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Cobblestone, April 2002 v23 i4 p6(2)

Beringia land bridge.(Alaska)

Throughout the earth's history, there have been many ice ages. During such periods, much of the earth's water supply is held frozen in massive glaciers. This leaves less water in the world's oceans. When ocean levels drop, more land is exposed. Then, when glaciers melt, water is returned to the oceans, causing the water levels to rise.

During times of lower ocean levels, a land bridge was exposed across the Bering Sea, the waterway between Russia's Siberia and North America's Alaska. Usually referred to as Beringia, the land bridge may have been exposed many times throughout history. It is thought that most of Beringia was grassland and even may have been a desert until 14,000 before present (B.P.). This bridge might have been up to one thousand miles wide and used by many huge animals to cross over between North America and Asia.

Most scientists believe one of two dates to be the time when humans, who were crossing the bridge from Asia to North America, arrived. A conservative date places humans landing about 10,000 to 12,000 B.P. A more radical date has humans crossing Beringia around 20,000 to 70,000 B.P.

Hundreds and thousands of years ago, humans probably used the land bridge to follow their traveling food source, which would have been huge animals known as mega-fauna. Some of the mega-fauna included mammoths and mastodons (huge elephant-like creatures weighing 4 to 8 tons), giant beavers (weighing up to 220 pounds), and large ground sloths (the size of a giraffe but weighing 3 tons). While adapting to the grasslands of Beringia, many early humans may have used the bones of mega-fauna to build shelters.

Although scientists know that people first arrived in North America by way of Beringia, it is difficult to provide an exact date because Beringia, along with any associated artifacts, currently is underwater.--K.I.

Ice ages are cold periods marked by episodes of extensive freezing (which causes ice to cover portions of the earth), alternating with times of relative warmth.

Artifacts are objects that are produced by humans and hold historical interest.

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Junior Scholastic/Current Events, Nov 5, 2012 v115 i5 p14(2)

Walk this way: scientists discover that the first settlers came to the Americas in three major waves, not one, as previously thought. GEOSKILLS

[ILLUSTRATION OMITTED]

Ancient settlers came to the Americas in three migrations, new research shows.

Scientists recently studied genetic data from more than 50 Native American groups. Research found that their ancestors traveled from Siberia, in Asia, to what is now Alaska in three periods--the first beginning about 15,000 years ago.

The settlers trekked across the Bering Land Bridge, a stretch of land that connected Russia and Alaska. It existed thousands of years ago when sea levels were lower. From there, the groups dispersed across the Americas.

In the first migration, settlers headed down the Pacific Coast, some as far as South America. The second migration group spread northeast across the Arctic Circle. The third group settled near the present-day U.S.-Canada border.

Scientists distinguish the waves by their language families. The first group spoke an early American Indian language. Travelers in the second wave spoke primarily Eskimo-Aleut, and people in the third migration spoke Na-Dene. Trace their routes with this map.

