

First Americans

I INTRODUCTION

First Americans, the earliest humans to arrive in the Americas. The first people to come to the Americas arrived in the Western Hemisphere during the late Pleistocene Epoch (1.6 million to 10,000 years before present). Most scholars believe that these ancient ancestors of modern Native Americans were hunter-gatherers who migrated to the Americas from northeastern Asia.

For much of the 20th century it was widely believed the first Americans were the Clovis people, known by their distinctive spearpoints and other tools found across North America. The earliest Clovis sites date to 11,500 years ago. However, recent excavations in South America show that people have lived in the Americas at least 12,500 years. A growing body of evidence—from other archaeological sites to studies of the languages and genetic heritage of Native Americans—suggests the first Americans may have arrived even earlier.

Many of the details concerning the first settlement of the Americas remain shrouded in mystery. Today the search for answers involves researchers from diverse fields, including archaeology, linguistics, skeletal anatomy, and molecular biology. The challenge for researchers is to find evidence that can help determine when the first settlers arrived, how these people made their way into the Americas, and if migrating groups traveled by different routes and in multiple waves. Some archaeologists and physical anthropologists have suggested that one or more of these migrations originated from places outside of Asia, although this view is not widely accepted.

Whoever they were and whenever they arrived, the first Americans faced extraordinary challenges. These hardy settlers encountered a vast, trackless new world, one rich in animals and plants and yet entirely without other peoples. As they entered new territories, they had to locate essential resources, such as water, food, and materials to make or repair their tools. They had to learn which of the unfamiliar animals and plants would feed or cure them and which might hurt or kill them. Their efforts ultimately proved successful. By the time European exploration of the Americas began in the late 15th century, the descendants of these ancient colonizers numbered in the millions.

II THE LATE PLEISTOCENE

From their evolutionary origins in Africa, anatomically modern humans, *Homo sapiens*, steadily spread out across Earth's landmasses (see Human Evolution). By 25,000 to 35,000 years ago humans had reached the far eastern reaches of modern Siberia in northeastern Asia—a region believed to be the most likely point of departure for any early migration to North America. Humans arrived in this remote corner of the world during the last major period of the

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Pleistocene Epoch, or Ice Age (see ice ages). Great glaciers covered much of the Northern Hemisphere at this time. In North America two immense ice sheets, the Laurentide in the east and the Cordilleran in the west, buried much of modern Canada and Alaska, as well as northern portions of the continental United States.

Pleistocene climates and environments were different than they are today, and so too was the Earth's surface. Glaciers had captured a significant amount of the world's water on land. Because that water no longer drained back to the oceans, worldwide sea levels dropped. Average sea levels were as much as 135 m (440 ft) lower than they are today.

A Beringia

As sea levels fell, large expanses of previously submerged continental shelf became dry land, including the area beneath what is now the Bering Sea. This area formed a 1,600-km- (1,000-mi-) wide land bridge that connected the northeastern tip of Asia and the western tip of modern Alaska. Known as Beringia, this natural land bridge existed from about 25,000 to nearly 10,000 years ago. It was a flat, cold, and dry landscape, covered primarily in grassland, with occasional shrubs and small trees. People and animals could use Beringia to walk from Siberia to Alaska and back.

B Possible Migration Routes

Migrants from northeastern Asia could have trekked to Alaska with relative ease when Beringia was above sea level. But traveling south from Alaska to what is now the continental United States posed significant challenges for any would-be colonizers. There were two possible routes south for migrating people: down the Pacific coast, or by way of an interior passage along the eastern flank of the Rocky Mountains. When the Laurentide and Cordilleran ice sheets were at their maximum extent, both routes were likely impassable. The Cordilleran reached across to the Pacific shore in the west and its eastern edge abutted the Laurentide, near the present border between British Columbia and Alberta.

B1 Pacific Coast Route

Geological evidence suggests the Pacific coast route was open for overland travel before 23,000 years ago and after 14,000 years ago. During the coldest millennia of the last ice age, roughly 23,000 to 19,000 years ago, lobes of glaciers hundreds of kilometers wide flowed down to the sea. Deep crevasses scarred their surfaces, making travel across them dangerous. Even if people traveled by boat—a claim for which there is currently no direct archaeological evidence—the journey would have been difficult. There were almost certainly fleets of icebergs to outmaneuver. Rivers of sediment draining Cordilleran glacial fields severely restricted the availability of near-shore marine life, which early colonizers would have

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relied on for nourishment. By 14,000 to 13,000 years ago, however, the coast was ice-free. By then, too, the climate had warmed, and coastal lands were covered in grass and trees. Hunter-gatherer groups could have readily replenished their food supplies, repaired clothing and tents, and replaced broken or lost tools.

B2 Ice-Free Corridor

The warming climate gradually opened a second possible migration route through the massive frozen wilderness in the continental interior. Geologic evidence indicates that by 11,500 years ago the Cordilleran and Laurentide ice sheets had retreated far enough to open a habitable ice-free corridor between them. By then, much of the exposed land was probably restored enough to support plants and animals on which migrating hunter-gatherer peoples depended.

