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The human colonization of the Americas: archaeology

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The colonization of the Americas from Siberia after 16 kya was one of the most remarkable achievements of early modern humanity. This chapter outlines the archaeological evidence for this dramatic founding human migration into two new continents.

It was long assumed that the first Americans were Siberian hunters, lured by game across the Bering Land Bridge (Beringia). Beringia emerged during the Pleistocene as precipitation over high latitudes froze, forming glaciers instead of returning to the oceans, thereby drawing down global sea levels by up to 130 m during the coldest phases. Such low sea levels exposed the shallow continental shelf below the Bering Sea, making it possible to walk to America without noticing one was leaving Asia. Yet, once in Alaska, travel further south was blocked by two vast ice sheets – the Cordilleran, which covered present-day British Columbia and portions of the Yukon, and the Laurentide, which stretched from Newfoundland to Alberta, and from the high Arctic to the American Midwest. These buried much of northern North America for thousands of years before, during and after the Last Glacial Maximum (LGM) that peaked at about 21 kya (18 kya bp[1]) (Dyke 2004).

Until recently, the earliest sites known in the Americas were from the Clovis culture, which appeared around 13,340 years ago (11,500 bp), soon after the Cordilleran and Laurentide ice sheets retreated and an ice-free corridor opened between them. In less than a millennium, Clovis fluted projectile points (Figure 8.1) spread throughout North America, suggesting a rapid movement across the continent – and perhaps even the hemisphere. Although no precise examples of Clovis points are found south of Panama (Ranere 2006), many believe Clovis descendants made it to the tip of South America. How had they moved so far so fast? Since Clovis points were early on found with mammoth remains, it was inferred they were big-game hunters, who pursued

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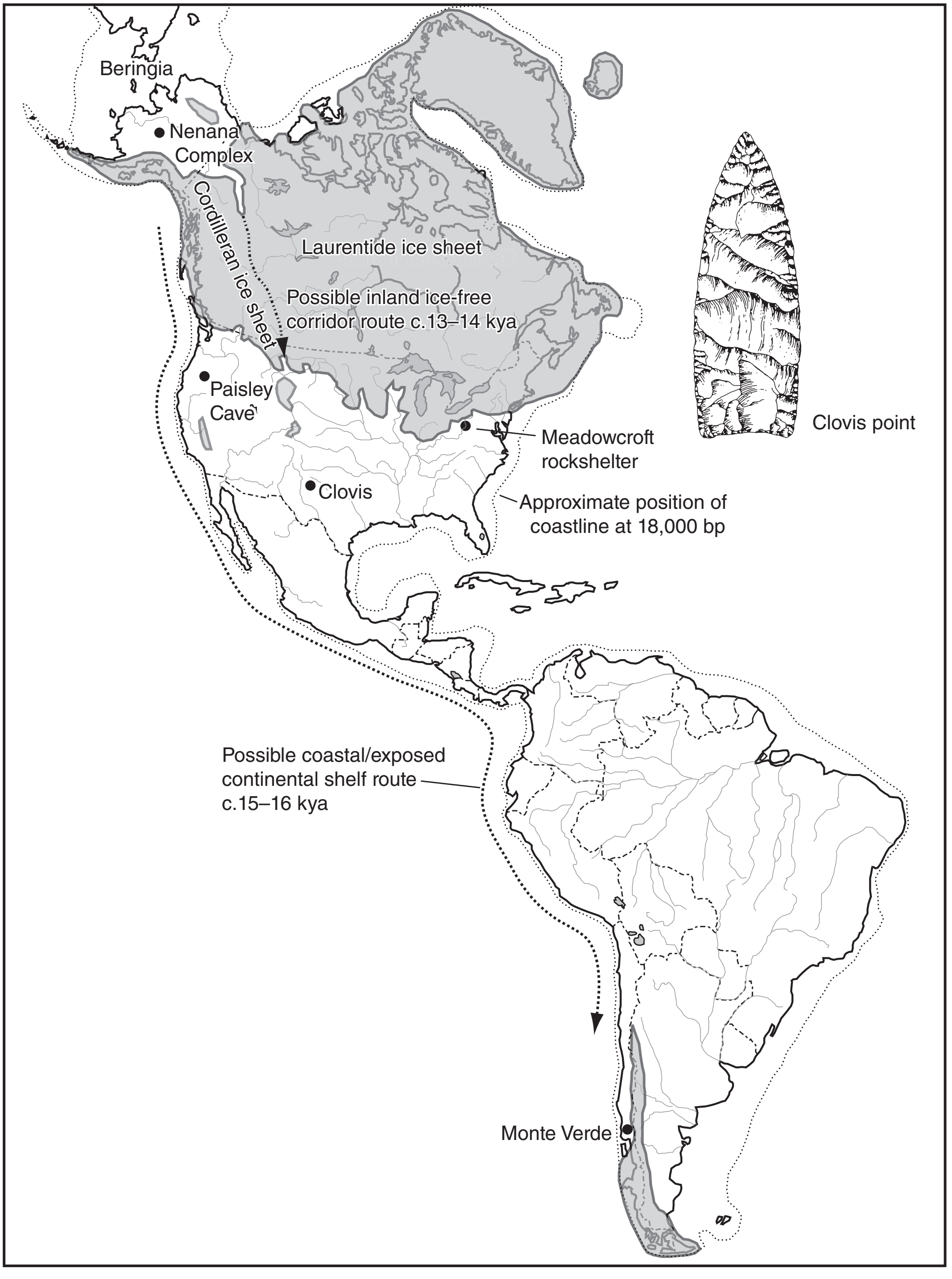