QUESTIONS

1. Scientists studied genetic data from about how many Native American groups?

2. Which migration group did not cross 40[degrees]N?

3. Settlers in the third migration split off into which two directions?

4. The first settlers were from which region of Asia?

5. Members of which migration group most likely experienced the warmest temperatures on their journey?

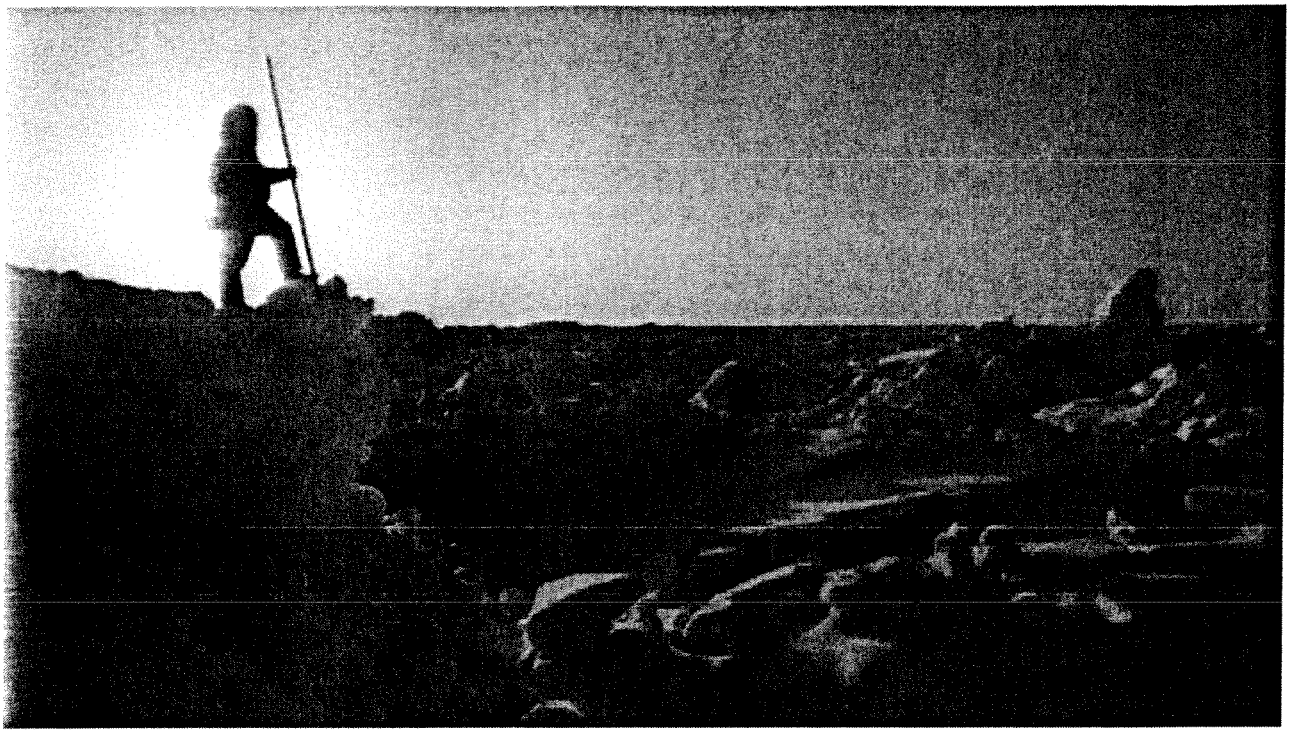
NATURE | NEWS FEATURE

Ancient migration: Coming to America

For decades, scientists thought that the Clovis hunters were the first to cross the Arctic to America. They were wrong — and now they need a better theory

Andrew Curry

02 May 2012



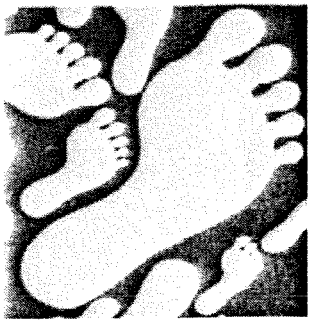
ALASKA STOCK/ALAMY

The mastodon was old, its teeth worn to nubs. It was perfect prey for a band of hunters, wielding spears tipped with needle-sharp points made from bone. Sensing an easy target, they closed in for the kill.

Almost 14,000 years later, there is no way to tell how many hits it took to bring the beast to the ground near the coast of present-day Washington state. But at least one struck home, plunging through hide, fat and flesh to lodge in the mastodon's rib. The hunter who thrust the spear on that long-ago day didn't just bring down the mastodon; he also helped to kill off the reigning theory of how people got to the Americas.

For most of the past 50 years, archaeologists thought they knew how humans arrived in the New World. The story starts around the end of the last ice age, when sea levels were lower and big-game hunters living in eastern Siberia followed their prey across the Bering land bridge and into Alaska. As the ice caps in Canada receded and opened up a path southward, the colonists swept across the vast unpopulated continent.

Archaeologists called these presumed pioneers the Clovis culture, after distinctive stone tools that were found at sites near Clovis, New Mexico, in the 1920s and 1930s.



PEOPLING THE PLANET

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As caches of Clovis tools were uncovered across North America over subsequent decades, nearly all archaeologists signed on to the idea that the Clovis people were the first Americans. Any evidence of humans in the New World before the Clovis time was dismissed, sometimes harshly. That was the case with the Washington-state mastodon kill, which was first described around 30 years ago[1] but then largely ignored.