III ESTABLISHING A PLEISTOCENE PRESENCE IN THE AMERICAS

A Early Investigations

Scientific inquiry into the peopling of the Americas began in the 1870s. At that time, many scholars wondered if modern humans had lived in the Americas for as long as they had in Europe, where numerous Stone Age sites indicated a Pleistocene-era occupation. Excavations at these sites revealed hand axes and other relatively simple stone tools, human bones, and the remains of several now-extinct animals, including the woolly mammoth. The discovery of Pleistocene-age animals alongside human bones and artifacts helped 19th-century archaeologists establish the age of ancient human encampments in Europe.

Yet, search as they might, American archaeologists found no comparable evidence of a Pleistocene-era human presence. But several sites revealed stone artifacts that some scholars believed looked similar to the ancient stone tools found in Europe. On the basis of this similarity, these experts claimed the American artifacts must be as old. By the 1890s, however, other scholars had challenged this claim. They argued the American and European artifacts did not really look alike, and they noted the American artifacts were of uncertain antiquity because none were found securely embedded in Pleistocene-age geological deposits. A lengthy debate ensued between those who saw evidence for ancient human settlement in the Americas and those who did not. This debate—often loud and sometimes bitter—remained unresolved for more than three decades.

B Discovery at Folsom

In 1927 archaeologists finally demonstrated that humans had occupied the Americas during the Pleistocene. This breakthrough occurred at a site discovered by ranch foreman George McJunkin near Folsom in northeastern New Mexico. Excavations at the site uncovered a stone

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projectile point embedded in the rib bones of a now-extinct bison—an ancestor of the modern North American buffalo. It was clear that a human hunter had killed this Pleistocene-era animal. The Folsom discovery proved beyond doubt that humans had lived in the Americas since the last ice age.

The spearpoints used to bring down the Folsom bison were distinctive, finely made points possessing a flute, or channel, on each face. These Folsom points were quite unlike those of the European Stone Age. American archaeologists coined the term *Paleo-Indian* to identify the ancient Pleistocene Americans who had produced these well-crafted artifacts.

C Clovis: An Earlier Occupation

In the decade after Folsom, more Paleo-Indian sites were discovered. Some held Folsom spearpoints, but others revealed larger, less finely made fluted points. These large points occasionally appeared with the bones of mammoths. The first such find came to light in 1933 at a site near Clovis in eastern New Mexico, where archaeologists found spearpoints and fossils in sediments below those that had produced Folsom artifacts. This meant that the Clovis people, as they came to be known, represented an even older Paleo-Indian culture. Just how much older was determined soon after the development of radiocarbon dating in the late 1940s (see Dating Methods). This modern dating technology showed that the people who made Clovis artifacts had inhabited North America by about 11,500 years ago—some 600 years before the Folsom culture appeared.

IV CLOVIS-FIRST THEORY

The age of the earliest Clovis sites coincided neatly with geological evidence that by 11,500 years ago the Laurentide and Cordilleran ice sheets had retreated far enough to open a habitable ice-free corridor—a fact first recognized by University of Arizona archaeologist C. Vance Haynes. It appeared that Clovis groups had moved south from Alaska through the continental interior right after it became possible to do so. That no sites older than Clovis were found, at least initially, seemed to confirm that Clovis people were the first colonizers of the Americas.

A Rapid Migration

Once they had traveled south of the ice sheets, Clovis groups spread rapidly. Soon after 11,500 years ago, Clovis and Clovis-like materials appear throughout North America. The oldest sites are in the Great Plains and the southwestern United States; younger sites are found in eastern North America. No subsequent group would achieve such a wide distribution in North America. But Clovis groups did not stop in North America. According to the *Clovis-first* theory, they must have continued on to South America. As these groups pushed south, the

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traditional thinking went, they developed different tools and other artifacts that were no longer readily recognizable as Clovis. They arrived at Tierra del Fuego on the southern tip of South America within 1,000 years of leaving Alaska.

The rapid dispersal of Clovis peoples throughout the hemisphere was remarkable given the landscape they traversed. Not only did they travel through desert, plains, and forest, they did so during the environmental upheaval that marked the end of the last Ice Age. Climates were growing warmer—drier in some areas and wetter in others—and the distributions of plants and animals were shifting in complex ways in response to the changing climates. As they entered each new habitat they must have quickly learned to find suitable plant and animal foods. They would need stone to repair their toolkits, freshwater to drink, and the ability to overcome environmental challenges encountered along the way.

B Big-Game Hunters

A long-favored explanation for the rapid spread of Clovis people was that they preyed on large animals, such as mammoth and mastodon. These animals were themselves wide-ranging in their distribution. Archaeologists believed a reliance on big-game hunting meant that Clovis groups would have less need to learn about available local resources.

