

= Columbian mammoth =

The Columbian mammoth (*Mammuthus columbi*) is an extinct species of mammoth that inhabited North America as far north as the northern United States and as far south as Costa Rica during the Pleistocene epoch . It was one of the last in a line of mammoth species , beginning with *M. subplanifrons* in the early Pliocene . The Columbian mammoth evolved from the steppe mammoth , which entered North America from Asia about 1 @. @ 5 million years ago . The pygmy mammoths of the Channel Islands of California evolved from Columbian mammoths . The closest extant relative of the Columbian and other mammoths is the Asian elephant .

Reaching 4 m (13 ft) at the shoulders and 8 ? 10 tonnes (18 @, @ 000 ? 22 @, @ 000 lb) in weight , the Columbian mammoth was one of the largest species of mammoth . It had long , curved tusks and four molars , which were replaced six times during the lifetime of an individual . It most likely used its tusks and trunk like modern elephants ? for manipulating objects , fighting , and foraging . Bones , hair , dung and stomach contents have been discovered , but no preserved carcasses are known . The Columbian mammoth preferred open areas , such as parkland landscapes , and fed on sedge , grass , and other plants . It did not live in the Arctic regions of Canada , which were instead inhabited by woolly mammoths . The ranges of the two species may have overlapped , and genetic evidence suggests that they interbred . Several sites contain the skeletons of multiple Columbian mammoths , either because they died in a single incident such as a flash flood , or because these locations were natural traps in which individuals accumulated over time .

For a few thousand years prior to their extinction , Columbian mammoths coexisted in North America with Palaeoamericans ? the first humans to inhabit the Americas ? who hunted them for food , used their bones for making tools , and depicted them in ancient art . Columbian mammoth remains have been found in association with Clovis culture artifacts ; these remains may have stemmed either from hunting or from scavenging . The Columbian mammoth disappeared at the end of the Pleistocene around 11 @, @ 000 years ago , most likely as a result of habitat loss caused by climate change , hunting by humans , or a combination of both .

= = Taxonomy = =

The Columbian mammoth was first scientifically described in 1857 by Scottish naturalist Hugh Falconer , who named the species *Elephas columbi* after Christopher Columbus . The animal was brought to Falconer 's attention in 1846 by Charles Lyell , who sent him molar fragments found during the 1838 excavation of the Brunswick ? Altamaha Canal in Georgia , in the southeastern United States . At the time , similar fossils from across North America were attributed to woolly mammoths (then *Elephas primigenius*) . Falconer found that his specimens were distinct , confirming his conclusion by examining their internal structure and studying additional molars from Mexico . Although William Phipps Blake and Richard Owen believed that *E. texianus* was more appropriate for the species , Falconer rejected the name ; he also suggested that *E. imperator* and *E. jacksoni* , two other American elephants described from molars , were based on remains too fragmentary to classify properly . More complete material that may be from the same quarry as Falconer 's fragmentary holotype molar was reported in 2012 , and could help shed more light on that specimen , since doubts about its adequacy as a holotype have been raised .

In the early 20th century , the taxonomy of extinct elephants became increasingly complicated . In 1942 , Henry Fairfield Osborn 's posthumous monograph on the Proboscidea was published , wherein he used various genus and subgenus names that had previously been proposed for extinct elephant species , such as *Archidiskodon* , *Metarchidiskodon* , *Parelephas* , and *Mammonteus* . Osborn also retained names for many regional and intermediate subspecies or " varieties " , and created recombinations such as *Parelephas columbi felcis* and *Archidiskodon imperator maibeni* . The taxonomic situation was simplified by various researchers from the 1970s onwards : all species of mammoth were retained in the genus *Mammuthus* , and many proposed differences between species were instead interpreted as intraspecific variation . In 2003 , palaeontologist Larry

Agenbroad summarised current views about North American mammoth taxonomy , and concluded that several species had been declared junior synonyms , and that *M. columbi* (the Columbian mammoth) and *M. exilis* (the pygmy mammoth) were the only species of mammoth endemic to the Americas (as other species lived both there and in Eurasia) . The idea that species such as *M. imperator* (the imperial mammoth) and *M. jeffersoni* (Jefferson 's mammoth) were either more primitive or advanced stages in Columbian mammoth evolution was largely dismissed , and they were regarded as synonyms . In spite of these conclusions , Agenbroad cautioned that American mammoth taxonomy is not yet fully resolved .

