

about 80,000 to 10,000 years ago), moose migrated to North America via Beringia (the broad isthmus linking Siberia and Alaska during glacial periods with greatly lowered sea level). [The Yakutian-Manchurian moose population is genetically one of the oldest and may represent the source of founders of extant populations in North America which were colonized within the last 15,000 years.] There, they replaced the giant moose, as wetter, forested terrain encroached on the steppe-like grasslands. Although there may be earlier Wisconsinan moose fossils from Eastern Beringia, the earliest radiocarbon-dated specimen is about 11,600 years old. The earliest *Alces alces* recorded in the United States are Late Wisconsinan (40,000 to 10,000 years ago) from Little Box Elder Cave, Wyoming and Strait Canyon, Virginia, so the species was able to penetrate directly south of the Wisconsinan ice sheets. This would have allowed the four existing North American subspecies to differentiate (*A. a. gigas* in the Eastern Beringian refugium, and *A. a. andersoni*, *A. a. americana*, *A. a. shirasi* in the southern refugium). However, lack of variation in moose DNA across North America neither supports or denies that view.

In any case, the calling card of the largest known deer *Alces latifrons*, although extinct, is still found in Yukon ice age deposits, mainly in the form of massive antler beams. Its demise and the rise of the modern moose (*Alces alces*) probably indicate the replacement of former steppe-like grasslands by wetter, more heavily forested zones toward the close of the last glaciation.

C.R. Harington  
March, 2007

#### Additional Reading

FAUNMAP Working Group. 1994. FAUNMAP: A database documenting Late Quaternary distributions of mammal species in the United States. Illinois State Museum Scientific Papers 25:1-690.

Guthrie, R.D. 1990. New dates on Quaternary moose, *Cervalces* – *Alces* – archaeological, evolutionary, and ecological implications. *Current Research in the Pleistocene* 7:111-112.

Harington, C.R. 2003. Annotated Bibliography of Quaternary Vertebrates of Northern North America – with Radiocarbon Dates. University of Toronto Press, Toronto.

Hundertmark, K.J., G.F. Shields, I.G. Udina, R.T. Bowyer, A.A. Danilkin and C.C. Schwartz. 2002. Mitochondrial phylogeography of moose (*Alces alces*): Late Pleistocene divergence and population expansion. *Molecular Phylogenetics and Evolution* 22(3):375-387.

Kahlke, R.-D. 1999. The History of the Origin, Evolution and Dispersal of the Late Pleistocene *Mammuthus* – *Coelodonta* Faunal Complex in Eurasia (Large Mammals). Fenske Companies, Rapid City.

Kurtén, B. and E. Anderson. 1980. Pleistocene Mammals of North America. Columbia University Press, New York.



Figure 1 – Restoration of a giant moose bull attacking wolves. Modified from a sketch by Bonnie Dalzell.

## Giant Moose and Moose

Giant moose (*Alces latifrons*) and moose (*Alces alces*) are known mainly from Pleistocene (about 2 million to 10,000 years ago) and Holocene (the last 10,000 years) deposits, respectively, in Eastern Beringia (unglaciated parts of Alaska, Yukon and adjacent Northwest Territories). They are commonly separated by size, antler characteristics and radiocarbon age.

The giant moose (Figure 1) was the largest-known (nearly 2 m high at the shoulders) deer (family Cervidae), exceeding in size the living moose and the extinct Scott's moose (*Alces scotti* – reported from southern North America). Sometimes known as the “broad-fronted moose”, the species is characterized by long, robust antler beams and relatively small palmations (the hand-like shovels at the ends of the beams). Beams are between 300 and 500 mm long, with a palmation of nearly equal length. Beams of giant moose from Old Crow, Yukon (Figure 2) and Fairbanks, Alaska reach maximum lengths of 460 and 450 mm respectively.

Like its ancestor the Gallic moose (*Alces gallicus*), the giant moose was not adapted to dense forest since the great span of its antlers would hamper movement. Furthermore, palaeobotanical (fossil plant) evidence from Tiraspol, Russia indicates that this species occupied cool forest-steppe or parkland. Although nothing is known of their diet, presumably marsh plants, willows and other shrubs were important food. Probably wolves were among their major predators (Figure 1).