Archaeologists initially found some support for the big-game hunting hypothesis in archaeological excavations, as well as in the Clovis toolkit itself. Along the San Pedro River in Arizona, for example, are four Clovis sites separated by less than 20 km (12 mi). Each site yielded Clovis points embedded in the skeletons of mammoths. So similar are the points at these sites that they may be the handiwork of a single group, which obviously found good hunting in the area. The artifacts at San Pedro and other Clovis sites include a variety of tools handy for hunting, killing, and butchering game animals. There are the distinctive fluted spearpoints, shown experimentally by University of Wyoming archaeologist George Frison to be capable of bringing down elephant-sized animals. In addition, there are stone knives, scrapers, *gravers* (tools for scoring bone), drills, and a few preserved artifacts of ivory and bone. These tools, which occur in Clovis sites across North America, support the view that Clovis peoples were practicing the same way of life.

Clovis tools were typically made of superior quality fine-grained stone, including chert, jasper, and chalcedony. Such stone is durable and readily flaked by skilled toolmakers into a desired, sharp-edged form. More important, it is easily resharpened and reused. That would be important to hunters pursuing wide-ranging big game. They could continue to use their stone tools as they tracked game far from the quarries where they acquired their stone. Analysis of these tools suggests that Clovis groups commonly traveled distances of 300 km (185 mi). In one instance, a dozen Clovis points quarried from the Texas Panhandle were left as a cache in northeastern Colorado, 485 km (300 mi) away. These distances indicate a range of movement across the landscape far greater than is observed in later periods of American prehistory.

C Big-Game Extinctions

The idea that Clovis people were big-game hunters could help explain an unsolved puzzle of the Americas in the late Pleistocene: the catastrophic extinction of dozens of species of large animals. Across the Americas millions of large animals—known as *megafauna*—disappeared. These animals included the mammoth, mastodon, and the giant ground sloth, as well as the horse, the camel, and many other herbivores. Some very large and formidable carnivores also died out, including the American lion, the saber-toothed tiger, and the giant short-faced bear. These extinctions were thought to coincide with the arrival of Clovis groups, a chronological coincidence that led University of Arizona ecologist Paul Martin to propose the hypothesis of Pleistocene overkill. This hypothesis, first put forward in 1967, contends that Clovis big-game hunters caused the extinctions. Martin suggested that overkill was especially likely—even inevitable—if Clovis groups were the first Americans. For if the megafauna had never before faced human hunters, they would have been especially vulnerable prey to this new, dangerous, two-legged predator.

V CHALLENGES TO CLOVIS-FIRST

For decades the Clovis-first theory seemed to fit well with the available geologic and archaeological evidence. However, some archaeologists always harbored doubts about the Clovis-first scenario. These doubts intensified toward the end of the 20th century. A reassessment of Clovis subsistence led many to challenge the traditional view of Clovis people as big-game hunting specialists. In addition, the discovery of a pre-Clovis human presence in the Americas has undermined the claim that Clovis people were the first Americans.

A A Broader View of Clovis Subsistence

Since the 1980s there has been increasing skepticism about the traditional view that Clovis groups were dependent on big-game hunting. Despite many years of searching, few Clovis archaeological sites have yielded evidence to support this view. The San Pedro Valley sites have proved to be the exception, not the rule. There are scarcely a dozen Clovis big-game kill sites known, mostly in western North America, with two possible kill sites in eastern North America. These contain the skeletal remains of just two of the Pleistocene megafauna—mammoth and mastodon. Clovis people did kill big game, but apparently not as often as once supposed.

A1 Diverse Diet

A broader view of Clovis subsistence now suggests that they often targeted slower, smaller, less dangerous prey. The roasted remains of turtles, for example, have been found at many

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sites, including Aubrey and Lewisville in Texas, Little Salt Spring in Florida, and even at the original Clovis site in New Mexico. Other sites indicate that the diet in Clovis times included small- and medium-sized mammals, such as beaver, snowshoe hare, and caribou, as well as fish and a variety of gathered plants.

A2 Big-Game Extinctions: Other Causes

Over time, it also became clear that the Pleistocene overkill hypothesis was not strongly supported by the archaeological record. Archaeologists have yet to document a single Clovis sloth kill, horse kill, camel kill, or a kill of any of the other several dozen megafaunal species. Whatever caused the extinction of these animals, it was not human hunting. Scientists are currently pursuing alternative hypotheses to explain megafaunal extinctions, such as the possibility they were caused by late Pleistocene climatic and environmental change, or perhaps disease. The puzzle remains unsolved.

A3 Multipurpose Toolkit

A revised view of Clovis subsistence coincides with a reevaluation of the Clovis toolkit. Analysis of Clovis spearpoints shows they were adequate weapons for bringing down big game, but they were not always used that way. Few spearpoints show the kinds of damage that routinely occurs when stone projectiles meet animal bone. Clovis points, like many items in the Clovis toolkit, were most likely used as multipurpose tools; many spearpoints show wear patterns indicating they were used as knives. There is also more variety in the Clovis toolkit than traditionally supposed. Clovis groups in different areas occasionally fashioned tools needed for particular tasks in the environments in which they found themselves. In addition, they probably made tools—perhaps wooden digging sticks or woven plant fiber nets with which to catch fish or small game—that have not been preserved from that remote time. A varied, multipurpose toolkit is to be expected of groups that hunt and gather a range of foods.

