After decades of research into the domestication process of horses and their relationship with humans, there are still many unresolved issues. However, in recent years, there have been important revisions of the views of various researchers on this subject. These changes are influenced not only by the increasingly common use of genetic research, but also by the careful consideration of the oral traditions of indigenous inhabitants.

Evolution and extinction of horses in North America

It is well established that Equidae evolved in North America and subsequently migrated across the land bridge of the Bering Strait to Eurasia (19, 30). This opened up great opportunities for expansion for them. It is believed that by the end of the Holocene, horses in the Americas had become extinct. Therefore, their contact with humans was not sufficient to precisely determine the nature of the human-horse relationship (31). The extinction of horses was probably the result of climate change, a shorter growing season, and human pressure during the Younger Dryas (26). In addition, during this period, constituting the late glacial climatic phase, many members of the megafauna became extinct.

New insights and evidence

There are well-preserved traces of contact between humans and equines, including *Hippidon principal* (Lund, 1846), and *Equus neogeus* (Lund, 1840) (26). The presence of the horses in the Clovis culture is confirmed by archaeological evidence dating back to 14,000 BCE (14). Additionally, evidence of their presence extends to 12,700 BCE in Alberta, Canada (6). This discovery is noteworthy as it suggests the possibility of alternative migration routes for these animals beyond the Bering Strait. Until recently, the prevailing belief was that horses were reintroduced to the American continent only in the 15th century as a result of Spanish colonization, spreading among indigenous inhabitants.

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people due to the Pueblo Revolt of 1680 AD (11, 12, 28). To date, there is no evidence indicating that the Viking colonization of Greenland and Newfoundland or Viking expeditions to the American continent, had any impact on the presence of horses there (28). In recent times, a perspective has emerged suggesting that horses did not go extinct on this continent, but survived and interacted with humans. This view is supported by the accounts of indigenous people belonging to the Dakota, Cheyenne, Choctaw, Ojibwa, and Navajo nations (9). Some authors, however, do not rule out the possibility of previously unknown contacts in ancient times between America and those continents where horses were present (28). This is a breakthrough in understanding contacts between ancient populations of people, which would probably translate into their relationships with domestic animals. Notably, Ake Hultkrantz recorded that the Shoshones (Shosones) believed that their ancestors possessed horses long before the arrival of the Spaniards (13). Similarly, Ewers noted that the Blackfoot tribe (Siksika) did not associate the presence of horses with settlers; instead, they held their own theories about the origin of horses. This theory finds support in new finds, including a petroglyph from Alto de Pitis, Peru, depicting a rider on a horse (dated to c. 900 AD), a geoglyph from the Mojave Desert near Blythe, Southeast California (dated to c. 900 AD), and the first, or one of the first, to domesticate horses was the Botai culture (around 4,000,000 BCE) (21, 23). The presence of horse remains at archaeological sites and the presence of horse milk lipids on vessel walls. The horses’ teeth bore traces of the possible use of a bit (7, 23). However, these conclusions were not universally accepted. Some authors believed that horses were simply harvested in large numbers and kept, or even ridden, but not bred. It was also pointed out that horse dressage is not synonymous with horse breeding. It merely suggests that horses had been tamed (16, 28). Many researchers did not consider the traces of bits on horses’ teeth in their studies, nor did they account for the presence of horse milk residues on vessels. This assertion is supported by noting comparable dental changes observed in the teeth of wild horses from the Pleistocene epoch in North America. Moreover, the interpretation of specific traces as milk residues has been considered evidence of horse meat consumption. In addition, they indicated the presence of horse milk residues on the teeth of people from the Bronze Age living in the Caspian-Pontic steppe, which serves as direct evidence of horse meat consumption (28, 33). The age distribution of the kept horse herd was also discussed, which made it possible to analyze the model of animal use.