Intense criticism also rained down on competing theories of how people arrived, such as the idea that early Americans might have skirted the coastline in boats, avoiding the Bering land bridge entirely. "I was once warned not to write about coastal migration in my dissertation. My adviser said I would ruin my career," says Jon Erlandson, an archaeologist at the University of Oregon in Eugene.

But findings over the past few years — and a re-examination of old ones, such as the mastodon rib — have shown conclusively that humans reached the Americas well before the Clovis people. That has sparked a surge of interest in the field, and opened it up to fresh ideas and approaches. Geneticists and archaeologists are collaborating to piece together who came first, when they arrived, whether they travelled by boat or by foot and how they fanned out across the New World.

To test their ideas, some researchers are examining new archaeological sites and reopening old ones. Others are sifting through the DNA of modern people and unearthing the remains of those buried millennia ago in search of genetic clues. "There's a powerful meshing of the archaeology we're pulling out of the ground with genetic evidence," says Michael Waters, a geographer at Texas A&M University in College Station.

Like those original Americans, researchers are exploring new frontiers, moving into fresh intellectual territory after a long period of stasis. "Clovis has been king for 50 years, and now we have to reimagine what the peopling of the New World looked like," Erlandson says. "If it wasn't Clovis, what was it?

Overthrowing king clovis

It took a chance finding halfway around the world to set this reappraisal in motion. In the late 1970s, Tom Dillehay, an archaeologist at Vanderbilt University in Nashville, Tennessee, uncovered the remains of a large campsite in southern Chile, close to the tip of South America (see 'Routes to a new world'). Radiocarbon dating of wood and other organic remains suggested that the site was around 14,600 years old, implying that humans made it from Alaska to Chile more than 1,000 years before the oldest known Clovis tools[2]. But because the remote site was so hard for most researchers to examine, it would take nearly

20 years for Dillehay to convince his colleagues.

The case for pre-Clovis Americans has now gained more support, including from analyses of ancient DNA. One of the first bits of genetic evidence came from preserved faeces, or coprolites, that had been discovered in a cave in south-central Oregon by Dennis Jenkins, an archaeologist at the University of Oregon. Radiocarbon dating showed that the coprolites are between 14,300 and 14,000 years old, and DNA analysis confirmed that they are from humans[3]. The recovered DNA even shared genetic mutations with modern Native Americans.

Since the coprolite evidence emerged, in 2008, ancient DNA has also been used to reconstruct that long-ago mastodon hunt. Radiocarbon studies in the 1970s had suggested that the mastodon pre-dated the Clovis people, but some researchers explained that away by arguing that the animal had died in an accident. However, DNA studies last year[4] showed that a fragment of bone embedded in the mastodon's rib had come from another mastodon — strong evidence that it was a spear point made by humans and not a shard that had chipped off a nearby bone in a fall.

The case against Clovis got another major boost last year, when an excavation in Texas unearthed stone tools that pre-dated Clovis-style artefacts by more than a millennium[5]. "We found a solid site with good context, good artefacts and solid dating," says Waters.

This slow avalanche of findings has all but buried the Clovis model — the problem now is what to replace it with. The abundant Clovis artefacts and sites discovered over the past century have set a high bar. Telling the story of the first Americans means coming up with a plausible explanation and definitive evidence to support it — a combination that researchers are struggling to achieve.

Related stories

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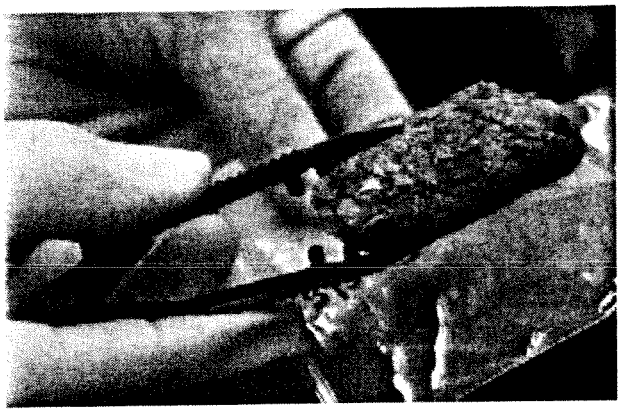
One idea they are exploring is that a small group of big-game hunters made it into the Western Hemisphere over land — but significantly earlier than previously thought. Another, more popular, theory argues that humans used boats to navigate along the coast of Siberia and across to the Americas.