= = = Evolution = = =

The earliest known members of Proboscidea , the clade that contains the elephants , existed about 55 million years ago around the Tethys Sea area . The closest living relatives of the Proboscidea are the sirenians (dugongs and manatees) and the hyraxes (an order of small , herbivorous mammals) . The family Elephantidae existed six million years ago in Africa , and includes the living elephants and the mammoths . Among many now extinct clades , the mastodon (*Mammut*) is only a distant relative , and part of the distinct family Mammutidae , which diverged 25 million years before the mammoths evolved . The Asian elephant (*Elephas maximus*) is the closest extant relative of the mammoths . The following cladogram shows the placement of the Columbian mammoth among other proboscideans , based on characteristics of the hyoid bone in the neck :

Since many remains of each species of mammoth are known from several localities , it is possible to reconstruct the evolutionary history of the genus through morphological studies . Mammoth species can be identified from the number of enamel ridges (or lamellar plates) on their molars : primitive species had few ridges , and the number increased gradually as new species evolved to feed on more abrasive food items . The crowns of the teeth became deeper in height and the skulls became taller to accommodate this . At the same time , the skulls became shorter from front to back to minimise the weight of the head . The short , tall skulls of woolly and Columbian mammoths are the culmination of this process .

The first known members of the genus *Mammuthus* are the African species *M. subplanifrons* from the Pliocene , and *M. africanavus* from the Pleistocene . The former is thought to be the ancestor of later forms . Mammoths entered Europe around 3 million years ago . The earliest European mammoth has been named *M. rumanus* ; it spread across Europe and China . Only its molars are known , which show that it had 8 ? 10 enamel ridges . A population evolved 12 ? 14 ridges , splitting off from and replacing the earlier type , becoming *M. meridionalis* about 2 ? 1 @. @ 7 million years ago . In turn , this species was replaced by the steppe mammoth (*M. trogontherii*) with 18 ? 20 ridges , which evolved in eastern Asia around 2 ? 1 @. @ 5 million years ago . The Columbian mammoth evolved from a population of *M. trogontherii* that had crossed the Bering Strait and entered North America about 1 @. @ 5 million years ago ; it retained a similar number of molar ridges . Mammoths derived from *M. trogontherii* evolved molars with 26 ridges 400 @, @ 000 years ago in Siberia and became the woolly mammoth (*M. primigenius*) . Woolly mammoths entered North America about 100 @, @ 000 years ago .

A population of Columbian mammoths that lived between 80 @, @ 000 and 13 @, @ 000 years ago on the Channel Islands of California , 10 km (6 @. @ 2 mi) away from the mainland , evolved to be less than half the size of the mainland Columbian mammoths . They are therefore considered to be the distinct species *M. exilis* , the pygmy mammoth (or a subspecies , *M. c. exilis*) . These mammoths presumably reached the islands by swimming there when sea levels were lower , and decreased in size due to the limited food provided by the islands ' small areas . Bones of larger specimens have also been found on the islands , but it is unknown whether these were stages in the dwarfing process , or later arrivals of Columbian mammoths .

A 2011 study of the complete mitochondrial genome (inherited through the female line) showed that two examined Columbian mammoths , including the morphologically typical " Huntington mammoth " , were grouped within a subclade of woolly mammoths . This suggests that the two populations interbred and produced fertile offspring . One possible explanation is introgression of a

haplogroup from woolly to Columbian mammoths , or vice versa . A similar situation has been documented in modern species of African elephant (*Loxodonta*) , the African bush elephant (*L. africana*) and the African forest elephant (*L. cyclotis*) . The authors of the study also suggest that the North American type formerly referred to as *M. jeffersonii* may have been a hybrid between the two species , as it is apparently morphologically intermediate . These findings were not expected by scientists ; nuclear DNA and more specimens will have to be analysed to clarify the situation .

