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OVERTURE

It was the final act in the prehistoric settlement of the earth. As we envision it, sometime before 12,500 years ago, a band of hardy Stone Age hunter-gatherers headed east across the vast steppe of northern Asia and Siberia, into the region of what is now the Bering Sea but was then grassy plain. Without realizing they were leaving one hemisphere for another, they slipped across the unmarked border separating the Old World from the New. From there they moved south, skirting past vast glaciers, and one day found themselves in a warmer, greener, and infinitely trackless land no human had ever seen before. It was a world rich in plants and animals that became ever more exotic as they moved south. It was a world where great beasts lumbered past on their way to extinction, where climates were frigidly cold and extraordinarily mild. In this New World, massive ice sheets extended to the far horizons, the Bering Sea was dry land, the Great Lakes had not yet been born, and the ancestral Great Salt Lake was about to die.

They made prehistory, those latter-day Asians who, by jumping continents, became the first Americans. Theirs was a colonization the likes and scale of which was virtually unique in the lifetime of our species, and one that would never be repeated. But they were surely unaware of what they had achieved, at least initially: Alaska looked little different from their Siberian homeland, and there were hardly any barriers separating the two. Even so, that relatively unassuming event, the move eastward from Siberia into Alaska and the turn south that followed, was one of the colonizing triumphs of modern humans, and became one of the great questions and enduring controversies of American archaeology. Those first Americans could little imagine our intense interest


Beringia
Old Crow
Cordilleran ice sheet
Laurentide ice sheet
Kennewick
Meadowcroft
Calico
Folsom
Pendejo
Clovis
Approximate position of coastline at 18,000 BP
Valsequillo
Taima-Taima
Pedra Furada
Monte Verde
Cerro Sota & Pali Aike

in their accomplishment thousands of years later, and would almost certainly be puzzled—if not bemused—at how seemingly inconsequential details of their coming sparked a wide-ranging, bitter, and long-playing controversy, ranking among the greatest in anthropology and entangling many other sciences.

Here are the bare and (mostly) noncontroversial facts of the case. The first Americans came during the Pleistocene or Ice Age, a time when the earth appeared vastly different than it does today. Tilts and wobbles in the earth's spin, axis, and orbit had altered the amount of incoming solar radiation, cooling Northern Hemisphere climates and triggering cycles of worldwide glacial growth. Two immense ice sheets up to three kilometers high, the Laurentide and Cordilleran, expanded to blanket Canada and reach into the northern United States (while smaller glaciers capped the high mountains of western North America).

As the vast ice sheets rose, global sea levels fell approximately 120 meters, since much of the rain and snow that came down over the land froze into glacial ice and failed to return to the oceans. Rivers cut deep to meet seas that were then hundreds of kilometers beyond modern shorelines (Figure 1). Lower ocean levels exposed shallow continental shelf, including that beneath the Bering Sea, thereby forming a land bridge—*Beringia*—that connected Asia and America (which are today separated by at least ninety kilometers of cold and rough Arctic waters). When Beringia existed, it was possible to walk from Siberia to Alaska. Of course, once people made it to Alaska, those same glaciers presented a formidable barrier to movement further south—depending, that is, on precisely when they arrived in this far corner of the continent.

These ice sheets changed North America's topography, climate, and environment in still more profound ways. It was colder, of course, during the Ice Age, but paradoxically winters across much of the land were warmer. And the jet stream, displaced southward by the continental ice sheets, brought rainfall and freshwater lakes to what is now western desert and plains, while today's Great Lakes were then mere soft spots in bedrock beneath millions of tons of glacial ice grinding slowly overhead.

A whole zoo of giant mammals (*megafauna,* we call them) soon to become extinct roamed this land. There were multi-ton American elephants—several species of mammoth and the mastodon—ground sloths taller than giraffes and weighing nearly three tons, camels, horses, and two dozen more herbivores including the glyptodont, a slow-moving mammal encased in a turtle-like shell and bearing an uncanny resemblance to a 1966 Volkswagen Beetle—or at least a submersible one with an armored tail. Feeding on these herbivores was a gang of formidable predators: huge lions, saber-toothed cats,

FIGURE 1.
Map of the Western Hemisphere, showing the extent of glacial ice at the Last Glacial Maximum (LGM) 18,000 years ago, the approximate position of the coastline at the time, and some of the key early sites, archaeological and otherwise, hemisphere-wide.

and giant bears. All of these mammals were part of richly mixed animal communities of Arctic species that browsed and grazed alongside animals of the forests and plains.

But this was no fixed stage. From 18,000 years ago, at the frigid depths of the most recent glacial episode—the Last Glacial Maximum (LGM) it's called—until 10,000 years ago when the Pleistocene came to an end (and the earth entered the Holocene or Recent geological period), the climate, environment, landscapes, and surrounding seascapes of North America were changing. Many changes happened so slowly as to be imperceptible on a human scale; others possibly were not. Certainly, however, the world of the first Americans was unlike anything experienced by any human being on this continent since.

Once they got to America, these colonists and their descendants lived in utter isolation from their distant kin scattered across the planet. Over the next dozen or so millennia, in both the Old World and the New, agriculture was invented, human populations grew to the millions, cities and empires rose and fell, and yet no humans on either side of the Atlantic or Pacific oceans was aware of the others' existence, let alone knew of their doings.

It would not be until Europeans started venturing west across the Atlantic that humanity's global encircling was finally complete. Peoples of the Old World and the New first encountered one another in a remote corner of northeast Canada around AD 1000.[1] But that initial contact between Norse and American Indians was brief, often violent, and mostly served to thwart the Vikings' colonizing dreams and drive them back to Greenland and Iceland. It had none of the profound, long-term consequences that followed Columbus's splashing ashore on a Caribbean island that October day of 1492.

Europeans, of course, were profoundly puzzled by what they soon realized was far more than a series of islands, but instead a continent and peoples about whom the Bible—then the primary historical source for earth and human history—said absolutely nothing. We can presume Native Americans were just as perplexed by these strange-looking men, but their initial reactions went largely unrecorded by them or contemporary Europeans. Over the next several centuries, Europeans sought to answer questions about who the American Indians were, where they had come from, when they had arrived in the Americas, and by what route. The idea that they must be related to some historically known group—say, the Lost Tribes of Israel—held sway until the mid-nineteenth century, when it became clear that wherever their origins, they had arrived well before any historically recorded moment. The answer would have to be found in the ground in the artifacts, bones, and sites left behind from a far more ancient time.