In Eurasia, more than 70 giant moose localities cluster between 45° and 71°N in a zone stretching from East Anglia, England and northern Italy in the west to Transbaikalia and northeastern Siberia in the east. The giant moose was the first moose to cross Beringia and colonize North America (Alaska, Yukon, Northwest Territories, Saskatchewan, Ontario, Nebraska and Iowa).

Perhaps the oldest and most remarkable of Canadian giant moose specimens was collected by Scott Dallimore of the Geological Survey of Canada in 1987 near Portage Point in the Southern Eskimo Lakes region, Northwest Territories. It consists of articulating left foreleg bones of an adult and its geological age is considered to be Middle Pleistocene (about 500,000 years ago?).

At least 10 giant moose antlers lacking palmations are known from Old Crow and Dawson City areas of the Yukon, and at least three have been found near Fairbanks, Alaska. Four partial carcasses are among the Alaskan specimens. Radiocarbon dates on the specimens are Mid-Wisconsinan (between 40,000 and 25,000 years ago).

In contrast, modern moose remains so far dated from Eastern Beringia are mainly Holocene in age (approximately 11,600 to 550 years ago). The oldest evidence of *Alces alces* in Alaska, and the earliest example of a moose showing signs of human use is an 8,700 year old antler with cut-marks from the Fairbanks area.

The moose (*Alces alces*) is the largest living deer. It has long legs (adapted for travel in deep snow), high humped shoulders, a long head with a drooping snout and a stubby tail. Bulls have a mane, a “bell” hanging from the throat, and broad antlers extending sideways from the skull, which cows lack. Compared to giant moose it is smaller. Males have shorter antler beams and relatively large palmations. Antler growth begins in April and they are shed between December and late February. Coat colour varies from brown to black and legs are paler. Bulls are about 260 cm long with a shoulder height of 180 cm and weigh 450 kg compared to females about 230 cm x 180 cm x 350 kg.

Moose presently occupy boreal forest belts across northern Eurasia from Scandinavia to the Pacific Coast, and across North America from Alaska to Maine and Newfoundland. Moose prefer aspen-birch parkland with shrubs and lakes. They are rather solitary, but sometimes gather in good forage areas. They are excellent swimmers and spend much of their time in water. They feed on water plants, leaves and twigs. Usually 1 or 2 calves are born between mid-May and early June. Wolves (*Canis lupus*), their main predators, are adept at weeding out old, weak and young animals.



Figure 2 – Front view of a shed giant moose antler beam from Old Crow River, Yukon. Collected by Vern Rampton in 1962.

The genus *Alces* originated in Eurasia. The Gallic moose *Alces gallicus* is the oldest-known moose species (Late Pliocene to Early Pleistocene – about 2.0 to 1.5 million years ago). The earliest evidence for it is from deposits near Rostov, Russia and Tadjikistan. It was slightly smaller than the modern moose, had a relatively shallow skull, with antlers featuring extremely long beams and rather small palmations. Like the giant moose it was probably adapted to open parkland range. In contrast to later moose, it ranged through southern and southwestern Eurasia.

By the early Middle Pleistocene (about 0.7 to 0.5 million years ago) in Eurasia, the giant moose (*Alces latifrons*) had evolved from *Alces gallicus*. This species was the first to enter North America from Eurasia – perhaps before the penultimate (Illinoian) glaciation (about 500,000 years ago?). I was convinced that *Alces latifrons* (= *Cervalces alaskensis*) was represented in Eastern Beringian deposits in 1966 when attempting to identify a massive antler beam collected by geologist Vern Rampton in 1962 along Old Crow River, Yukon. Fossils collected since then have reinforced the preliminary evidence. I think that many specimens previously described as *Cervalces* (e.g. *C. roosevelti* and *C. borealis*) actually represent the giant moose, and indicate that it had reached southern North America from Eastern Beringia by at least the Sangamonian (about 130,000 years ago) interglacial. Presumably that stock gave rise to the solely North American species, Scott's moose (*Alces scotti* = *Cervalces scotti*), with long antler beams but very complex palmations. Moose with shorter antler beams may be transitional between the giant and modern moose. Evidently the giant moose died out in Eurasia about 500,000 years ago, but survived in Eastern Beringia until some 25,000 years ago.

The moose (*Alces alces*) evolved from the giant moose, perhaps as early as the last (Eemian – about 130,000 years ago) interglacial or earlier in Eurasia and became widespread there during the last glaciation. During that glaciation (Wisconsinan –