A 2015 study of mammoth molars confirmed that *M. columbi* evolved from Eurasian *M. trogontherii* , not *M. meridionalis* as had been suggested earlier , and noted that *M. columbi* and *M. trogontherii* were so similar in morphology that their classification as separate species may be questionable . The study also suggested that the animals in the range where *M. columbi* and *M. primigenius* overlapped formed a metapopulation of hybrids with varying morphology . In 2016 , a genetic study of North American mammoth specimens confirmed that *M. columbi* and *M. primigenius* interbred extensively , were both descended from *M. trogontherii* , and concluded that morphological differences between fossils may therefore not be reliable for determining taxonomy . The authors also questioned whether *M. columbi* and *M. primigenius* should be considered " good species " , considering that they were able to interbreed after supposedly being separated for a million years , but cautioned that more specimens need to be sampled .

= = Description = =

The Columbian mammoth reached 4 m (13 ft) tall at the shoulder , and weighed up to 8 ? 10 tonnes (18 @,@ 000 ? 22 @,@ 000 lb) . It was about the same size as the earlier mammoth species *M. meridionalis* and *M. trogontherii* , and was larger than the modern African elephant and the woolly mammoth , both of which reached about 2 @.@ 7 to 3 @.@ 4 m (8 @.@ 9 to 11 @.@ 2 ft) . Males were generally larger and more robust . The best indication of sex is the size of the pelvic girdle , since the opening that functions as the birth canal is always wider in females than in males . Like other mammoths , the Columbian mammoth had a high , single @-@ domed head and a sloping back with a high shoulder hump ; this shape resulted from the spinous processes (protrusions) of the back vertebrae decreasing in length from front to rear . Juveniles , on the other hand , had convex backs like Asian elephants . Other skeletal features include a short , deep rostrum (front part of the jaws) , a rounded mandibular symphysis (central jaw ridge) and the coronoid process of the mandible (upper protrusion of the jaw bone) extending above the molar surfaces .

Apart from its larger size and more primitive molars , the Columbian mammoth also differed from the woolly mammoth by its more downturned mandibular symphysis ; the dental alveoli (tooth sockets) of the tusks were directed more laterally away from the midline . Its tail was intermediate in length between that of modern elephants and the woolly mammoth . Since no Columbian mammoth soft tissue has been found , much less is known about its appearance than that of the woolly mammoth . It lived in warmer habitats than the woolly mammoth , and probably lacked many of the adaptations seen in that species . Hair thought to be that of the Columbian mammoth has been discovered in Bechan Cave in Utah , where mammoth dung has also been found . Some of this hair is coarse , and identical to that known to belong to woolly mammoths ; however , since this location is so far south it is unlikely to be woolly mammoth hair . The distribution and density of fur on the living animal is unknown , but it was probably less dense than that of the woolly mammoth due to the warmer habitat .

= = = Dentition = = =

Columbian mammoths had very long tusks (modified incisor teeth) , which were more curved than those of modern elephants . The largest known mammoth tusk , 4 @.@ 9 m (16 ft) long , belonged to a Columbian mammoth , and others range from 3 @.@ 5 to 4 @.@ 121 m (11 @.@ 48 to 13 @.@ 52 ft) long . Columbian mammoth tusks were usually not much larger than those of woolly mammoths , which reached 4 @.@ 2 m (14 ft) . The tusks of females were much smaller and

thinner . About a quarter of the tusks ' length was inside the sockets ; they grew spirally in opposite directions from the base , curving until the tips pointed towards each other , and sometimes crossed . Most of their weight would have been close to the skull , with less torque than straight tusks would have provided . The tusks were usually asymmetrical , with considerable variation ; some tusks curved down , instead of outwards , or were shorter due to breakage . Columbian mammoth tusks were generally less twisted than those of woolly mammoths . At six months of age calves developed milk tusks a few centimeters long , which were replaced by permanent tusks a year later . Annual tusk growth of 2 @. @ 5 ? 15 cm (0 @. @ 98 ? 5 @. @ 91 in) continued throughout life , slowing as the animal reached adulthood .