But *how* ancient would prove a matter of much dispute. In 1927, and after centuries of speculation and more than fifty years of intense archaeological debate, a discovery at the Folsom site in New Mexico finally demonstrated the first Americans had arrived at least by Ice Age times. The smoking gun?—a distinctive, *fluted* spear point found embedded between the ribs of an extinct Pleistocene bison. A hunter had killed that Ice Age beast (see Plate 1).

A half-dozen years later, outside the town of Clovis (also in New Mexico), larger, less finely made, and apparently still older fluted spear points than those at Folsom were found—this time alongside the skeletal remains of mammoth. As best matters could then be determined, these were the traces of the most distant ancestors of Native Americans. *Paleoindians,* they were named, to recognize their great antiquity and their ancestry to American Indians.

But were these the very *first* Americans, and if so, just when had they arrived? A more precise measure of their antiquity would have to wait on chemist Willard Libby's Nobel Prize–winning development of radiocarbon dating in the 1950s. By the early 1960s, that technique showed that the Folsom occupation was at least 10,800 years old, while Clovis dated to almost 11,500 radiocarbon years before the present (BP).[2] This was relatively new by Old World standards—humans had lived there for millions of years—but it was certainly old by New World standards.

Better still, the Clovis radiocarbon ages apparently affirmed the suspicion this archaeological culture represented the first Americans, for the dates coincided beautifully with the retreat of North America's vast continental glaciers that, it was widely believed, had long obstructed travel to the south and forced any would-be first Americans to cool their heels in Alaska.

As those glaciers retreated, an "ice-free" corridor opened between them (around 12,000 years ago) along the eastern flanks of the Rocky Mountains, forming a passageway for travel into unglaciated, lower-latitude North America. Emerging from the southern end of the corridor onto the northern plains fast on the heels of its opening, the first Americans radiated across the length and breadth of North America with apparently breathtaking speed, spreading Clovis and Clovis-like artifacts across North America within a matter of centuries. Nor did they stop at the border: their descendants evidently continued racing south, arriving in Tierra del Fuego within 1,000 years of leaving Alaska (having developed en route artifacts that were no longer recognizably Clovis). It's an astonishing act of colonization, especially given it took our species more than 100,000 years just to reach the western edge of Beringia.

Indeed, the possibility that Clovis groups traversed North America in what may have been barely 500 years is all the more striking given that North America was then in the midst of geologically rapid climatic and environmental change. Yet, Clovis groups seemingly handled the challenge of adapting to this unfamiliar, ecologically diverse, and changing landscape with ease. Their toolkit, including its signature fluted points, is remarkably uniform across the continent. That lack of variability is taken as testimony to the rapidity of their dispersal (that is, it happened so quickly there was hardly time for new point styles to emerge).

That some of those points were found embedded in the skeletons of mammoth and bison suggested an answer to the question of how Paleoindians had moved so quickly and effortlessly: they were apparently big-game hunters, whose pursuit of now-extinct animals pulled them across the continent. Some took the argument a step further: it was their relentless slaughter that drove the Pleistocene megafauna to extinction.

ON DATES AND DATING

Throughout this book, time is denoted in years before present, abbreviated simply as BP. In regard to deep geological time, as with the onset of glaciation 2.5 million years ago, little need be said by way of qualification. Such ages are, at best, well-rounded estimates derived by a variety of geochemical dating methods, and are certainly accurate at the scale of hundreds of thousands of years, which is sufficient for our purposes. However, when attention turns to the last 50,000 years, the period of particular interest here, we seek more precise chronological control.

For that span, radiocarbon dating is the method of choice. It works off a straightforward decay principle (illustrated in Figure 2): when cosmic ray neutrons

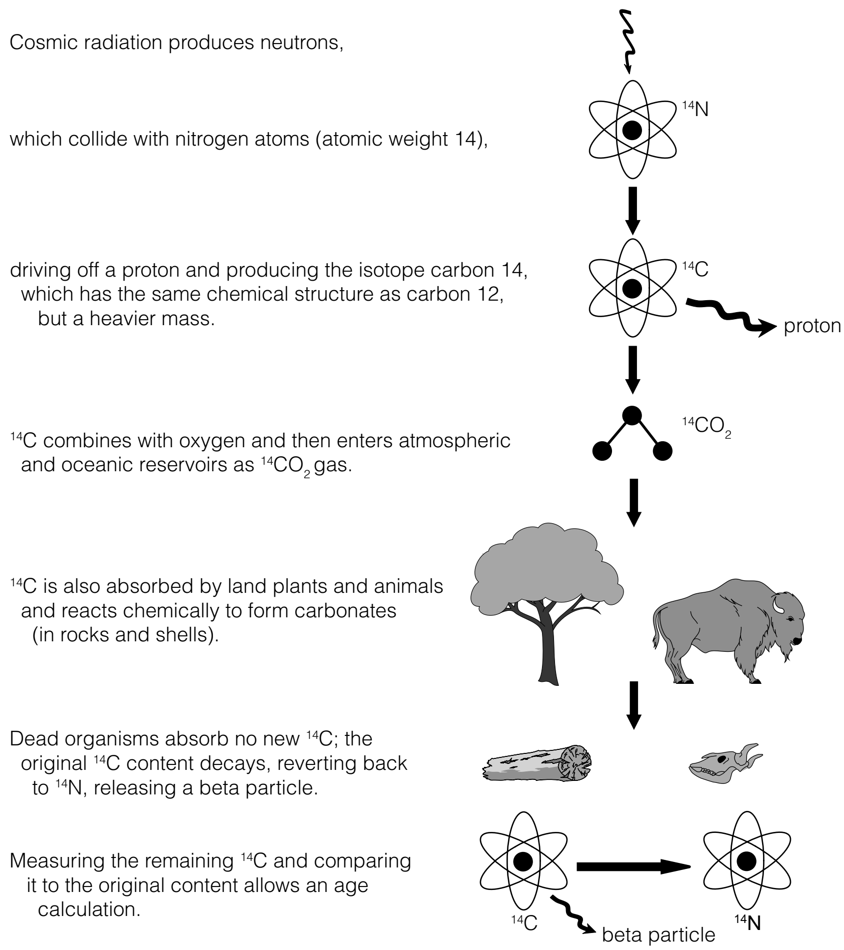

FIGURE 2.
The radiocarbon process in schematic form (see text for a fuller explanation).

bombard the earth's upper atmosphere, they react with nitrogen (^{14}N) to drive off a proton to form radioactive carbon or radiocarbon (^{14}C), one of several isotopes (*isotope* = same element, different mass) of carbon. Radiocarbon has the same chemical structure as elemental carbon (^{12}C), but a heavier mass (maintaining nitrogen's atomic mass of 14). And like ^{12}C, radiocarbon combines with oxygen to form carbon dioxide (CO_2), which is then absorbed by plants via photosynthesis, and which moves up the food chain into the animals that feed on those plants.

