steppe, who relied heavily on horses for food, tools, and transport. The latest evidence was on display this week at the Annual Meeting of the Geological Society of America in Philadelphia.

"There's very little direct evidence of horse domestication," says Sandra Olsen, an archaeologist and horse domestication researcher at the Carnegie Museum of Natural History in Pittsburgh, Pa. That's because 5,600 years ago there were no saddles or metal bits to leave behind. Equipment like bridles, leads, and hobbles would have been made from thongs of horse hide and would have rotted away long ago. Likewise, horses themselves have not changed much physically as a result of domestication, unlike dogs or cattle. So ancient horse bones don't easily reveal the secrets of domestication.

With research funding from the National Science Foundation, Olsen's team took a different tack. They looked for circumstantial evidence that people were keeping horses. One approach was to survey the Krasnyi Yar site with instruments to map out subtle electrical and magnetic

irregularities in the soils. With this they were able to identify the locations of 54 pit houses and dozens of post molds where vertical posts once stood. Some of the post molds were arranged circularly, as would be most practical for a corral.

Next, Michael Rosenmeier, assistant professor of geology and planetary science in the University of Pittsburgh's School of Arts and Sciences, collected soil samples from inside the fenced area and outside the settlement. The samples were analyzed for nitrogen, phosphorus, potassium, and sodium concentrations by Rosemary Capo, Pitt associate professor of geology and planetary science, and her students. Modern horse manure is rich in phosphorous, potassium, and especially nitrogen, compared to undisturbed soils. But because nitrogen is mobile in soils, it can be lost to groundwater or transferred to the atmosphere by organic and inorganic processes. Phosphorus, on the other hand, can be locked into place by calcium and iron and is more likely to be preserved in the soils for millennia.

As it turned out, the soil from inside the alleged corral had up to 10 times the phosphorus concentration as the soils from outside the settlement. Lots of phosphorus can also indicate a hearth, said Capo, but that phosphorus is usually accompanied by a lot of potassium, which is not the case in the corral at Krasnyi Yar.

The corral soils also had low nitrogen concentrations, says Capo, reducing the likelihood that the phosphorus came from more recent manure. "That's good, actually," she said of the recently completed nitrogen analyses. "It suggests we've got old stuff."

Even more compelling will be if we find long-lived molecules of fat, or lipids, directly attributed to horse manure in the soils, says Olsen.

Early as the Botai were, they were probably not the first to domesticate

horses, says Olsen. "The very first horse domestication was probably a bit earlier in Ukraine or western Russia," she said. "Then some horse-herders migrated east to Kazakhstan."

Horses allowed the Botai to build large perennial villages with, in one case, hundreds of homes. They did so without the benefit of agriculture, Olsen explained, as theirs was a horse economy.

The Botai were able to stay put year-round because horses are very well adapted to cold winters, she said. "Horses can survive ice storms and don't need heated barns or winter fodder," Olsen said. They are, in fact, some of the last remaining large, Ice Age, Pleistocene mammals living in one of the last places on Earth where Pleistocene vegetation survives.

Because they were domesticated, the horses supplied meat year-round and vitamin-rich mare's milk from spring through fall. "No one in their right mind would try to milk a wild mare," said Olsen.

There is also evidence that the Botai were carrying a lot of heavy material, like rocks and large skulls, over long distances. That is a lot more practical and explicable if they used pack horses.

Later people of the same region adopted shepherding and cattle raising, said Olsen. That created a more nomadic culture, since sheep and cattle are not well suited for subzero climates and therefore needed to be taken south in winter. The tradeoff, she says, was that cows and sheep give far fattier milk year round, which can be made into yogurt and cheese. Sheep also provide wool.

Kazakh people today still eat horsemeat. They were forced to abandon their nomadic lifestyle during the Soviet era and have returned to small village pastoralism, Olsen says.

Source: University of Pittsburgh