Figure 8.1 The initial settlement of the Americas, from archaeological and genetic perspectives.

their highly mobile prey across the continent. As many large mammals seemingly vanished from the landscape about the same time, it was even suspected they drove those animals to extinction (Martin 1973).

The idea that the first Americans were wide-ranging fast-moving hunters, whose arrival was tied to the rhythms of glaciation, made sense. For a time. But there were also persistent claims of *pre-Clovis* sites said to be twenty, fifty, or even several hundred thousand years old. Yet none withstood scientific scrutiny. In some instances, the estimated ages were shown to be spurious, in others the supposed artifacts proved to be made by natural processes that fractured stone or bone in ways that mimicked human tool-making. Archaeologists became highly skeptical of pre-Clovis claims (Dincauze 1984).

But then support for pre-Clovis got an unexpected boost. In the late 1980s, geneticists began to develop "molecular clocks" using uniparentally inherited mitochondrial DNA (passed from mother to child), and a decade later the non-recombining portion of the Y-chromosome (inherited from father to son). By gauging the genetic distances between modern Asians and Native Americans, and calculating the time elapsed since they were part of the same gene pool, these molecular-clock estimates seemingly confirmed that the first Americans left their Asian relations in pre-Clovis times.

Yet, genes cannot be directly dated in themselves (though bones or organic material yielding ancient DNA can be radiocarbon-dated, giving some measure of the antiquity of a particular genetic marker). To prove a pre-Clovis presence, a radiocarbon-dated pre-Clovis archaeological site was needed. That came with the excavations at Monte Verde, an extraordinary site in southern Chile where, soon after its occupants departed, the surface on which they had been living was covered by a water-logged peat. That stalled the usual decay processes and preserved a stunning array of organic remains, including wooden timbers, some with bits of adhering mastodon hide, "tent stakes" from huts, a wide range of plants, some charred and others apparently well chewed, and a range of wood, stone, bone, and ivory artifacts (Dillehay 1997). All were dated to 14,625 years ago (12,500 bp).

Although just one thousand years older than Clovis, Monte Verde's distance (about 16,000 km) from Beringia, and the decidedly non-Clovis look of its projectile points, raised questions about who were the first Americans, where they came from, when they arrived, how they traveled south from Alaska at a time when the ice-free corridor had yet to open, whether Monte Verde and Clovis were part of the same or separate colonizing pulses, and how these groups adapted to a landscape that was completely unknown, highly diverse, and changing.