When a plant or animal dies, its supply of ^{14}C is no longer being replenished, and the resident ^{14}C slowly begins to revert back to ^{14}N, and in this decay process releases a radioactive emission (beta particle). Immediately after death, ^{14}C decay produces roughly 15 beta emissions/gram/minute. After 5,730 years, half of the ^{14}C is gone, and the decay process yields roughly 7.5 beta emissions/gram/minute. That lapsed period is called a *half-life*. After another 5,730 years have passed (that is, 11,460 years after the organism died), another half of the original ^{14}C is now gone (we are down to 25% remaining), and the decay process yields roughly 3.75 beta emissions/gm/minute. And so on.

Thus, by measuring the amount of radiocarbon still present in a sample, one can determine the approximate date that the organism died. By consensus, all radiocarbon ages are expressed as years before present, present being arbitrarily set at 1950, the year the first successful dates were reported by Willard Libby, the chemist who invented the technique (for which he received a Nobel Prize). We set all our radiocarbon clocks to years before 1950 to avoid the confusion that would follow when comparing the ages of different samples whose radioactivity was measured at different times (e.g., 1950 vs. 2000).

Radioactivity is a statistically random process. When it's measured, the result is an estimate of the average amount of ^{14}C in the sample, with an accompanying standard deviation to show the estimated error (the true value should fall within one standard deviation 68% of the time). A date of 10,130 ± 60 BP means that the estimated age of the sample based on the mean of the emissions was 10,130 years, and the chances are two out of three that the true age lies between 10,070 and 10,190 BP.

Theoretically, radiocarbon decay takes place until all the ^{14}C is gone from a sample—and that takes about ten half-lives. In principle we should be able to date material that old, but problems of preservation, the difficulty of detecting the tiniest amounts of ^{14}C, and the potential for contamination of ancient samples, put the present reliable upper limit of radiocarbon dating at about 50,000 years.

In terms of detection, measuring the amount of ^{14}C in a sample can be done in one of two ways: the conventional decay-counting method is to prepare a sample as a liquid or a gas, put it in a radioactive counter, and wait for beta emissions to happen. Older samples with less ^{14}C obviously have fewer and more widely spaced beta emissions, and obtaining a statistically reliable count of them can take days, weeks, and sometimes months.

The alternative technique, Accelerator Mass Spectrometry (AMS) dating, uses particle accelerators to count ^{14}C atoms directly by sending a sample at high speeds around a circular or oval particle accelerator. The lighter ^{12}C atoms can take the tight turns; the heavier ^{14}C atoms can't and fly off the molecular racetrack and crash into a strategically placed mass spectrometer, which counts the number of atoms. AMS dating takes only minutes or hours, not days or weeks, and standard errors are often less than fifty years. Best of all, because atoms are counted directly, large samples are no longer necessary. Prior to the advent of AMS dating, approximately 5 grams of carbon were required; now, it is on the order of 1 *milligram*. That's the difference between needing the entire limb bone of a bison, as opposed to the single tooth of a rodent.

Since AMS dating became available in the 1980s, it has greatly expanded our ability to date sites. But radiocarbon dating is not without complications, especially because the amount of radiocarbon in the atmosphere and ocean has varied over time. In effect, we cannot assume that all plants and animals over time started with the same amount. That variation is driven by how much radiocarbon is produced in the upper atmosphere, which is largely a function of changing amounts of neutrons bombarding the atmosphere at a given time (blame the sun for that), and changes in the relative amount of CO_2 stored in the atmosphere versus the ocean. Speed up or slow down how much CO_2 is squirreled away in the deep ocean, and one's radiocarbon-dated sample might have higher (or lower) amounts of ^{14}C—not because the sample is younger (or older), but because when it formed, the atmosphere had more (or less) ^{14}C to absorb.

To control for this variation, radiocarbon measurements are *calibrated* against objects whose ages are precisely known, such as the growth rings of a tree. Simplifying a bit: a tree adds one ring every year, and since most years differ from one to the next in rainfall and temperature, the rings are often different widths (wide and light colored if it's a good growth year, dark and narrow if not). The ring pattern becomes a fingerprint for a particular period in time. And like fingerprints, no two periods are exactly alike. By pushing the tree ring pattern back in time—thanks to some well-preserved and long-lived trees from the American Southwest, Ireland, and Germany (along with well-preserved wood specimens from archaeological sites)—a tree ring sequence has been compiled for the last 12,410 years.

By radiocarbon dating a specific tree ring of known age, one can measure how far the radiocarbon age diverges from the true age, making it possible to calibrate the radiocarbon result to bring it into line with a calendar age. When one sees an age listed as "cal BP," one is in the presence of a calibrated age.[3]

Unfortunately, the period of greatest interest to the study of the first Americans—the late Pleistocene—was also a window of geological time during which there were unusually rapid changes in ocean circulation (for reasons explained in Chapter 2), causing atmospheric ^{14}C to yo-yo. As a result, the radiocarbon clock at times ran too fast or too slow, and so a single radiocarbon age from this time period often corresponds to more than one calibrated age.[4]

TABLE 1 Approximate equivalence of radiocarbon and calibrated ages, from the Last Glacial Maximum to the Early Holocene.

Radiocarbon age *(^{14}C years before present or BP)*	Median calibrated age *(calibrated years before present)*
18,000	21,285
17,500	20,635
17,000	20,120
16,500	19,665
16,000	19,170
15,500	18,815
15,000	18,320
14,500	17,475
14,000	16,690
13,500	16,040
13,000	15,350
12,500	14,625
12,000	13,865
11,500	13,340
11,000	12,945
10,500	12,465
10,000	11,485
9,500	10,840
9,000	10,085
8,500	9,440
8,000	8,860
7,400	8,200

NOTE: As derived by OxCal 3.10 (http://c14.arch.ox.ac.uk/oxcal.php).