There is also a controversial variant of the coastal migration model, put forward by archaeologists Dennis Stanford at the Smithsonian Institution in Washington DC and Bruce Bradley at the University of Exeter, UK. Called the Solutrean hypothesis, it suggests that coastal migration from Asia could have been supplemented

by parallel migrations across the Atlantic, bringing stone-tool technologies from present-day Spain and southern Europe to eastern North America.

DNA studies argue strongly against this hypothesis, and it gets little support from researchers. But some are hesitant to reject the idea outright, recognizing that the community was once before too conservative. "That's what happened with the Clovis paradigm," says Dillehay.



Radiocarbon dating of ancient faeces found in Oregon shows that humans were in North America as early as 14,300 years ago.

J. BARNARD/AP

To move the field forward, researchers are using as many types of data as possible. Some key clues have emerged from studies of population genetics, in which researchers tallied the number of differences between the genomes of modern Native Americans and those of people living in Asia today. They then used estimates of DNA mutation rates as a molecular clock to time how long the diversity took to develop. That provides an estimate for when people split from ancient Asian populations and migrated to the Americas.

Judging from the limited genetic diversity of modern Native Americans, Ripan Malhi, a geneticist at the University of Illinois at Urbana-Champaign, and others have argued that the founding population was small, perhaps just a few thousand hardy settlers. In a study of mitochondrial DNA from modern Native American and Asian populations, Malhi and his colleagues also found hints that the first American colonists paused on their way out of Asia[6], waiting out the peak of the last ice age on the exposed Bering land bridge for perhaps 5,000 years — long enough to become genetically distinct from other Asian populations. When the glaciers blocking their path into North America began to melt around 16,500 years ago, the Beringians made their way south over land or sea, passing those genetic differences on to their descendants in America.

Other researchers say that there is a major problem with relying on population genetics to answer questions about the peopling of the Americas. At least 80% of the New World's population was wiped out by disease, conflict or starvation after Europeans first arrived some five centuries ago. And the genes of many Native Americans today carry European and African markers, which confounds efforts to piece together the migration story. "If we look pre-contact, we're going to find a lot more indigenous diversity," says Malhi.

That means going back in time, by studying ancient genomes. "You're going to see a lot of ancient-DNA studies coming out, and that's going to tell a powerful story about the first Americans," says Waters.

The chances of finding well-preserved bones from the first Americans are slim, but valuable information can be pulled from DNA samples that fall in between then and now, argues Eske Willerslev, who studies ancient

DNA at the University of Copenhagen. Willerslev and his colleague Thomas Gilbert proved that point in 2010, when they extracted the first complete ancient-human genome from a 4,000-year-old hank of hair found in Greenland that had languished for decades in a museum storeroom in Copenhagen. The DNA helped to show that there had been multiple waves of migration into Greenland, and that modern Greenlanders arrived more recently[7]. Now, Willerslev's lab is trying to extract similar information about population movements from ancient-human remains from sites all over the Americas.

Joining forces

When paired with sequences from modern populations, ancient DNA can help to refine the calculations made by population geneticists and test the claims made by archaeologists. In 2008, Brian Kemp, now at Washington State University in Pullman, extracted mitochondrial DNA from a 10,300-year-old tooth found in On Your Knees Cave in Alaska. When he compared the DNA sequences with those from modern Native Americans, he found that the mutation rate was faster than previously thought[8]. The results, he says, effectively rule out the possibility that humans came to North America as early as 40,000 years ago — a date based on equivocal evidence from archaeological sites in the eastern United States. The finding also argues against the idea that people used boats before the thaw to go around the glaciers and come down the coast. Instead, the DNA evidence supports the consensus that people didn't migrate into the Americas — whether by boat or over land — until the end of the last glacial maximum, 16,500 years ago at most.

"Now we have to reimagine what the peopling of the new world looked like. if it wasn't Clovis, what was it?"