A4 Clovis Explorers

If they were not pursuing wide-ranging big game, why were Clovis groups moving such great distances across the landscape? The answer may be exploration. Hunter-gatherer peoples need to know where to go when resources in one location begin to diminish, as animals are hunted out or flee and as available plants are gathered up. For colonizers in an unfamiliar landscape, that means ranging widely across newly discovered lands to see what resources occur where, when, and in what abundance. Not knowing where they might encounter stone to refurbish their tools on their journeys, it is not surprising that Clovis explorers selected only the highest quality stone for their toolkits, or that they left caches of tools along their way—as the cache in Colorado demonstrates. They could return to the caches to replace diminished supplies without having to walk all the way back to a distant stone quarry.

B Pre-Clovis Settlement of the Americas

Claims of a pre-Clovis human occupation in the Americas have been around for decades. By the 1980s, dozens of such sites had been reported, some estimated to be as much as 200,000 years old.

Archaeologists have carefully scrutinized each site to determine if three basic criteria are present. Sites lacking all three criteria cannot be accepted as valid. First, the site must have genuine artifacts produced by humans or human skeletal remains. Second, these artifacts or remains must be found in unmixed geological deposits to ensure that younger objects are not accidentally buried in older layers of sediment. Third, these artifacts or remains must be accompanied by reliable radiocarbon dates that indicate a pre-Clovis occupation. For decades all sites reputed to be of pre-Clovis age failed to meet these criteria. All, that is, except one.

B1 Breakthrough at Monte Verde

In the mid-1970s University of Kentucky archaeologist Tom Dillehay began excavating at Monte Verde, a site on the banks of Chinchihuapi Creek in southern Chile. Monte Verde is an extraordinary site. Unusual geological conditions quickly buried the remains of an ancient camp beneath wet, swampy sediments. Since the remains left on the surface by the site's inhabitants were not exposed to the air, many organic remains—which normally decay and disappear—were preserved.

Dillehay's team found an astonishing array of organic materials. These included wooden foundation timbers of roughly rectangular huts, finely woven string, and chewed leaves, seeds and other plant parts from nearby species—many with food or medicinal value. In addition, excavations revealed burned bones of mastodon along with pieces of its meat and hide. Some bits of hide still clung to pieces of wooden timbers, the apparent remnants of hide-coverings that once draped over the huts. Also found was the footprint of a child in the once-sticky mud, an assortment of hearths, and hundreds of stone, bone, and wood artifacts. Dillehay's team firmly radiocarbon dated these organic remains to 12,500 years ago—1,000 years before Clovis times.

The excavations at Monte Verde lasted nearly a decade, and the laboratory research, analysis, and writing about what Dillehay's team had found took another dozen years. Dillehay's findings had to be carefully studied and presented in order to overcome the skepticism of archaeologists who had grown accustomed to seeing pre-Clovis claims fail. When Dillehay's second book on the results of his investigations appeared in 1997, most archaeologists were convinced; the Clovis barrier had fallen at last.

B2 Other Possible Pre-Clovis Sites

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Since Monte Verde, several new candidates for a pre-Clovis settlement in North America have appeared. The Cactus Hill site in Virginia has yielded artifacts below layers in which Clovis-like fluted points were found. Precisely how old those more deeply buried artifacts might be is uncertain, however. The layer in which they were found has produced widely varying radiocarbon ages, from 16,000 years ago to modern times. It therefore remains unclear how old these artifacts might be. Archaeologists have also refocused attention on the Meadowcroft Rockshelter in Pennsylvania. Excavations at Meadowcroft in the 1970s and 1980s produced unmistakable artifacts in deposits perhaps as much as 14,250 years old. Questions remain, however, about whether the artifacts and organic remains are as old as the radiocarbon-dated charcoal. For the time being, neither site, nor any of the other sprinkling of recent pre-Clovis claims, is fully accepted by a still-cautious archaeological community.

VI THE FIRST AMERICANS: ALTERNATIVE THEORIES

The excavations at Monte Verde conclusively demonstrated that people inhabited the Americas in pre-Clovis times. But Monte Verde also raised many new questions about the first Americans. Several new theories have been advanced to explain the identity, antiquity, and entryway of the first Americans.

Most archaeologists believe the first Americans—whether traveling in a single migration or multiple migrations—originated in northeastern Asia. This view is based mainly on geological evidence that a land bridge once connected Asia and North America and on genetic similarities between northeastern Asian peoples and Native Americans. It is not, however, founded on any direct archaeological evidence. The kinds of tools typical of the Monte Verde site or Clovis culture are not found in either northeastern Asia or Beringia. But Monte Verde is far from that region and in a very different environmental setting, so it is not surprising its artifacts are different.

Although archaeologists have yet to find a single Clovis spearpoint in northeastern Asia, one artifact comes close: a stone point from the site of Uptar in Siberia that has a flute on one face. But the age of the spearpoint is unknown, and it is not otherwise similar to Clovis fluted points. There are archaeological sites in Alaska, such as the Nenana Complex, that slightly predate Clovis. However, these sites lack the hallmark of Clovis technology: fluted stone projectile points. A few Clovis-like fluted points have been found in Alaska, but these are younger, not older, than those to the south.