Columbian mammoths had four functional molar teeth at a time , two in the upper jaw and two in the lower . About 23 cm (9 @. @ 1 in) of the crown was within the jaw , and 2 @. @ 5 cm (1 in) was above . The crown was pushed forward and up as it wore down , comparable to a conveyor belt . The teeth had separated ridges of enamel , which were covered in " prisms " directed towards the chewing surface . Wear @-@ resistant , they were held together with cementum and dentin . A mammoth 's molars were replaced five times over the animal 's lifetime . The first molars were about the size of those of a human , 1 @. @ 3 cm (0 @. @ 51 in) ; the third were 15 cm (5 @. @ 9 in) long , and the sixth were about 30 cm (1 ft) long and weighed 1 @. @ 8 kg (4 lb) . With each replacement , the molars grew larger and gained more ridges ; the number of plates varied between individuals . Growing 18 cm (7 @. @ 1 in) of ridge took about 10 @. @ 6 years .

= = Palaeobiology = =

Like that of modern elephants , the mammoth 's sensitive , muscular trunk was a limb @-@ like organ with many functions . It was used for manipulating objects and social interaction . Although healthy adult mammoths could defend themselves from predators with their tusks , trunks and size , juveniles and weakened adults were vulnerable to pack hunters such as wolves and big cats . Bones of juvenile Columbian mammoths , accumulated by Homotherium (the scimitar @-@ toothed cat) , have been found in Friesenhahn Cave in Texas . Tusks may have been used in intra @-@ species fighting for territory or mates and for display , to attract females and intimidate rivals . Two Columbian mammoths that died in Nebraska with tusks interlocked provide evidence of fighting behavior . The mammoths could use their tusks as weapons by thrusting , swiping or crashing them down , and used them in pushing contests by interlocking them , which sometimes resulted in breakage . The tusks ' curvature made them unsuitable for stabbing . On Goat Rock Beach in Sonoma Coast State Park , blueschist and chert outcrops (nicknamed " Mammoth Rocks ") show evidence of having been rubbed by Columbian mammoths or mastodons . The rocks have polished areas 3 ? 4 m (9 @. @ 8 ? 13 @. @ 1 ft) above the ground , primarily near their edges , and are similar to African rubbing rocks used by elephants and other herbivores to rid themselves of mud and parasites . Similar rocks exist in Hueco Tanks , Texas , and on Cornudas Mountain in New Mexico .

Accumulations of modern elephant remains have been called " elephants ' graveyards " , because these sites were erroneously thought to be where old elephants went to die . Similar accumulations of mammoth bones have been found ; it is thought these are the result of individuals dying near or in rivers over thousands of years and their bones being accumulated by the water (such as in the Aucilla River in Florida) , or animals dying after becoming mired in mud . Some accumulations are thought to be the remains of herds which died at the same time , perhaps due to flooding . Columbian mammoths are occasionally preserved in volcanic deposits such as those in Tocuila , Texcoco , Mexico , where a volcanic lahar mudflow covered at least seven individuals 12 @, @ 500 years ago . It is unknown how many mammoths lived at one location at a time , but it is likely that the number varied by season and life cycle . Modern elephants can form large herds , sometimes consisting of multiple family groups , and these herds can include thousands of animals migrating together . Mammoths may have formed large herds more often than modern elephants , since animals living in open areas are more likely to do this than those in forested areas . Although it is unclear to what extent Columbian mammoths migrated , an isotope analysis of Blackwater Draw in

New Mexico indicated that they spent part of the year in the Rocky Mountains , 200 km (120 mi) away . The study of tusk rings may aid further study of mammoth migration .

Like modern elephants , Columbian mammoths were probably social and lived in matriarchal (female @-@ led) family groups ; most of their other social behavior was also similar to that of modern elephants . This is supported by fossil assemblages such as the Dent Site in Colorado and the Waco Mammoth National Monument in Waco , Texas , where groups consisting entirely of female and juvenile Columbian mammoths have been found (implying female @-@ led family groups) . The latter assemblage includes 22 skeletons , with 15 individuals representing a herd of females and juveniles that died in a single event , probably a flash flood ; the arrangement of some of the skeletons suggests that the females may have formed a defensive ring around the juveniles . At the same site another group , consisting of a bull and six females , also appears to have been killed by a flash flood ; although both groups died between 64 @,@ 000 and 73 @,@ 000 years ago , whether they died in the same event is unknown . At the Murray Springs Clovis Site in Arizona , where several Columbian mammoth skeletons have been excavated , a trackway similar to that left by modern elephants leads to one of the skeletons . The mammoth may have made the trackway before it died , or another individual may have approached the dead or dying animal ? similar to the way modern elephants guard dead relatives for several days .