Because calibrating radiocarbon ages for this time period is neither straightforward nor certain,[5] calibrated ages are not used here; instead, all ages are given in radiocarbon years BP. Although this can mean a slight loss of chronological precision, that won't particularly matter since I am, for the most part, speaking of ages in general. At some point in the future, calibration of radiocarbon ages in this window of time will be more precise, and then we can make the switch. Until then, using radiocarbon years BP has the ancillary benefit of making them comparable to the vast bulk of the literature on the Pleistocene and on the first Americans, and so will cause less confusion for those who wish to look into that literature.

One can, of course, convert the radiocarbon years given here to calibrated years. Readers can try this at home, either using web-based programs such as CALIB (http://calib.qub.ac.uk/calib/), or by downloading calibration share-ware such as OxCal (http://c14.arch.ox.ac.uk/oxcal.php). I provide in the accompanying table a set of radiocarbon-to-calendar age calibrations at 500-year intervals (with one exception) covering the period from 18,000–7400 BP. These were calculated using OxCal 3.10.[6] These are just rough cuts and imply a more straightforward relationship between radiocarbon and calendar years than actually exists. Real calibration is a complicated and messy business, especially for the late Pleistocene.

EARLIER THAN WE THOUGHT?

The idea the first Americans were highly mobile, wide-ranging, big-game hunters, whose arrival was tied to the final rhythms of Pleistocene glaciation, made perfect sense. For a time. But there were always nagging doubts, not least the persistent claims of a *pre*-Clovis presence in the Americas. As more archaeologists took to the field in the 1960s and 1970s, perhaps driven (more than they might care to admit) by the chance of finding America's oldest site, every field season promised a pre-Clovis contender. Some were heralded with great fanfare: the legendary Louis Leakey, fresh from his triumph at Olduvai Gorge, flew to California to proclaim the Calico site to be middle Pleistocene in age (several hundred thousand years old). Unfortunately, its supposed artifacts—pulled from massive gravel mudflow deposits—proved indistinguishable from the millions of naturally broken stones the site's excavators burrowed through and tossed aside in great piles, still visible on final approach to Los Angeles International airport.

Other pre-Clovis claims were made by lesser mortals, but in all cases the result was the same: a purportedly ancient site burst on the scene with great promise, only to quickly tumble down what I came to call the *pre-Clovis credibility decay curve,* wherein the more that was learned about a site—for example, that its supposed artifacts were likely naturally flaked stone, or that the dating technique was experimental and unreliable, or that its deposits were so hopelessly mixed that the allegedly ancient artifacts were found alongside discarded beer cans—the fewer the archaeologists there were willing to believe it.

Dozens, even scores of sites failed to withstand critical scrutiny. There were so many false alarms archaeologists grew skeptical, even cynical, about the possibility of pre-Clovis. And we have long memories—it's part of our business, after all. The response may not have been commendable, but it was certainly understandable, particularly in light of the fact that once artifacts are out of the ground, they can never again be seen in their original context. In effect, we "destroy" aspects of our data in the process of recovering it, and because our sites cannot be grown in a petri dish in a lab, replication and confirmation of a controversial claim is no easy task and independent experiments to check results are nigh on impossible (archaeology may not be a 'hard' science, though it can be a difficult one all the same).

Pre-Clovis proponents cried foul, claiming the demands made of their sites and evidence were unfair, their work chronically underfunded, and their task overdemanding. Critics replied with a sneer that those same demands were met easily enough at Africa's and Australia's earliest sites, and perhaps the proponents' eagerness to find pre-Clovis sites marked a basic flaw in the motivational structure of American academia. Bystanders wisely kept their heads down and declared neutrality. Opinion quickly outran and outweighed the meager facts, and in science disagreement moves in quickly to fill the void between fact and opinion. So controversy grew.

All of this was testimony, cynics smirked, that academic battles are so ferocious because the stakes are so low.

The cynics are partly right. Knowing that the first Americans may have arrived 14,250 years ago, as suggested by artifacts deep within Meadowcroft Rockshelter, Pennsylvania, only tells us American prehistory is a couple of thousand years older than we used to think. In the grand scheme of the last 6 million years of human evolutionary history, that hardly matters. People could have arrived in the Americas tens of thousands of years earlier still, and it would not radically alter our understanding of human evolution (though if they came here hundreds of thousands of years ago, the ante is upped considerably—but the odds that happened are vanishingly small).

Nonetheless, there is more here than an academic turf war. Hanging in the balance is an understanding of when, how, how fast, and under what conditions hunter-gatherers can colonize a rich and empty continent; insight into the population and biological history of New World peoples; a gauge of the speed with which the descendants of the first Americans domesticated a cornucopia of plants (some as early as 10,000 years ago) and became the builders of the complex civilizations here when Europeans arrived; a better and more precise calibration of the rates of genetic, linguistic, and skeletal change in populations over that time; and most unexpectedly, a deeper understanding of the often-tragic historical events that unfolded in the wake of the Europeans' arrival on the shores of what they mistakenly, if self-righteously, proclaimed a New World.

As the peopling controversy deepened, support for pre-Clovis got a boost from an unexpected quarter. Starting in the late 1980s, molecular biologists and human geneticists began to piece together histories of modern American Indians from their mitochondrial DNA (which is inherited mother to child) and from DNA in the non-recombining portion of the Y chromosome (inherited father to son). By determining the genetic distance between modern Asians and Native Americans, and assuming that distance marks the time elapsed since they were once part of the same gene pool, geneticists have a molecular clock by which they can reckon the moment the ancestors of these groups split from one another. By some estimates, it was upwards of 40,000 years ago.

The linguists spoke up as well. There were an estimated 1,000 American Indian languages spoken in historic times. If all those evolved from a single ancestral tongue, they argued, then the time elapsed since those first speakers arrived in the New World might be as much as 50,000 years. The Clovis chronology, one linguist proclaimed, was simply in "the wrong ballpark." Although geneticists and linguists were happy to go where right-thinking archaeologists feared to tread, they could not prove the existence of pre-Clovis. Neither genes nor languages can be dated: only archaeological materials can.