The DNA told researchers a few more things. The ancient man who died in that Alaskan cave had mitochondrial DNA most closely related to Native American groups living today along the west coast of North America. "Most of the people who descended from that type are still living near the coast," Kemp says. So the first wave of migrants probably came down the coast and then spread east from there, developing tiny variations in their DNA as they went, Kemp says.

Dennis O'Rourke, a geneticist at the University of Utah in Salt Lake City, is using similar comparisons to fill in the map of ancient migrations in the New World. In the past ten years, dozens of similar studies have established a clear trend — comparisons of DNA from modern people with ancient DNA have shown that the geographic distribution of genetic groups in the Americas has been stable for millennia. "The patterns must have been established more than 4,000 years ago," he says. That helps to constrain the timing of when people spread across the continent and when they stopped migrating, he says.

In Point Barrow, Alaska, O'Rourke recently began studying human remains from a cliff-top cemetery threatened by coastal erosion, where people have been buried for the past 1,000 years. By comparing the samples from ancient Alaskans to populations from Greenland, eastern Canada and elsewhere, O'Rourke hopes to learn more about the colonization of the Arctic, an environment similar to what the first Americans would have encountered towards the end of the last ice age.

O'Rourke's collaborators are also collecting DNA samples from Inupiat people in northern Alaska. By matching up the modern and ancient DNA sequences from that region, they hope to refine the genetic clock and improve estimates for when people arrived in the Americas. Similar work is going on at a cemetery on Prince Rupert Island off northern British Columbia, where local Tsimshian people are working with archaeologists to gather ancient and modern DNA evidence.

While geneticists open up intellectual frontiers, archaeologists are searching for ways to test the migration theories in the field. Direct evidence for coastal migration will be hard to come by, because a rise in the sea level since the end of the last ice age has flooded the ancient coastlines. But researchers are turning up indirect evidence in many locations. Last year, for example, Erlandson demonstrated that humans lived on California's Channel Islands as far back as 12,200 years ago[9], which shows that they must have mastered the use of boats before that time.

And at the Monte Verde site in Chile, researchers have found evidence that the ancient occupants were fans of seafood[10]. "Monte Verde has ten different species of seaweed at the site," Dillehay says. "Somebody was intimately familiar with seaweeds and the microhabitats where they could be found." That lends support to the idea that the earliest Americans were seafarers, he says.

Dillehay's recent findings, which came 30 years after the first excavations at Monte Verde, show that previously studied sites can become potential gold mines, says Waters. Because so many sites were either dismissed or forgotten during the 'Clovis-first' era, Waters says that "the field can really be pushed forward by going back and taking a look at sites that were put up on a shelf". He is already planning to reopen sites in Tennessee and Florida, where evidence of pre-Clovis mammoth hunting was uncovered in the 1980s and 1990s.

Geneticists and archaeologists agree that the death of the Clovis theory has injected the field with excitement and suspense. "There's a sense that there was something before Clovis," says Jenkins, whose coprolite study shook the field four years ago. "But what it was and how it led to the patterns that we see in North and South America — that's a whole new ball game."

Nature **485,** 30–32 (03 May 2012) doi:10.1038/485030a

See Editorial page 6

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ICE-AGE AMERICANS ; Tankersley, Kenneth Barnett; ; Dig ; 04-01-2007 ;

WILL WE EVER KNOW WHO CAME FIRST IN THE AMERICAS?

The most interesting questions are always the simplest. Who were the first Americans? Where did they come from? When did they arrive? The answers to these questions are as old as the people themselves.

EUROPEAN STORIES

Since the first arrival of Europeans in America more than 1,000 years ago, Native Americans have been asked, "What do you call this place and how long have you lived here?" No matter what tribe was asked, the answers were always the same, "This is Turtle Island and we have always lived here." No one believed them. Not the Norse, not the Spanish, not the French, not the British. Instead, Europeans came up with their own explanations.