Consider the *who* and *from where* questions. Although we assume the first Americans came from northeast Asia, finding their traces has been a challenge. The oldest site in the Siberian Arctic – Yana RHS, dating to 27 kya (Pitulko et al. 2004) – is still about 2,000 km west of the Chukotka Peninsula, the jumping-off point for America (see Figure 4.1 for its location). Currently, the earliest site in far northeastern Asia close to America is only slightly older than 13 kya (11 kya bp) (Goebel et al. 2010). That's too late to be ancestral to Clovis, let alone pre-Clovis. But then, the Siberian archaeological record is sparse and poorly known; earlier evidence may yet be discovered. Even so, on the more intensively surveyed eastern side of Beringia, the earliest Alaskan sites (belonging to the Nenana Complex) are scarcely more than 14,000 years old (12,200 bp) – likewise too young to represent ancestral Monte Verdeans. Nenana sites precede Clovis, but their artifacts don't look particularly Clovis-like.

Our inability to spot ancestral Americans in the Beringia region hardly disproves that they came from Asia. Sites produced by small, highly mobile populations were likely ephemeral, and difficult to find after time and erosion have taken their toll. Nonetheless, the scarcity of sites calls into question the "standstill model" from genetics, which hypothesizes that humans were isolated in Beringia for some 15,000 years before migration into the rest of North America began (Tamm et al. 2007). Such a prolonged occupation ought to have produced a more visible archaeological record than exists.

So *when* and *how* did the first colonists reach America? Colonizers could have walked across Beringia anytime after 33 kya until nearly 11.5 kya (28–10 kya bp) (Brigham-Grette et al. 2004). The landscape was flat, unglaciated, cold, dry, and covered in grassy steppe-tundra, across which people and animals could move east (or even west) with relative ease (which explains why, with a few exceptions, the Pleistocene fauna is virtually identical on both sides of the Bering Sea).

Travel to North America south of the ice sheets was not so easy. The Cordilleran ice sheet covered much of the Pacific coast. Intermittent ice-free areas would not have provided much food or fuel, and travel – whether on foot or by boat – would have been impeded by icebergs, sea ice, heavily crevassed and unstable ice fronts, and sediment draining the ice fields that would have choked tidal waters.

As the ice sheets melted two routes south opened, though not simultaneously. The coast was clear by around 16 kya (13.4 kya bp). The ice-free corridor opened from both ends, roughly along the eastern flank of the Rocky Mountains (Figure 8.1). Initially, this corridor was an impassable wasteland of mudflats, meltwater lakes, and glacial deposits, kept cold by nearby glaciers. It only became stocked with plants and animals, and thus a viable route for humans, around 13.8 kya (12 kya bp) (Dyke 2004).

If colonization took place *before* the LGM, groups could have come via the coast or interior. Although we lack secure evidence of pre-LGM groups in the Americas, we cannot preclude the possibility. On a continent this large, colonists were surely present long before their traces appear on our archaeological radar. But unless we find the very first site in the Americas, the oldest site we have provides only a minimum age for colonization. Correspondingly, genetics may provide a maximum age for colonization, in so far as it reveals when ancestral Asians and Native Americans were part of the same population. Molecular clocks currently put that common ancestry at c.15 kya (see Chapter 9), but this is at best a ballpark figure for several reasons, not least the imprecision of calibrating the ticking of those clocks – more properly, the rate by which mutations occur – against absolute years.

If colonization occurred after the LGM, then presumably colonizers came via the Pacific coast, since the interior corridor was impassable, and remained so until well after Monte Verde was abandoned. Although there are a few late Pleistocene sites along the coast, none are pre-Clovis in age. The effort to find older ones is hampered by postglacial sea-level rise, which drowned much of the Pleistocene coast. Nonetheless, there are regions of southeast Alaska where isostatic rebound (land rising after the heavy load of glaciers has been lifted) and/or tectonic uplift have outpaced sea-level rise, and so preserve the Pleistocene coastline by raising it above contemporary sea level. These areas have yet to receive much archaeological attention.

Although ancestral Monte Verdeans could not have traveled through the ice-free corridor because of their early date, the appearance of Clovis coincides neatly with the opening of that route. So, were Clovis and Monte Verde descendents of the same colonizing pulse? There are no obvious historical or technological links between their artifacts (Dillehay 2008) – but these are cultures widely separated in space and time, so links may be difficult to discern.