The absence of similar artifacts in Siberia or Alaska is not surprising. Finding archaeological traces of a small group, or several groups, that briefly passed through this vast area is a difficult task. In addition, the most recognizable feature of the first Americans' toolkit—fluted spearpoints in the case of the Clovis people—may not have been invented until the migrants reached what is now the continental United States. For a few archaeologists, however, the lack

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of Clovis spearpoints in northeastern Asia and Alaska suggests an alternative hypothesis: that these early colonizers did not come from Asia.

A Pacific Coast Route

Working from the assumption that the first Americans originated in northeastern Asia, many archaeologists are researching the possibility that ancient migrants traveled overland down the Pacific coast. Some researchers have suggested these people used small, skin-covered boats, although no direct archaeological evidence exists to support this claim. By about 14,000 years ago the vast North American ice sheets had retreated far enough to open the Pacific Coast route for travel—an event that occurred some 2,500 years before a habitable ice-free corridor opened in the North American interior. A coastal migration could explain how people arrived in Monte Verde 12,500 years ago. By the time the interior route opened, the ancient Monte Verdeans had long departed from the banks of Chinchihuapi Creek.

Finding sites occupied by coastal migrants, however, is no easy task. Much of the late Pleistocene-age shoreline along which migrating groups would have traveled was later submerged when the continental ice sheets melted and their waters returned to the sea. To meet this challenge, researchers are using sonar and taking core samples from the sea floor to explore and probe underwater landscapes and coastlines.

Archaeological excavations have occurred at sites on several islands off the coasts of Alaska and British Columbia. The effort has had some initial success. A cave on Prince of Wales Island in southeastern Alaska has yielded artifacts and human remains radiocarbon dated to about 10,000 years ago. Bear remains from another part of the same cave are dated to 41,000 years ago. These findings provide tantalizing hope that still older traces of a human presence can be found in this area. Further south, on one of the Channel Islands off the coast of California, and at several coastal Peruvian sites, materials as much as 11,000 years old have been found. Still, none of these sites have produced remains old enough to be those of the first Americans.

B North Atlantic Route

Some archaeologists believe the first Americans did not come from northeastern Asia, but from Europe, crossing the North Atlantic Ocean by boat. No ancient boats have been found, but proponents note that modern humans traveled by boat to Australia perhaps 30,000 to 40,000 years ago. Archaeological support for this theory is based mainly on similarities observed between Clovis artifacts and those of the Solutrean Period of prehistoric Europe. Some researchers also find support for a North Atlantic route in several ancient human skeletons found in the Americas. These skeletons, proponents argue, appear to have more anatomical similarities with modern Europeans than with modern Native Americans.

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Despite the claimed similarities, Solutrean and Clovis artifacts have important differences—in form, method of manufacture, and materials. Most obviously, Solutrean points lack fluting, and Solutrean sites include many stone artifacts and bone tools never found in the Americas. Most archaeologists believe the similarities in artifacts that do exist can be explained as the result of cultural convergence. The concept of cultural convergence suggests that different groups at different times and places might create or use similar materials or tools in similar ways. Solutrean and Clovis cultures are also separated by many thousands of kilometers, most of which is ocean, and by 5,000 years. The Solutrean period ended more than 16,500 years ago, while the earliest Clovis site is only 11,500 years old.

The ancient American skeletons considered by some archaeologists to be anatomically distinct from modern Native Americans also fail to support a North Atlantic route. After more detailed anatomical study, those remains proved to be far less similar to Europeans than initially believed. Many physical anthropologists believe all ancient skeletal remains found in the Americas are ancestral Native Americans. The fact that ancient and modern Native Americans do not precisely resemble each other is not surprising: many thousands of years of anatomical and evolutionary change separate them. In addition, for several thousand years after the Americas were first settled, the human population was small, widely scattered, and groups were relatively isolated for long periods of time. Under these circumstances, variability in anatomical features can emerge. Groups of ancient Americans would not necessarily look alike, let alone resemble their descendants many thousands of years later.

VII LINGUISTIC AND GENETIC STUDIES OF NATIVE AMERICANS

If the first Americans migrated from northeast Asia, then the study of modern Native American people—descendants of the first Americans—may hold vital clues about the number and timing of the ancestral migrations to the Americas. Linguists and geneticists have searched for these clues in the languages and genetic heritage of modern Native Americans.

A Linguistic Research

Linguistic studies are based on the assumption that ancient elements, or “echoes,” of an ancestral language can still be heard in the shared words, grammar, sounds, and meanings of the diverse languages spoken by modern Native Americans (see Native American Languages). By searching for these elements, researchers hope to learn if all Native American languages evolved from a single ancestral tongue. This common ancestral tongue, if present, may be the language spoken by the earliest Americans. If these elements are not present, however, they could indicate the Americas were peopled at different times by groups speaking distant or unrelated languages.

Linguists are still searching for answers. Most linguists, however, believe the sheer number and variety of Native American languages—of which hundreds are known—bespeaks a long period of language diversification. University of California linguist Johanna Nichols estimates that language diversification in the Americas began as early as 35,000 years ago.