The Vikings called Native Americans Skraeling, which means "trolls"-that is, savage little people with great strength and no brains. Christopher Columbus called them Indians because he thought his ship had landed in the Indies. Even when the Spanish realized that Columbus had not sailed to Asia, they still insisted that Native Americans came from there. The British thought they were Tartars, people who came from Mongolia. Still other Europeans said that Native Americans came from the South Pacific. By the time of the American Revolution, Europeans considered every possible part of the world as a homeland for Native Americans, except America itself. The only point on which all Europeans agreed was that Native Americans were wrong about their history. They could not possibly have been in America for more than a few thousand years, reasoned the Europeans.

A SPEARHEAD TELLS IT ALL

Then, in 1929, European stories changed forever when a young Native American, a Powhatan named Osapana, found a stone spearhead among the bones of a mammoth, a hairy type of elephant that lived during the Ice Age. Today, we call these spearheads Clovis, after the town in New Mexico that was near the find site. Clovis spearheads were clear evidence that supported the oral histories of Native Americans.

For the next 70 years, archaeologists looked for older and older sites across the Western Hemisphere, in Russia, and even in Europe that might offer clues to the origins of Native Americans. The entire time, however, the Native American story remained unchanged: "We have always lived here, on Turtle Island." By the turn of the 21st century, answers to the questions that Europeans had been asking for more than 1,000 years came not from stones, bones, or pots dug up from the ground, but from the DNA and the languages of Native Americans.

NATIVE AMERICAN LANGUAGES

Language is the way people communicate the world around them to others. Every culture, past and present, has its own unique language. Cultures are constantly changing, as are the words they use. By studying changes in words, we can follow changes in cultures through time. We do this by comparing words from one culture with another. If two cultures are related, then they will share words. The more closely one culture is related to another, the more words they will have in common.

Some Native American languages are more similar than others. Eskimo languages-Inuit and Yup'ik, which are

spoken in Greenland, northern Canada, and Alaska-are so similar that we can say they are related. Languages spoken in the American Southwest, such as Dine and Apache, are so similar to Athabaskan languages spoken in Alaska and Canada that we can say they are related. Likewise, languages spoken in Mexico are similar to those spoken on the Great Plains and eastern North America. The variety of Native American languages spoken over large geographic areas suggests that they are more than 13,000 years old, older even than the age of Clovis points.

ANSWERS IN THE DNA

People who speak the same language belong to the same culture. They are related. Like language, biology can be used to examine how people are related. Scientists who study the relationship of one group of people to another are called geneticists. They compare the DNA in one person with another's to see how similar or different it is.

The cells of plants and animals, including people, contain DNA. It is a molecule (see below) called a double helix, and it looks like a twisted ladder. The rungs on this molecular ladder are made up of four different kinds of chemicals, acids called A, C, G, and T. They can be rearranged in about 3,000,000,000 different ways. What makes you different from another person is the fact that about one letter out of every thousand is different.

DNA contains the instructions for how to make a person. It dictates the color of our eyes, the shape of our earlobes, and even how tall we will be when we grow up. It comes from all of our ancestors, our parents, grandparents, great-grandparents, and many thousands of generations farther back. Every person, both boys and girls, has the mitochondrial (mtDNA) of his or her mother's family- the so-called X-chromosome. Boys also have the DNA of their fathers family. It is called the Y-chromosome. Both the X- and Y-chromosomes contain information about our ancestors that go back to the Ice Age, and beyond.

MUTRATIONS AT WORK

Differences in our X- and Y-chromosomes come from changes, called mutations, that occurred in the past. Mutations are permanent and are passed down from parents to child, from one generation to the next. Mutations in our chromosomes occur about every 250 generations. One generation is about 25 years, and 250 generations is 6,250 years. By counting the number of mutations in the X- and Y-chromosomes, we can determine about how long people have lived in one place. If we count the number of mutations found in Native Americans from Alaska to the tip of South America, it is clear that they have been living in the Western Hemisphere between 25,000 and 35,000 years.

If we consider that the first fully modern-language-speaking humans lived about 35,000 years ago, then the oral histories of Native Americans are, in fact, correct.

THE FUTURE

Despite these new discoveries, two stories about the origins of Native Americans will continue to be told. Archaeologists will never be able to make a final decision about when and from where Native Americans first arrived because archaeological knowledge of the past is, and will always be, incomplete. For Native Americans, the answers to these questions will remain the same: "We have always lived here, on Turtle Island."