Then the site of Monte Verde, Chile, excavated and analyzed by Tom Dillehay, came along. Monte Verde is an extraordinary locality, and what makes it so is that soon after this creek-side spot was abandoned, the remains left behind were submerged and ultimately buried in waterlogged peat, thereby stalling the usual decay processes and preserving a stunning array of organic items rarely seen archaeologically. These included wooden artifacts; planks used in hut construction; burned, broken, and split mastodon bones and ivory, along with pieces of its meat and hide, some still stuck to the wood timbers, the apparent remnants of coverings that once draped over the huts; and *Juncus* reed string wrapped around wooden stakes (Figure 3). There were also human footprints; a wide range of plants, some exotic, others charred, still others apparently well chewed, as well as a complement of stone artifacts. All of which dated to 12,500 years ago.

At Dillehay's invitation, a group of Paleoindian experts visited Monte Verde in January 1997, having studied in advance the 1,000 pages of his massive, soon-to-be-published second and final volume on the site. We came away convinced of its pre-Clovis antiquity. This was news even the *New York Times* deemed fit to print.

Although just 1,000 years older than Clovis, Monte Verde's distance (approximately 16,000 km) from the Beringian entryway and its decidedly non-Clovis look, raises a flurry of questions about who the first Americans were, where they came from, what triggered their migration, when they crossed Beringia, how they came south from Alaska (given the ice-free corridor would not be open until after they had arrived in South America), whether Monte Verde and Clovis represent parts of the same colonizing pulse, how many migratory pulses there were to America in Pleistocene times, how

FIGURE 3.
Two of the more than eighty "tent stakes" found at the Monte Verde site. These stakes have flattened heads from being pounded into the ground, were set behind timbers hewn from a different kind of wood, and had wrappings of string made from a third type of plant (*Juncus* reed). (Photograph courtesy of Tom Dillehay.)

and how fast the first Americans traversed the continent, and why (at the moment at least) the oldest site in the New World is about as far from Beringia as one can reach, with no sites in between as old or older.

The good news is we have plenty of answers to all these questions. The bad news is we cannot tell which answers are right. But I'll try to sift through what we know and don't, and what we can say or not.

TRACING FIRST PEOPLES

The chapters that follow explore the origins, antiquity, and adaptations of the first Americans. When they arrived, which at the very least was by 12,500 years ago, the world was still in the grip of an Ice Age, and North America was a vastly different place than it is today. Chapter 2 sets that stage. It explores the causes of Ice Ages in the intricate links between changes in the earth's orbit, solar radiation, ocean circulation and salinity, and greenhouse gasses such as carbon dioxide (CO_2), and their consequences, not least of which were the immense ice sheets of higher-latitude North America (as well as at higher elevations in lower latitudes). These were glaciers large enough to have bulldozed landscapes, changed the course of rivers (including the Missouri and Mississippi), altered atmospheric circulation (creating the paradox of Ice Age winters that in places were no colder and possibly even warmer than those of the present), and frozen so much water on land that sea levels fell worldwide, creating land bridges across which people could walk from one hemisphere to another.

South of the vast continental ice sheets and beyond their immediate refrigerating effects, North America experienced climates and environments unlike any at present, comprised of complex plant and animal communities that were changing dramatically, or in some cases heading toward extinction. The first Americans were there to witness and experience some of those changes, as well as the end of the Ice Age, which refused to die quietly but instead went out in a rush of floodwaters of Noachian proportions and one brief, if failed attempt to reassert its glacial dominance.

But just when did the first Americans arrive? During the most recent glacial cycle, or earlier still? The next few chapters range widely over the efforts, historical and contemporary, archaeological and non-archaeological, to establish the origins and antiquity of the first Americans. This is a problem that's been around, as detailed in Chapter 3, for well over a century, and has been disputed almost from the very moment it was first posed. The initial round of controversy was prolonged in part because archaeology itself was in its adolescence; it hadn't well-established methods and techniques for finding, evaluating, or reliably determining the age of ancient artifacts or sites; and it was being tugged in different directions by practitioners who wanted to craft the discipline in their own images.

Demonstrating people had arrived in the Americas by Ice Age times came only after better chronological markers were established, and when a particular kind of site was discovered, namely a kill site—as at Folsom—in which the prey was an extinct Pleistocene animal. If the animal lived during the Ice Age, then so did the people who killed it. This enabled a site's antiquity to be assessed in the ground, a necessity in those pre-radiocarbon dating years. That demonstration at Folsom also taught archaeologists what to look for and how to look for Pleistocene-age sites. Soon dozens more such sites were found, including Clovis, which not only helped paint a picture of North American Paleoindians, but also had the more subtle consequence of creating expectations that guided much of the archaeological research into the Paleoindian period over the ensuing decades.

One of those expectations—that Clovis sites were oldest and therefore represented the first Americans—quickly became fact, and as Chapter 4 shows, sparked a decades-long effort to prove otherwise. The criteria for demonstrating a pre-Clovis presence were straightforward in principle—one needed unmistakable artifacts in a secure geological context with reliable ages from radiocarbon or some other dating technique—but they proved extraordinarily difficult to meet in practice. Nature was partly to blame: it has the mischievous ability to break stone and bone in ways that neatly mimic primitive human artifacts. But we archaeologists shoulder part of the blame for not recognizing nature's deviousness, or for using unproven dating techniques, or for misreading geological circumstances. Even so, much was learned in the decades of contentious debate over pre-Clovis and how best to meet the standards of proof—which were finally met at Monte Verde in 1997.

How resolution came about was in some ways reminiscent of events that took place seventy years earlier at Folsom—including the venerable tradition of a site visit by outside experts—but in important ways, the events were very different, not least in the way that Monte Verde gave fewer clues of how to find sites like it. But it has certainly redirected where we look. In Monte Verde's wake, archaeological attention has shifted to the coast as a possible entry route, which was available for passage well before the ice-free corridor opened. It has also redoubled efforts to find sites of comparable age here in North America, but so far these have proven elusive. It leaves us wondering: why are pre-Clovis sites so hard to find, and how do they relate to Clovis? Are they different parts of the same colonizing pulse into the New World?

Archaeology speaks directly to questions of *when* and *where,* and sometimes *how,* the first people came to the Americas, but struggles mightily with the question of *who* these people were, in tracing their population histories (forward or backward) or in ascertaining their relationship to contemporary American Indians. It is no easy task to measure the historical affinity between groups widely separated in space and time from the manner in which they crafted their stone tools. Accordingly, Chapter 5 turns to DNA, language, teeth, and skeletal remains to attempt to fill the gap between the most ancient and modern Native Americans. By grouping together similarities in the words and grammar of many hundreds of native languages, and by examining the diversity and patterning in mitochondrial and Y chromosome DNA, it should in principle be possible to unravel the complex relationships among American Indians, and then go the next step to infer the number and timing (using molecular clocks or inferences about rates of language change) of their ancestors' migration(s) to the New World.