B Genetic Research

Historical studies of the genetic material of modern Native Americans appear to offer additional clues about the earliest Americans. These studies are based on the knowledge that some types of deoxyribonucleic acid (DNA, the chemical that encodes genetic information) are inherited strictly from one parent or the other, but not both. Mitochondrial DNA (mtDNA) is passed from mothers to their offspring, and Y-chromosome DNA is passed from fathers to sons. Genetic change in these types of DNA is a result of mutation, not recombination of the parents' DNA. By looking at the genetic difference in mtDNA or Y-chromosome DNA over time, researchers can determine how closely related certain populations are and how much time has elapsed since they were members of the same population.

Genetic studies have shown that virtually all Native Americans share a set of four major mtDNA lineages, and at least two such lineages on their Y chromosome. This indicates these groups are all closely related to one another. The nearest relatives of Native Americans beyond the Americas are the native peoples of northeastern Asia. Native Americans are unrelated genetically to Europeans. Geneticists have variously estimated that peoples of Asia and the Americas were part of the same population from 21,000 to 42,000 years ago.

Geneticists, like linguists, still debate when and how many migratory bands may have trekked from Asia to the Americas. Some scholars believe the evidence indicates a single migration. Others see support for multiple movements of people across Beringia and back. How this is resolved, and how the genetic heritage and languages of modern Native Americans are linked to ancient archaeological data, such as Clovis artifacts, remain important unsolved challenges.

VIII TRACING AMERICAN ANCESTRY: LEGAL CHALLENGES

One of the most obvious ways of directly linking ancient and modern Native Americans is by examining the DNA found in prehistoric human skeletal remains. Such remains are extremely rare, however, and recovering DNA from ancient remains can be difficult, if it is even preserved. In the United States the difficulty of linking ancient remains with modern Native Americans might be a strictly scientific concern were it not for legislation that has influenced the progress and conduct of such research.

The Native American Graves Protection and Repatriation Act (NAGPRA), signed into law in 1990, was aimed at righting the wrongs of earlier generations of scientists. In the past,

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researchers sometimes indiscriminately collected the bones of Native Americans for study and display in museums and universities. Native American peoples were not the only groups to receive such treatment, but their remains and artifacts were gathered in lopsided numbers. To many Native Americans, this was one more instance of mistreatment at the hands of Euro-Americans. In response, NAGPRA required institutions in possession of Native American skeletal remains and artifacts to return them at the request of known lineal descendants.

A Proving Lineal Descent

In the wake of NAGPRA, thousands of skeletons and associated artifacts were returned to Native American peoples. Many of these objects are only a few hundred years old. In such cases, debates over the identity of the descendants have been rare. Other cases, particularly those involving older remains, are more difficult to resolve. Proving lineal descent in cases of greater antiquity is no easy task. This is because descendants of early Americans formed new groups as populations grew, and these groups moved away to settle new lands. A group living 11,000 years ago would almost certainly be ancestral to many modern Native American tribes, not just one. In the future, geneticists may identify sufficiently precise genetic markers to link DNA extracted from ancient human skeletal remains with a group of modern tribes. But in most cases, it will be difficult to make the link to only one tribe.

B The Case of Kennewick Man

In one prominent case involving ancient skeletal remains, the debate over lineal descent ended up in a court of law. The remains, known as Kennewick Man, were found in 1996 on the Columbia River near Kennewick, Washington, on property belonging to the federal government. A skull and more than 300 bones and bone fragments were found at the site, making up among the oldest, best preserved, and most complete human remains ever found in North America. Initial radiocarbon dating indicated the remains were between 7,000 and 9,500 years old. Five Native American tribes living in the area submitted a joint claim under NAGPRA for the return of the remains. A group of archaeologists and physical anthropologists then filed a lawsuit to block the return until detailed scientific studies, including analysis of Kennewick Man's DNA, could be conducted.

The lawsuit sparked several years of legal and scientific wrangling. The Native American groups felt scientific studies were an unnecessary desecration of the remains. They believed they had lived in the area since the beginning of human prehistory in the Americas; therefore, Kennewick Man must be one of their ancestors. The scientists bringing the lawsuit, however, argued that ancestry could not be ascertained without detailed study. This research, they noted, would also add vital information to the meager knowledge about ancient American peoples. Both sides were well intentioned, and under the ambiguous terms of NAGPRA, both

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were right. NAGPRA allows lineal descendants to be identified not just by DNA, but also by tribal traditions and geographic proximity.

In 2004 a three-judge panel of a federal appeals court ruled in favor of the scientists. The tribes chose not to appeal the decision to the Supreme Court of the United States, and in July 2005 scientists began the first phase of studies on the remains. Fortunately, few NAGPRA cases have been as contentious as that surrounding Kennewick Man. The human remains from Prince of Wales Island, found about the same time, were excavated and analyzed without pitting science against tribal tradition, or archaeologists against Native Americans. Ensuring there is room for both perspectives remains an important challenge under the framework established by NAGPRA.