Even so, there are hints that Clovis was a separate migration which traversed North America in just a few centuries (Waters & Stafford 2007). That suggests they were crossing an empty landscape. If so, what became of any pre-Clovis colonizers who presumably passed through earlier? It's a good question, but one without a good answer. There are a few pre-Clovis contenders in North America, most notably Paisley Cave, Oregon, which has yielded 14,200-year-old (12,300 bp) human coprolites preserving ancient DNA (Gilbert et al. 2008). Why haven't more pre-Clovis sites been found? It may be that the search has not been in the right places or in the right ways.

The genetic record is equivocal on the question of whether there was more than one migration to the Americas. There are a limited number of mtDNA (only five in total) and Y chromosome (only two) lineages among modern Native American tribes, and it has seemed unlikely that completely separate migrations from Asia would have introduced so few founding lineages. Still, the sample of DNA is small and many groups are not well represented, and recent discoveries in ancient DNA are revealing previously unrecorded lineages, suggesting a more complex colonization history (Malhi et al. 2007).

Assuming Clovis was a separate, later migration into North America, the question of how fast it spread is perhaps not as interesting as *how* and *why* Clovis, and possibly related South American groups, moved so far, so fast, across such a vast, unknown, dynamic, and diverse landscape. The traditional explanation is that they were pursuing wide-ranging big-game, now-extinct Pleistocene mammals, which in North America included some 35 genera, plus another 52 in South America. Of the latter, nearly 70 percent were unique to that continent (Barnosky et al. 2004). Many were large mammals, including several proboscideans (mammoth, mastodon, gompothere), and multiple genera of giant ground sloths (especially in South America). Also headed toward extinction were camels, horses, tapirs, peccaries, and some highly unusual animals like the glyptodont, a mammal weighing upwards of one ton encased in a turtle-like carapace. Preying on these herbivores were carnivores such as the giant short-faced bear, lions and cheetahs, and the aptly named *Smilodon fatalis*, the sabertooth cat (Grayson 2007).

As noted, it has been claimed that Clovis and related South Americans hunted these mammals to extinction (Martin 1973), but there is reason to be skeptical. Despite a rich fossil record of many of these extinct animals, evidence of actual slaughter by hunters is extremely rare. Of the 76 North American archaeological sites said to testify to big-game hunting, only 14 provide unequivocal evidence that humans killed and dismembered the animals (Grayson & Meltzer 2002). And just two genera appear in those sites: mammoth and mastodon. There are no kill sites of the other 33 North American genera that went extinct. The record from South America is equally telling: kill sites of large mammals are extremely rare, limited to two genera (horse and ground sloth), and even these lack secure evidence of human involvement (Borrero 2009).

To be sure, early Americans could, and occasionally did, take big game, perhaps with four-footed help: they had brought their dogs, recently domesticated from wolves, along with them to the Americas (Snyder & Leonard 2006). Still, even with such help there was no strong incentive to tackle large prey. Hunter-gatherers aim to reduce risk, and there is considerable risk of coming home empty-handed or, worse, not coming home at all, when preying on large game (Meltzer 2004).

So what was behind the possibly rapid dispersal of colonists into the Americas? Colonization occurred at the end of the Pleistocene, when the plant and animal communities on which humans depended were changing. Yet, even during the Younger Dryas, a millennium span of northern-hemisphere cooling and biotic change starting 12.9 kya (11 kya bp), those changes proved to be variable across the hemisphere and occurred on a time scale of centuries (Meltzer & Holliday 2010). That was likely not fast enough to be detectable by hunter-gatherers who had to respond to daily, weekly, and seasonal conditions. Moreover, adapting to changing environments was nothing new to them: they'd been meeting the challenges of novel habitats since their ancestors left northeast Asia.