Another location proposed as a potential site of horse domestication is the Sredny Stog shepherd culture (romanized as Sered’nstohivs’ka kul’tura) from the Copper Age in Derivki, Ukraine (4500-3500 BCE) (1, 2, 29). This is supported by numerous remains of horses discovered there and the traces of a bit on the
teeth of one of them. However, later studies using the carbon-14 dating method showed that the only horse with changes in the teeth came from the Iron Age and therefore could not have any relation with the early domestication of horses (4).

Genetic research has been conclusive, showing that neither the horses of the Botai culture nor those of the Sredny Stog culture or the Yamnaya tribe culture were the ancestors of modern domestic horses. Interestingly, the horses of the Botai and Deriivka cultures were genetically related to Przewalski’s horses (Takhi) (24). These may have been early attempts to domesticate horses, but they did not result in a wide-ranging expansion of these animal populations. This strongly supports the theory of polytopic horse domestication. It suggests that there were numerous attempts to domesticate horses, but only a few genetic lines have been successful in achieving expansion. According to archived genetic sequences, modern horses (Fig. 1) are descended from horses of the DOM2 genetic line, and their homeland is the Pontic-Caspian steppe (South-Eastern Europe) (18). The rapid expansion of the DOM2 horse lineage appears to have been driven not only by the needs of local societies, but also by broader socio-economic factors and the militarization of horse riding (22, 24). The spread of horses was related to the simultaneous expansion of bronze metallurgy and Indo-European languages. It was also associated with the spread of pastoral cultures (3), particularly among groups capable of harnessing horses to chariots. War chariots were drawn by horses and served a purely military purpose. The use of these war chariots marked a significant offensive revolution that had a direct impact on global power dynamics.

A study by Librado et al. (18) raises doubts about the idea that the spread of DOM2 lineage horses was related to the expansion of Yamnaia herdsmen. The expansion of these horses occurred much later, around 2200-2000 BCE, when they reached Anatolia, the lower Danube region, Bohemia, and Central Asia. From there, they extended their presence to Western Europe and Mongolia, eventually supplanting local horse populations around 1500-1000 BCE. Techniques of horseback riding and the combat use of chariots first emerged in the Trans-Ural Sintashta culture. This expansion appears to have had a military character, motivated by competition for grazing land. Another model for the spread of horses of the DOM2 lineage involves Anatolia, the Levant, and the Carpathian Basin. Horses arrived in these regions through trade along with specialists in horse breeding and chariot construction.

We possess detailed documentation of the horse-related activities of the Indo-European peoples. Historical records indicate that the Indo-Europeans found developed civilizations coexisting with horses in the Middle East (including Anatolia, Syro-palestine, and Mesopotamia). The remarkable history of humans alongside horses can be vividly reconstructed throughout the annals of the history. It often shows the unique significance of the bond between people and these animals. In ancient Mitanni (Northern Mesopotamia and Syria), chariot warriors were a special caste referred to as “maryannu” (the word etymologically related to the Old Indian noun “márya”, meaning boy) (17, 25). The earliest written sources regarding horses come from the city of Ur (Mesopotamia, c. 2100 BCE). They refer to the horse as “a donkey from the mountains” because it was brought there from Iran and eastern Anatolia (17). Horses are presented in the Standard of Ur, a monument of Sumerian art deposited in the local royal tomb. Its war page shows Mesopotamia’s military elites in horse chariots (Fig. 2). Based on historical data, a map depicting the spread and development of domesticated horses was created (Fig. 3).

**Summary and future prospects**

The domestication of the horse continues to be of interest to many scientists. Thanks to the continuous development of research methods, knowledge about the history of Equidae is increasingly comprehensive. Nevertheless, many unknowns remain, offering entirely new and intriguing avenues for research based on the intricate synthesis of the increasing pool of data.
Fig. 2. The war side of the Standard of Ur (Mesopotamia) displaying figural scenes (A). Source: “Royal Standard of Ur” – Mosaic With Sumer Images, Source: public domain

Fig. 3. Charting the Historical Dissemination and Evolution of Domestic Horses: A Geographic Overview. Source: A. Tomańska