= = = Natural traps = = =

Many specimens also accumulated in natural traps , such as sinkholes and tar pits . The Hot Springs Mammoth Site in South Dakota is a 26 @,@ 000 @-@ year @-@ old , approximately 40 m (130 ft) -long sinkhole that functioned for 300 to 700 years before filling with sediment . The site is the opposite scenario of that in Waco ; all but one of the at least 55 skeletons ? additional skeletons are excavated each year ? are male , and accumulated over time rather than in a single event . It is assumed that like modern male elephants , male mammoths primarily lived alone , were more adventurous (especially young males) and more likely to encounter dangerous situations than the females . The mammoths may have been lured to the hole by warm water or vegetation near the edges , slipping in and drowning or starving . Isotope studies of growth rings have shown that most of the mammoths died during spring and summer , which may have correlated with vegetation near the sinkhole . One individual , nicknamed " Murray " , lies on its side , and probably died in this pose while struggling to get free . Deep footprints of mammoths attempting to free themselves from the sinkhole 's mud can be seen in vertically @-@ excavated sections of the site .

Since the early 20th century , excavations at the La Brea Tar Pits in Los Angeles have yielded 100 tonnes of fossils from 600 species of flora and fauna , including several Columbian mammoths . Many of the fossils are the remains of animals that became stuck in asphalt puddles which seeped to the surface of the pits , 40 @,@ 000 to 11 @,@ 500 years ago . Dust and leaves likely concealed the liquid asphalt , which then trapped unwary animals . Mired animals died from hunger or exhaustion ; their corpses attracted predators , which sometimes became stuck themselves . The tar pits ' fossil record is dominated by the remains of predators , such as large canids and felids . Fossils of different animals are found stuck together when they are excavated from the pits . The tar pits do not preserve soft tissue , and a 2014 study concluded that asphalt may degrade the DNA of animals mired in it after an attempt was made to extract DNA from a Columbian mammoth .

= = = Diet = = =

An adult Columbian mammoth would have needed more than 180 kg (400 lb) of food per day , and may have foraged for twenty hours a day . Mammoths chewed their food by using their powerful jaw muscles to move the mandible forward and close the mouth , then backward while opening ; the sharp enamel ridges thereby cut across each other , grinding the food . The ridges were wear @-@ resistant , enabling the animal to chew large quantities of food which contained grit . The trunk could be used for pulling up large tufts of grass , picking buds and flowers or tearing leaves and branches from trees and shrubs , and the tusks were used to dig up plants and strip bark from trees . Digging

is indicated on preserved tusks by flat , polished sections of the surface that would have reached the ground . Isotope studies of Columbian mammoths from Mexico and the United States have shown that their diet varied by location , consisting of a mix of C3 (most plants) and C4 plants (such as grasses) , and they were not restricted to grazing or browsing .

Stomach contents from Columbian mammoths are rare , since no carcasses have been found , but plant remains were discovered between the pelvis and ribs of the " Huntington mammoth " when it was excavated in Utah . Microscopy showed that these chewed remains consisted of sedge , grass , fir twigs and needles , oak and maple . A large amount of mammoth dung has been found in two caves in Utah . The dry conditions and stable temperature of Bechan Cave (bechan is Navajo for " large faeces ") has preserved 16,000- to 13 @, @ 500 @-@ year @-@ old elephant dung , most likely from Columbian mammoths . The dung consists of 95 percent grass and sedge , and varies from 0 to 25 percent of woody plants between dung boluses , including saltbush , sagebrush , water birch and blue spruce . This is similar to the diet documented for the woolly mammoth , although browsing seems to have been more important for the Columbian mammoth . The cover of dung is 41 cm (16 in) thick , and has a volume of 227 m ³ (8 @, @ 000 cubic ft) , with the largest boluses 20 cm (7 @. @ 9 in) in diameter . The Bechan dung could have been produced by a small group of mammoths over a relatively short time , since adult African elephants drop an average of 11 kg (24 lb) of dung every two hours and 90 ? 135 kg (198 ? 298 lb) each day .