IX THE FUTURE OF FIRST AMERICAN STUDIES

Studies of the first Americans entered the 21st century on the cusp of change. The traditional view that the first Americans were fast-moving Clovis big-game hunters who migrated into the North American interior on the heels of retreating ice sheets has been undermined. Evidence from Monte Verde demonstrates that humans arrived in the Western Hemisphere in pre-Clovis times, and a reassessment of Clovis subsistence suggests Clovis people were not the big-game hunting specialists imagined in the past. As yet, no widely accepted theory has arisen to replace the older Clovis-first theory. Researchers are proposing many new ideas. Which of these ideas will succeed or fail remains to be seen.

A Promising Research

The instruments of archaeological study continue to improve at a rapid pace. Shovels and trowels, the traditional tools of excavation, are now being used alongside ground-penetrating radar, seismic studies of surface features, and other techniques to find now-buried sites. A variety of new studies are providing information about where the materials to make ancient stone artifacts were acquired, how the artifacts were made, and how they were used. These include studies of the geological sources of stone artifacts, experimental work in stone fracture mechanics to better understand how stone tools were made, and analyses of microscopic wear patterns visible on such artifacts. A battery of techniques are now available to study the chemical composition of bone, plant, shell, and other organic and inorganic remains, providing archaeologists with a clearer picture of the environments to which the first Americans adapted. New dating techniques under development should allow archaeologists to reliably date sites more than 50,000 years old—the current limits of radiocarbon dating. These techniques could prove useful in the event sites of greater antiquity are eventually found in the Americas.

B Finding Archaeological Evidence of Ancient Americans

First Americans

The time-honored process of acquiring archaeological evidence through careful and meticulous site excavation continues. Where the oldest preserved sites might be is not yet known. There are obvious places to look, however, including eastern Siberia, which is still relatively unknown to archaeologists. Other promising locations for future research include the remnants of Beringia, coastal islands of the Pacific, the Isthmus of Panama—through which any group headed into South America must have passed, and perhaps places not yet imagined. Some of the most interesting discoveries in years to come may even be made in museums, when new techniques for analysis are applied to old collections of artifacts and human remains. Hopefully, this can be done with the interest and cooperation of Native American groups.

Archaeologists may never find evidence of the very first humans to arrive in the Western Hemisphere. It is, after all, a very big place. But ongoing research is sure to reveal much about how the first Americans colonized a new world.

Contributed By:

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First Americans



Ice-Age Migration Routes

Humans are believed to have crossed into the Americas before the end of the last ice age, when a natural land bridge called Beringia linked present-day Siberia and Alaska. During the coldest part of the ice age, about 23,000 to 19,000 years ago, vast glaciers blanketed much of the northern hemisphere, making travel south toward what is now the continental United States virtually impossible. By about 14,000 years ago, as the climate warmed, a passable route opened along the Pacific Coast. Then, about 2,500 years later, an ice-free corridor opened in the continental interior as the great ice sheets retreated. Some scientists believe both routes were used by early migrating peoples.

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1997: Anthropology

Archives consist of articles that originally appeared in Collier's Year Book (for events of 1997 and earlier) or as monthly updates in Encarta Yearbook (for events of 1998 and later). Because they were published shortly after events occurred, they reflect the information available at that time. Cross references refer to Archive articles of the same year.

1997: Anthropology

During 1997 anthropologists announced the discovery of 117,000-year-old human footprints in South Africa and pushed back the generally accepted date for the oldest human habitation of the Americas by over 1,000 years. Scientists also reported the first successful extraction and analysis of ancient DNA from a Neanderthal bone; analysis of the DNA seemed to exclude a direct ancestral relationship between Neanderthals and modern humans.

Earliest Human Footprints.

South African scientists reported the results of research on fossilized footprints found in 1995 at the edge of Langebaan Lagoon, about 100 kilometers (60 miles) north of Cape Town. The footprints were in sandstone whose age was measured at 117,000 years. The ancient feet that formed the prints belonged to an anatomically modern human being. The two best-preserved prints show the shape of the foot's big toe, ball, arch, and heel. Judging from the length of the stride and the 22-centimeter ($8\frac{1}{2}$ -inch) foot size, scientists concluded that the individual was either a female or a small male, no more than 1.6 meters ($5\frac{1}{2}$ feet) tall. A variety of tools were uncovered nearby, including blades, scrapers, and a projectile point that may have been used to kill and butcher prey and prepare skins.

Scientists regard the footprints as a very important discovery because they provide much-needed evidence from the period when archaic humans evolved into modern *Homo sapiens*. A steadily growing inventory of South African evidence, including human remains dating from 60,000 to 120,000 years ago that were found in caves at the Klasies River, suggests that modern humans emerged in South Africa and then migrated north, eventually reaching Asia, Europe, and beyond. Recent studies of human genetic material that is passed only through females (so-called mitochondrial DNA) support the idea that modern humans originated in Africa. On the basis of measured variations in mitochondrial DNA in contemporary populations, many scientists believe that all humans are descended from a common female ancestor — the hypothetical Eve — who lived between 100,000 and 200,000 years ago.