Assuming, that is, there is an unbroken chain from the present back into the past, and that modern Native Americans are descendants of the first Americans, a matter that's now hotly disputed by some physical anthropologists. They see among rare ancient human skeletal remains skulls that do not resemble the crania of American Indians—the most famous (infamous) being Kennewick, which after its discovery was described at a press conference by the arcane term "Caucasoid," which on the notepads of the assembled reporters quickly morphed into "Caucasian." Could the Americas have originally been peopled by Europeans? Were ancestors of American Indians *not* the discoverers of America, but later arrivals? These are not innocent academic questions, but ones that inevitably take on a political character with real-life implications for modern-day American Indians. Even so, a couple of archaeologists blithely leaped on that bandwagon, and proclaimed that Solutreans from Stone Age Europe had paddled the iceberg-choked Pleistocene North Atlantic and landed on the east coast of North America several thousand years before Clovis. But are there traces of non-Asian ancestry in genes or language? How reliable are skulls for tracing the origins of populations? Just what do crania tell us about "race"—whatever that loaded term implies? That's why Chapter 5 aims to detail how all these methods work, what they can and cannot reveal, and the reliability of the conclusions drawn from them.

That chapter also shows that compounding the evidence and methods being brought to bear on the peopling of the Americas has in no small measure compounded the controversy. Now, instead of archaeologists arguing with one another—as we still do, even in these post–Monte Verde days—linguists, physical anthropologists, and geneticists are haggling among themselves, and all of us with one another. There's a good reason for that, as explored in Chapter 6: linguists, physical anthropologists, and geneticists speak with no more unanimity on this question than archaeologists, nor is it easy to reconcile such radically different kinds of evidence. Each of these disciplines approaches the central questions from very different angles. Linguists and geneticists view the peopling of the Americas backward from the present, through the languages or DNA of living American Indians. Archaeologists and physical anthropologists, working with ancient sites and skeletal remains, come from the opposite direction.

Naturally, there are advantages and disadvantages to each, and significant differences in data and method, such that linking modern languages or genes with Pleistocene archaeological or skeletal remains proves no easy task—not that we haven't tried. We have many scenarios for the number, relative timing, and antiquity of migrations to America. Although there is no consensus among them, we have begun to answer questions about who the first Americans were and where they came from, and can perhaps narrow down the window of time within which the migration (migrations?) occurred, and what our best chance is of more precisely resolving such questions. Even so, controversy remains.

Of course, the search for the first Americans is not just about origins and antiquity—it's also about adaptations. Once here, they apparently colonized the length and breadth of the hemisphere in less than a millennium. That's a stunning achievement for any human group, but especially for hunter-gatherers in a novel and changing setting. Chapters 7 through 9 look into how it is they moved so far so fast, what life was like in Ice Age America for the new arrivals, and what adaptive strategies keyed their successful colonization of a continent as diverse and dynamic as late Pleistocene North America.

Central to these issues is the matter of adapting to a new land, considered in detail in Chapter 7. As these bygone Siberians moved south into an ever-more-exotic New World, they surely possessed a general knowledge of animals and plants, but were increasingly encountering ones they had never seen before. Which would feed them, clothe them, cure them, or kill them? There was no one to greet them or provide helpful advice about, say, rattlesnakes or poisonous plants. Nor were there signposts at the gateway to America as there are today (tongue-in-cheek) in downtown Barrow, Alaska, pointing the way to New York City or Ayachucho, Peru.

Colonists in new landscapes face great risks, especially early on when their numbers are low and they know little of the availability, abundance, and distribution of plant and animal foods, or of how severe local climates might be, or of where (and what) potential dangers might lurk. To reduce that risk, it would have been to their advantage to learn about their new world as quickly as possible, a strong incentive to range widely and rapidly. Yet, doing so would have meant moving away from other people.

The first Americans are often stereotyped as manly hunters, Pleistocene versions of the mountain men and fur traders who boldly ventured across the American West in the eighteenth and nineteenth centuries. But if the goal was not merely to exploit but also to explore, adapt, and settle, "early man" would not get very far without early woman, and without producing early children. And when those children came of age, they needed spouses. Where were those to be found? Within their immediate band, or among distant kin who'd split off to find their own way? And how could or did groups maintain long-distance contacts with others with whom they could exchange information, resources, and mates, and do so over a vast and uncharted landscape with few known landmarks, across which they and others were possibly moving rapidly?

We have only recently begun to model the processes of colonization. Central to seeing if those models work is an understanding of the archaeological record and what it reveals of Paleoindian adaptations, the subject of Chapter 8. The first Americans surely hunted more than gathered: their long Arctic traverse from Asia to America had few other options. Those habits continued as they moved south of the ice sheets, where Clovis Paleoindians took down mammoth, mastodon, and giant bison.

But just how often were they out hunting big game, or better, how often were they successful at it? So successful they drove the Pleistocene megafauna to extinction? By 10,800 years BP, soon after Clovis groups appeared, that extraordinary assortment of large mammals (some thirty-five genera all together) had disappeared, vanishing in a geological instant from a world where they had thrived for tens and hundreds of thousands of years. Paleoindians are charged with killing—or more properly, overkilling—the Pleistocene megafauna, a wholesale slaughter routinely invoked today by conservationists as a grim homily of human destruction.

Yet, if Paleoindians are guilty as charged, then they behaved unlike any other hunter-gatherer groups known before or since, and then artfully covered up virtually all evidence of their wrongdoing. It is possible, of course, that we've not found their kill sites, or that we do not know what members of our own species are wont to do on a rich, virgin landscape teeming with game never before hunted by wily human predators. Perhaps the rules that govern hunter-gatherers in other times and places do not apply here. The first Americans were unique in many ways; this may be another.

Of course, those extinctions also coincided with the end of the Pleistocene. The sweeping climatic and ecological changes that marked that transition are just as likely (maybe even more likely) to be responsible for this massive extinction event. But if that's so, more questions remain: why did horses disappear from North America at the end of the Pleistocene, and yet flourish when reintroduced by the Spanish in the early 1500s? And isn't it odd that the plants that comprised the diet of the giant ground sloths are common today outside the very southwestern caves these now-extinct animals once frequented? These are good questions for which we have, as yet, no good answers.