It has been proposed that giant North American fruits of plants such as the Osage @-@ orange , Kentucky coffeetree and honey locust evolved in tandem with now @-@ extinct American megafauna such as mammoths and other proboscideans , since there are no extant endemic herbivores able to ingest these fruits and disperse their seeds . Introduced cattle and horses have since taken over this ecological role .

= = = Life history = = =

The lifespan of the Columbian mammoth is thought to have been about 80 years . The lifespan of a mammal is related to its size ; Columbian mammoths are larger than modern elephants , which have a lifespan of about 60 years . The age of a mammoth can be roughly determined by counting the growth rings of its tusks when viewed in cross section . However , ring @-@ counting does not account for a mammoth 's early years ; early growth is represented in tusk tips , which are usually worn away . In the remainder of the tusk each major line represents a year , with weekly and daily lines found in between . Dark bands correspond to summer , making it possible to determine the season in which a mammoth died . Tusk growth slowed when foraging became more difficult , such as during illness or when a male mammoth was banished from the herd (male elephants live with their herds until about the age of ten) .

Mammoths continued growing during adulthood , as do other elephants . Males grew until age 40 , and females until age 25 . Mammoths may have had gestation periods of 21 ? 22 months , like those of modern elephants . Columbian mammoths had six sets of molars in the course of a lifetime . At 6 ? 12 months the second set of molars would erupt , with the first set worn out at 18 months of age . The third set of molars lasted for ten years , and this process was repeated until the sixth set emerged at 30 years of age . When the last set of molars wore out the animal would be unable to chew , and would die of starvation .

Almost all vertebrae of the " Huntington mammoth " , a very aged specimen , were deformed by arthritic disease , and four of its lumbar vertebrae were fused ; some bones also indicate bacterial infection , such as osteomyelitis . The condition of the bones suggests the specimen died of old age and malnutrition .

= = Distribution and habitat = =

Columbian mammoths inhabited the southern half of North America , ranging from the northern United States across Mexico as far south as Costa Rica . One Costa Rican specimen , a molar , was reported in 1963 but has since been lost . The environment in these areas may have had more

varied habitats than those inhabited by woolly mammoths in the north (the mammoth steppe) . Some areas were covered by grass , herbaceous plants , trees and shrubs ; their composition varied from region to region , and included grassland , savanna and aspen parkland habitats . There were also wooded areas ; although mammoths would not have preferred forests , clearings could provide them with grass and herbs .

The Columbian mammoth shared its habitat with other now @-@ extinct Pleistocene mammals (such as Glyptodon , Smilodon , ground sloths , Camelops and the American mastodon) , horses and buffalos . It did not live in Arctic Canada , which was inhabited by woolly mammoths . Fossils of woolly and Columbian mammoths have been found in the same place in a few areas of North America where their ranges overlapped , including the Hot Springs Site . It is unknown whether the two species were sympatric and lived there simultaneously , or if the woolly mammoths entered southern areas when Columbian mammoth populations were absent . The Columbian mammoth coexisted with the other extinct proboscideans *Stegomastodon mirificus* and *Cuvieronius tropicus* at sites in Texas and New Mexico during the early Irvingtonian .

= = Relationship with humans = =

Humans entered the Americas through Beringia , and evidence documents their interactions with Columbian mammoths . Tools made from Columbian mammoth remains have been discovered in several North American sites . At Tocuila , Mexico , mammoth bones were quarried 13 @,@ 000 years ago to produce lithic flakes and cores . At the Lange @-@ Ferguson Site in South Dakota , the remains of two mammoths were found with two 12 @,@ 800 @-@ year @-@ old cleaver choppers made from a mammoth shoulder blade ; the choppers had been used to butcher the mammoths . At the same site , a flake knife made from a long mammoth bone was also found wedged against mammoth vertebrae . At Murray Springs , archaeologists discovered a 13 @,@ 100 @-@ year @-@ old object made from a mammoth femur ; the object is thought to be a shaft wrench , a tool for straightening wood and bone to make spear @-@ shafts (the Inuit use similar tools) .

