

A Brief Look at the Evolution of Bison

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Below is a slightly more detailed analysis of the evolutionary history of bison than the sketch we provided in our bison genetics article.

THE BOS FAMILY

Bison and cattle have a common ancestry that begins around nine million years ago in Europe with the appearance of an animal called *Parabos* (Mammalia – Artiodactyla – Bovidae). The oldest *Parabos* fossils are found in Spain, but there are also sites containing *Parabos* in Romania, Italy, Moldova, and the most recent evidence is found in Hungary, indicating that *Parabos* survived until about 1.8 million years ago.

The reason *Parabos* is of interest to us is that around 4 million years ago in China, it gave rise to *Proleptobos*, an animal that is the direct ancestor of both *Bos* and *Bison*.

Bos-Bison branches from *Proleptobos-Leptobos* around 2.2 million years ago and begins rapidly radiating across Europe and Asia. The climate was deteriorating, heading into the Pleistocene Ice Age, which began about 1.8 million years ago. As the forage quality diminished with the increasing cold, competition among large

herbivores also increased. The more specialized and efficient grazers and browsers became larger-bodied, and developed more body hair and horns in both sexes, perhaps to fight predators, or for sexual selection, probably both. *Bison* evolved further north than any other Bovini genus and was obviously best adapted to the colder temperatures of the late Pliocene and early Pleistocene.

Bos and *Bison* split approximately 2 million years ago. As the Pleistocene glaciers advanced around the

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world (at its peak, about 30% of the earth's surface was covered by glaciers), *Bison* adapted to the dramatically changing environments. Bison were confined to the temperate zones of east Asia until after the Donau glaciation, around 550,000 years ago. By 450,000 years ago they had spread into southeastern and central Europe, and by the late Wurm glaciation (15,000 years ago) they'd become common fossils, as well as showing up in cave paintings throughout much of

Europe—like the Altamira cave site in Spain.

The Old World bison population split into two groups: 1. A rare short-horned woodland wisent, *Bison schoetensacki*, and the large steppe wisent that we are all familiar with, *Bison priscus*.

B. priscus first reached North America during the Mindel-Riss epoch, a global warming period that lasted from 380,000 years ago to around 200,000 years ago. *B. Priscus* crossed the land bridge that connected Asia and North

America, known as Beringia, and entered what is today Alaska. *B. Priscus* survived in Alaska, Beringia, and parts of Canada until around 12,000 years ago, as documented at the Old Crow

archaeological site in the Yukon.

There were two migrations of *B. Priscus* from Beringia into North America. The first during the Mindel-Riss period gave rise to the giant-horned bison, *Bison latifrons*. The second migration of *B. Priscus* occurred during the late Sangamonian, another warm period, around 130,000 years ago, and gave rise to *Bison bison*. *B. latifrons* survived until around 21,000 years ago, as dated from the Rainbow

Ranch site in Idaho. Its extinction probably resulted from competition with *B. bison* and from genetic swamping.

In an article in the journal, SCIENCE, entitled, “Rise and Fall of the Beringian Steppe Bison,” Beth Shapiro, et. al., using mitochondrial DNA, discovered that the most recent common ancestor (MRCA) of all bison in their study lived around 136,000 years ago, which “suggests that late Pleistocene bison from the Ural Mountains to northern China are descendants of one or more dispersals from North America.” The article goes on to say that several North American bison maternal lineages fall within the European clade (a clade is a branch on the family tree), which means that the traffic didn’t just move one way. Bison wandered back and forth across Beringia from North America to Asia for thousands of years.

From about 60,000 to 25,000 years ago, bison were widely distributed across Beringia and moved down an ice-free corridor along the face of the Rocky Mountains into central North America. However, between 22,000 to 18,000 years ago, the Ice Age reached its glacial maximum. At its worst, 18,000 years ago, three miles of ice covered Hudson Bay in Canada and the ice sheets crept as far south as Illinois and Iowa. There were two massive glaciers, the Cordilleran Ice

Sheet and the Laurentide Ice Sheet, that finally met at the Rocky Mountains and closed the ice-free corridor, isolating the bison south of the ice sheets. By 18,000 years ago bison in central North America were sparse. The ice-free corridor opened again, as the glaciers melted back, around 14,000 years ago, allowing bison to move freely from Beringia into North America until around 11,000 years ago, when dense spruce forests across Alberta started to crowd out grasslands, and the development of peatland across western and northwestern Canada created new barriers to travel.

Two subspecies evolved from *Bison bison*. 1. *Bison bison antiquus* and, 2. *Bison bison occidentalis*. Both subspecies are found in the Great Bison Belt that extended from Alberta to Texas, and were hunted extensively by PaleoIndian peoples, particularly the Clovis and Folsom cultures.

One of the most important points that Shapiro, et. al., make in their article is that “modern bison are descended from populations that were south of the ice before the LGM (the Last Glacial Maximum, 18,000 years ago), and that...all modern bison belong to a clade distinct from Beringian bison. This clade has a MRCA (most recent common ancestor) between 22 and 15 ky B.P.”

This MRCA is different from the ancestor that dates to

136,000 years ago because that clade included all bison in Shapiro’s study, many of which were not modern bison but prehistoric species of bison. The best way to visualize this is to imagine a family tree with many branches. The large branch that contains the ancestor from 136,000 years ago has smaller limbs growing from it, one of which contains the ancestor of all modern bison and dates to between 22,000 to 15,000 years ago.

Around 4,000 to 5,000 years ago, the Plains Bison, *Bison bison bison*, and the Wood Bison, *Bison bison athabascaae* evolved. Plains bison seem to have evolved from *B. bison antiquus*. Wood Bison are more difficult to access. Some researchers say that *B. b. athabascaae* descends from *B. b. occidentalis*. Others say that Wood bison descended directly from *B. b. bison*. More research needs to be done to clarify this issue. Despite being a little dated, the best article on this is found in the journal, GENOME (42: 483-496, 1999), and written by G.A Wilson and C. Strobeck, “Genetic Variation within and relatedness among wood and plains bison populations.”

In the future, good DNA research will fill in more of the gaps in this family tree and we’ll have a clearer idea of the details that led to the development of modern bison.