What is certain is that during Paleoindian times, climates were warming, glaciers worldwide were in full retreat, sea levels were rising, plants and animals were shifting their ranges (or going extinct), and the end of the Ice Age was just over the horizon. But around 11,000 years ago, the world's climates took a sharp turn. According to one prevailing theory, when the retreating Laurentide ice sheet uncovered the St. Lawrence seaway that apparently diverted glacial meltwater—which to that point mostly drained down the Mississippi River into the Gulf of Mexico—into the North Atlantic. Flushing very cold, very fresh water directly into the northern ocean upset circulation patterns in the Atlantic and triggered a nearly instantaneous climatic response: the Northern Hemisphere was plunged back into near-glacial conditions that lasted a thousand years. The Younger Dryas, as it's called, was no Ice Age rerun, since by then many of the conditions that had put the earth under Pleistocene ice had changed. Even so, the sudden polar freeze of the Younger Dryas is blamed for the "fragmentation of Clovis culture" and even the extinction of the Pleistocene megafauna: it wasn't Pleistocene Overkill. It was Pleistocene Over*chill*. Or not.

Regardless, the Younger Dryas set the stage on which the final millennium of colonization was played out. It was during this time, as discussed in Chapter 9, that the Paleoindian descendants of wide-ranging and highly mobile Clovis groups began to settle in different regions. As they did, they developed distinctive adaptations: lifeways in the mountainous and semi-arid Great Basin soon became very different from those on the grasslands of the Great Plains, or in the rich forests of eastern North America.

This settling in inevitably severed ties among populations, and over the next ten millennia, their descendants developed new dialects and languages, along with distinctive genetic lineages, cultures, and material culture. Evolutionary pathways diverged and converged as populations sporadically reconnected (peaceably or not) and exchanged genes, words, or artifacts. By the time Europeans arrived, some 400 generations of intermittent isolation, migration, and gene flow had passed, and the descendants of what may have been a single band of colonists was now many hundreds of separate peoples, cultures, and languages, whose histories were hopelessly entangled in complex skeins.

All shared, however, a Pleistocene ancestry, and it was nearly their undoing—as explored in Chapter 10. For when more than 12,000 years of isolation ended in 1492 and the peoples of the Old and New worlds came into contact, the consequences were profound, not least in the devastating impact of repeated waves of Old World epidemic disease on American Indians. The worst was smallpox, and against it—as well as against measles, influenza, plague, and other contagions—Native Americans had little, if any, immunity. Mortality rates may have spiked at over 90% in native populations and, in so doing, arguably altered the course of American history. But to understand why American Indians were so extraordinarily vulnerable to introduced infectious diseases, and harbored none of their own (which could have slowed the colonization of the Americas by Europeans), the answer must be sought deep in their prehistory.

And something more: American archaeology has changed dramatically in the last decade, not least because of events well outside the shelter of academia where we've long cloistered ourselves. Federal legislation—the Native American Graves Protection and Repatriation Act (NAGPRA)—aimed at righting the often egregious wrongs of history, mandated that skeletal remains held in museums and universities receiving federal funding (that's just about all of them) must be returned if requested to the American Indian tribes that are biologically or culturally affiliated. It's easy enough to identify affiliation if the remains come from sites of no great antiquity, where there is clear continuity from past to present. The task is immeasurably harder when attempting to identify specific tribal descendants of the first Americans. That has sparked plenty of fights about how or even whether ancient skeletal remains can be linked with modern peoples. Legally they can be, ethically they should be, but scientifically they can't be (at the moment anyway). And so at times, as with Kennewick, it's gotten ugly.

But there have been positive steps, too, often made far from the harsh partisan limelight: archaeologists and Native Americans have become increasingly more aware and appreciative of the other's perspectives. And all sides now recognize that questions about the peopling of the Americas matter, and can matter deeply—even if for very different reasons among different constituencies.

Getting the answers to those questions is a long story, and to start the telling requires returning, ever so briefly, to where it all began.

GETTING TO BERINGIA ON TIME

The deep roots of human prehistory reach back to Africa, and a long evolutionary line of early hominids. When our very earliest hominid ancestors become recognizable about 6 million years ago (we cannot call them humans just yet), they were barely refined apes, and certainly were not in possession of the adaptive abilities necessary to venture into the far north, let alone make their way to Siberia and then on to America.

The first groups to do that were members of the genus *Homo,* of which there are various species that first appeared nearly 2 million years ago. Within a few hundred thousand years of their emergence, they had mastered fire and learned to build shelters, which enabled them to establish beachheads in colder climes outside Africa, even with the astonishingly primitive stone tools that mark the Lower and Middle Paleolithic cultural periods. *Homo erectus* and its evolutionary kin ranged widely over temperate Eurasia and lived during glacial times, yet do not appear to have expanded in any significant numbers into northern latitudes, at least not until a few hundred thousand years ago when they and their descendants occupied Pleistocene Europe. By then they were clothed, revealed by the fact that body lice (which feed on the body but live in clothing) have made their evolutionary appearance.[7] Still, there were limits to humanity's range. They spanned the distance from western Europe to China, yet few (if any) descendants of this first wave to leave Africa made it to the far northern or eastern regions of Asia or Siberia, nor were they ever within striking distance of the Americas.

It was, instead, descendants of the second major wave out of Africa who, bearing a more sophisticated stone tool technology (not to mention increasingly elaborate artifacts of bone and ivory), pushed into Europe and all the way across Asia. These were our earliest direct ancestors, the first modern humans—*Homo sapiens*—that, based on genetic and archaeological evidence, arose in Africa nearly 200,000 years ago, and from which they subsequently dispersed.