The earliest suggested evidence of Columbian mammoth @-@ butchering in America (from Lovewell , Kansas) dates from 18 @,@ 000 to 21 @,@ 000 years ago . Paleo @-@ Indians of the Clovis culture , which arose 7 @,@ 000 years later , may have been the first humans to hunt mammoths extensively . These people are thought to have hunted Columbian mammoths with Clovis pointed spears which were thrown or thrust . Although Clovis points have been found with Columbian mammoth remains at several sites , archaeologists disagree about whether the finds represent hunting , scavenging dead mammoths , or are coincidental . A female mammoth at the Naco @-@ Mammoth Kill Site in Arizona , found with eight Clovis points near its skull , shoulder blade , ribs and other bones , is considered the most convincing evidence for hunting . In modern experiments , replica spears have been able to penetrate the rib cages of African elephants with re @-@ use causing little damage to the points .

Other sites show more circumstantial evidence of mammoth hunting , such as piled bones bearing butcher marks . Some of these sites are not closely associated with Clovis points . The Lehner Mammoth @-@ Kill Site and the Dent Site , where multiple juvenile and adult mammoths have been found with butcher marks and in association with Clovis points , were once interpreted as the killing of entire herds by Clovis hunters . However , isotope studies have shown that the accumulations represent individual deaths at different seasons of the year , and therefore not herds killed in single incidents . Many other such assemblages of bones with butcher marks may also represent accumulations over time , and are therefore ambiguous as evidence for large scale hunting .

Petroglyphs in the Colorado Plateau depict either Columbian mammoths or mastodons . A 13 @,@ 000 @-@ year @-@ old bone fragment from Vero Beach , Florida , the earliest example of art in the Americas , is engraved with either a mammoth or a mastodon . 11 @,@ 000 ? 13 @,@ 000 @-@ year @-@ old petroglyphs from the San Juan River in Utah are thought to include depictions of two Columbian mammoths ; the mammoths ' domed heads distinguish them from mastodons . They are also shown with two " fingers " on their trunks , a feature known from European depictions of mammoths . The tusks are short , which may indicate they are meant to be females . A carving of a

bison (possibly the extinct *Bison antiquus*) is superimposed on one of the mammoth carvings and may be a later addition . Other possible depictions of Columbian mammoths have been shown to be either misinterpretations or fraudulent .

The Columbian mammoth is the state fossil of Washington and South Carolina . Nebraska 's state fossil is " Archie " , a Columbian mammoth specimen found in the state in 1922 . " Archie " is currently on display at Elephant Hall in Lincoln , Nebraska , and is the largest mounted mammoth specimen in the United States .

= = Extinction = =

Columbian and woolly mammoths both disappeared during the late Pleistocene and early Holocene , alongside most of the Pleistocene megafauna . The most recent Columbian mammoth remains have been dated to around 11 @, @ 500 years ago . This extinction formed part of the Quaternary extinction event , which began 40 @, @ 000 years ago and peaked between 14 @, @ 000 and 11 @, @ 500 years ago . Scientists do not know whether these extinctions happened abruptly or were drawn out . During this period , 40 mammal species disappeared from North America , almost all of which weighed over 40 kg (88 lb) ; the extinction of the mammoths cannot be explained in isolation .

Scientists are divided over whether climate change , hunting , or a combination of the two , drove the extinction of the Columbian mammoths . According to the climate change hypothesis , warmer weather led to the shrinking of suitable habitat for Columbian mammoths , which turned from parkland to forest , grassland and semi @-@ desert , with less diverse vegetation . The overkill hypothesis , on the other hand , attributes the extinction to hunting by humans . This idea was first proposed by Paul S. Martin in 1967 ; more recent research on this subject have varied in their conclusions . A 2002 study concluded that the archaeological record did not support the overkill hypothesis , given that only 14 Clovis sites (12 with mammoth remains and two with mastodon remains) out of 76 examined provided strong evidence of hunting . In contrast , a 2007 study found that the Clovis record indicated the highest frequency of prehistoric exploitation of proboscideans for subsistence in the world , and supported the overkill hypothesis . Whatever the actual cause of extinction , large mammals are generally more vulnerable than smaller ones due to their smaller population size and low reproduction rates .