Neanderthal DNA Analyzed.

Much controversy has raged over whether the muscular, heavy-boned Neanderthals played a role in the development of modern humans. In a report published in August 1997, scientists said they had successfully extracted mitochondrial DNA from a

Kennewick Man

Neanderthal bone believed to be 30,000 to 100,000 years old, and had compared a short sequence of it to mitochondrial DNA from modern humans, including Africans, Europeans, Asians, Native Americans, Australians, and Pacific Islanders. The extraction and analyses were performed under pristine conditions, since ancient DNA degrades on exposure to air and is easily contaminated by human DNA. The researchers stated that the high degree of variation between the Neanderthal DNA and the DNA of modern humans suggests that Neanderthals were not ancestral to modern humans — despite fossil evidence indicating the two groups coexisted in close proximity in Europe as recently as 30,000 years ago — and that an evolutionary split occurred some half million years before modern humans first emerged.

The sudden and mysterious disappearance of Neanderthals around 30,000 years ago would presumably be due not to a merging of the two human groups through interbreeding but more likely to some catastrophic event. The researchers cautioned that their conclusions were based on DNA from a single Neanderthal specimen, which might not necessarily represent the genetic makeup of all Neanderthals.

Oldest Site in New World.

Seemingly ending years of debate, 1997 brought solid verification that the Chilean site known as Monte Verde is the oldest generally accepted known human habitation in the New World. Monte Verde is located about 800 kilometers (500 miles) south of Santiago. Excavations at Monte Verde, begun in 1976, uncovered the wooden remains of about 12 huts, logs with attached animal hides, poles and stakes tied together with grass cords, stone projectile points, grinding and bone tools, mastodon meat, and a child's footprint near a hearth. The water-saturated peat that covered the site had preserved the artifacts from decay by preventing oxygen from reaching them. The site was probably inhabited by 20 to 30 people, who lived in hide-covered shelters, gathered edible vegetation, hunted game, and occasionally traveled the 50 kilometers (30 miles) to the Pacific coast to gather shellfish.

Even though anthropologists excavating the site had long claimed that radiocarbon dating of charcoal and bones from Monte Verde's hearths placed the encampment at 12,500 years B.P. (before the present), many scientists remained skeptical about its authenticity. They doubted that human habitations could exist as far south as Chile 12,500 years ago, because North America was presumably closed to human traffic by two massive ice sheets from 20,000 to 30,000 years ago. Even if the ice sheets had created a passable corridor between them 15,000 to 20,000 years ago, the absence of vegetation necessary to support large animals meant people would not have had sufficient food supplies to survive the long journey south. Until the 1997 Monte Verde verification, an 11,200-year-old site near Clovis, NM, was the oldest generally accepted known human habitation in the New World. Humans were presumed to have moved into Central and South America sometime after Clovis.

The 1997 confirmation resulted from a January visit by a group of U.S. anthropologists and archaeologists, including some key skeptics, to Monte Verde under the auspices of the Dallas Museum of Natural History. Their purpose was to examine the site and determine its authenticity. They came away fully convinced that it was a real pre-Clovis habitation. The critics' acceptance of Monte Verde mandates a rewriting of the first

Kennewick Man

chapter of the history of humans in the Americas. Anthropologists now theorize that people may have migrated south much earlier than previously believed, perhaps by moving along the coast, sometimes using small boats.

Kennewick Man Controversy.

Some anthropologists also believe that Europeans with Caucasoid features migrated to North America thousands of years ago, over ice packs when seasonal freezes extended from what are now Britain and Nova Scotia. A skeleton that might resolve the debate remained locked in a vault in Richland, WA, while a three-way legal battle for its custody wended its way through the judicial system.

In July 1996 a human skeleton was discovered on the bank of the Columbia River near the small town of Kennewick in Washington State. The forensic anthropologist who first examined the skeleton concluded that it had been a Caucasoid or European male of 45 to 50 years in age. Subsequent radiocarbon dating determined that the skeleton was at least 9,300 years old, making it the oldest one ever found in the Northwest.

Five Native American tribes, headed by the Umatilla Indians, sued under the 1990 Native American Graves Protection and Repatriation Act for possession of the Kennewick remains. In response, scientists filed their own suit, claiming that the act permits full examination of such remains and that preliminary evidence showed that the bones were not those of an ancient Indian. Complicating matters more, the Asatru Folk Assembly, a religious group whose deities include the Norse gods Odin and Thor, also filed suit, claiming the remains as their own.

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Kennewick Man



Kennewick Man

In 1996 a skull and other parts of a male human skeleton were discovered on the shores of the Columbia River near Kennewick, Washington. Radiocarbon dating showed the remains to be between 7,000 and 9,500 years old, making them among the oldest ever found in North America. A nine-year legal battle ensued over the fate of the ancient remains. A coalition of five Native American tribes argued that the skeleton should be reburied, while a group of scientists argued that it should be subject to scientific study. The courts ultimately agreed with the scientists, who began a detailed study of the remains in July 2005.

Elaine Thompson/AP/Wide World Photos

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