The degree to which these early moderns are related to the descendants of the first wave of humans who left Africa, such as Europe's Neanderthals, has for many years been hotly debated. Because they briefly co-existed on the same landscapes—the one using vintage Middle Paleolithic stone tools, the other the more elaborate Upper Paleolithic technology—some paleoanthropologists insist we are descended from a genetic mix of Neanderthals and early moderns. That claim has steadily lost adherents over the years, precipitously so after ancient DNA extracted from Neanderthal skeletal remains showed a genomic sequence very different from that of living humans. Based on the molecular clock, it is estimated *Homo neanderthalensis* and *Homo sapiens* went their separate ways over 500,000 years ago (which is to say, they are both descendants of a deep common ancestor, but we trace our evolution via the *Homo sapiens* line).[8]

Once *Homo sapiens* struck out on their own, they scarcely stopped. It is this species that first traveled beyond temperate Eurasia to colonize the distant corners of the globe, including Australia and the Americas, the last of the habitable continents of prehistory. Although brainy, innovative, and highly adept hunter-gatherers, getting to America was no easy journey even for *Homo sapiens,* not with Siberia in between and especially not during harsh, full-glacial times. As archaeologist Ted Goebel observes, it appears no one was in Siberia (even southern Siberia) during the LGM, and understandably so. Climates were cold and harsh though, ironically, glacial ice was no barrier: virtually all of central and western Siberia was ice free, even during the LGM.[9]

Not that there is evidence humans had reached Siberia much before then. There are only a few archaeological sites north of 55°N latitude and east of 80°E longitude (near present-day Novosibirsk) that possibly predate the LGM. And the oldest of these, Nepa I in central Siberia, which dates to 35,000 years ago, and Yana RHS in northern Siberia near the Laptev Sea, dated to 27,000 BP, are both still many thousand kilometers shy of the western edge of Beringia, the New World's entry point.

Humans more or less permanently colonized far northeastern Asia only after 18,000 BP. By then, they had reoccupied the Lena and Aldan river basins and left behind a number of sites, including Dyuktai Cave, occupied as early as 14,000 years ago, where bifacial knives, blades, scrapers, and points were found with a range of animal remains, including mammoth, bison, musk ox, horse, reindeer, and moose. Even then, they were still several thousand kilometers away and well shy of the latitude of Beringia, which is mostly north of 60°N, about the latitude of Seward, Alaska (Figure 4).

Over late Pleistocene time, humans moved further north and east, and finally approached the gateway to America. Archaeologist John Hoffecker and paleoecologist Scott Elias suggest that improved stone tool technology, more efficiently insulated clothing, and a post-glacial expansion of trees (to provide wood for hearth fires) likely aided that expansion. But humans were still sparse on the ground. Their presence is well documented and securely dated only at the sites of Berelekh on the Indigirka River close to the Arctic Coast (at 70°N latitude), and at Ushki in central Kamchatka. These two localities were relatively late in the grand scheme of prehistory: they are no more than about 14,000 and 11,300 years old, respectively. Importantly, they contain artifact types—including the distinctive Chindadn point—we will soon see on the Alaskan side of Beringia.

Otherwise, it has so far proven difficult to pinpoint archaeologically when and from where in Siberia the earliest Americans originated. Could it be that they did not come this way at all? More on this later (Chapter 6), when we confront a bold daylight attempt to rob Siberia of its role as the jumping off point for the colonization of the New World.

Taken at face value, it appears that far northeastern Siberia and Beringia were not occupied by humans until as late as 14,000 years ago. But let's not leap to that conclusion just yet. The Siberian archaeological record on the whole is sparse, and gets even more so as one approaches the Bering Land Bridge. The timing of the peopling of Siberia will

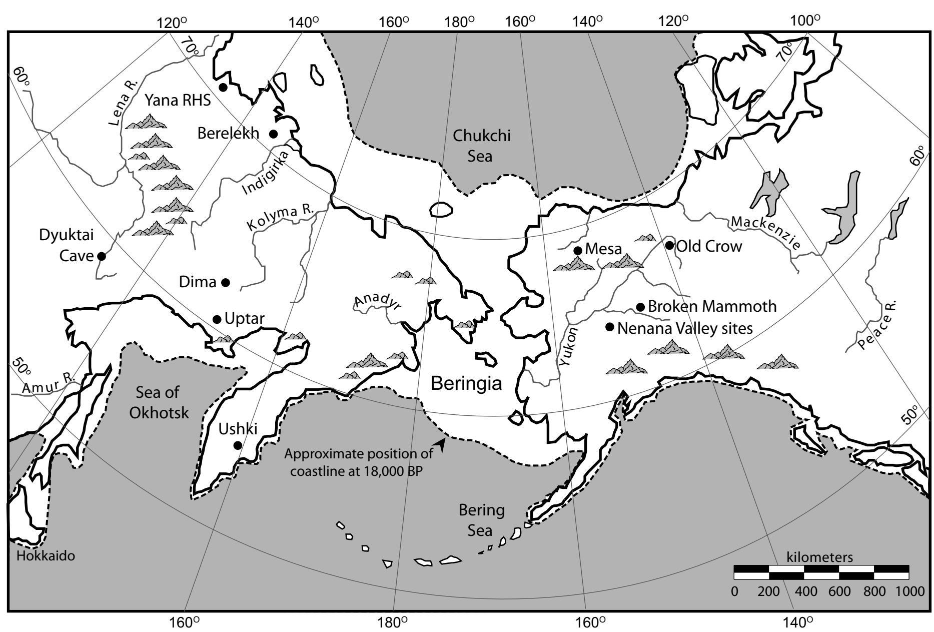

FIGURE 4.
Map of the extent of Beringia at the Last Glacial Maximum (LGM), showing the location of early Siberian and Alaskan archaeological sites discussed in the text.

not be known until Siberia is peopled by more archaeologists. Given the archaeological near invisibility of what must have been small and highly mobile human populations, the vast area to be searched for their sites, and the relatively limited archaeological work that's been done to date, this negative evidence is sure not to endure.

But prehistory in this region (or in the Americas) will likely not go too far back. No Neanderthals or any other earlier (non-*sapiens*) form of human has ever been found in far northeast Asia and Siberia, let alone in the New World. One should never say never in archaeology, but at this point, it seems exceedingly unlikely that premodern humans made it to the Americas, though that hasn't stopped speculation on this score—or claims from sites like Calico (California) or Old Crow (Canada) that the first Americans arrived some 200,000 to 350,000 or more years ago.

Of course, if such claims of deep antiquity (or European ancestry) are right, then our hard-won understanding of human evolution is badly wrong. But there's no need to rush a textbook rewrite just yet. More likely, such claims are simply flawed. We have long assumed, and have no reason to doubt, the Americas were colonized by anatomically modern humans, coming by way of Asia and bearing an Upper Paleolithic artifact technology, and arriving at some time during the latter stages of the Ice Age.

But what kind of place was this New World?