The environment is important in another way, however. As colonists moved south into an ever-more exotic New World, they carried with them a general knowledge of animals and plants, but were increasingly encountering species they had never seen and even some they could not see: colonists would have been exposed to a variety of novel pathogens when they entered the American tropics (Dillehay 2008). They would have faced the greatest risk of failure early on, when their numbers were low, and the landscape and its resources unknown and unpredictable. To reduce that risk, it was to their advantage to learn the landscape as quickly as possible (Meltzer 2004). They had to learn about the abundance and distribution of impermanent resources like animals and plants, as well as more permanent ones like stone or reliable freshwater, in order to know *how to move*. They needed to understand weather and climate, to anticipate better their effects on vital resources and thus to know *when* to move. Furthermore, they had to learn the geography of each unfamiliar place, in order to move across it without getting lost and, importantly, to find the way back, in order to know *where* to move.

Landscape learning must have involved more than their immediate surroundings: insurance for hunter-gatherers is not just knowing what resources are available locally, it's knowing where to go when local conditions deteriorate (Binford 1983). There would have been an incentive to range widely and rapidly across the new landscape to see what was over the next hill, so as to reduce uncertainty and risk.

But there are costs involved in moving too far too fast, since this almost certainly would have meant moving away from other people. Colonizers also had to maintain contact with other dispersing groups, to avoid inbreeding costs or extinction. This would have been more or less difficult depending on the group's size, growth rates, kin structure, age and sex composition, and how rapidly it was moving away from other groups (Moore 2001). Arguably, colonization involved a compromise between multiple demands: maintaining resource returns, maximizing mobility, minimizing group size to hedge the possibility of some environmental calamity, and maintaining contact between dispersed groups to sustain the gene pool (Meltzer 2004).

As one might expect of hunter-gatherers new to a landscape and unfamiliar with its resources, there was a range of items on the menu, including a variety of mammals from bison and caribou to rabbit and fox, as well as birds, fish, turtles, and occasionally (though the evidence is sparse) plants (Cannon & Meltzer 2004). There is tantalizing evidence that they brought one plant – the bottle gourd – to America, though perhaps for use as a container rather than food (Erickson et al. 2005). Likewise, South American colonists in inland areas exploited an extinct species of llama, deer, guanaco, and a variety of small mammals, and along the coast, seabirds, marine fish, and shellfish; in many areas plants such as tubers, pine and palm nuts, prickly pear, and wild potato were gathered (Borerro 2006; Dillehay 1997; Sandweiss 2008).

The toolkit Clovis groups used to exploit those resources is remarkably uniform across North America, though there were variations. It is primarily a biface-based technology, with distinctive tools and tool classes, for example blades, ivory tools, limaces (a slug-shaped unifacial tool), and adze-like forms, occurring in some areas but not others. The toolkit was generalized, adaptable to a variety of tasks and often made out of exotic high-quality stone, which had the virtue of being less prone to failure, longer lasting, and more readily resharpened and quickly refurbished into other forms, as the circumstances required (Ellis 2008).

In contrast, stone tools in early South American assemblages are more diverse, but can be grouped into several apparently contemporaneous traditions: a bifacial tradition, including diagnostic forms such as El Jobo, Fishtail, and Paijan, which is typically found in the Andean region from Columbia to the Southern Cone of Patagonia, and various unifacial, edge-trimmed tools found in forest and parkland areas of northern and central South America (Dillehay 2008). Unlike Clovis groups to the north, South American colonists were not as finicky about the quality of the stone they used to make their tools, which may in turn speak to differences in mobility and adaptation (Borrero 2006).

Sites of this time period throughout the Americas were relatively ephemeral. Evidence of structures, perhaps built of wood, reeds, or other materials that quickly degraded and disappeared are rare, though not absent (Sandweiss 2008). Curiously, caves and rockshelters were commonly used in South America, rarely so in North America. Groups appear not to have stayed long in any one spot, nor returned. Such is the advantage to colonists inhabiting a landscape with few other people, and ample resources.

On such a landscape, hostility toward strangers would have been decidedly disadvantageous; rather, colonists likely had social systems that were sufficiently open to help recognize even strangers as friends. Open social systems are difficult to detect archaeologically, but we may be seeing this in proxy form in their distinctive projectile points. These are stylistically similar within North America, and in broad swaths of South America, and perhaps helped groups recognize one another as descendents of a common people who had gone separate ways years or decades earlier.

But even if it was sometimes temporarily checked, that centrifugal process of dispersal never stopped, and over the centuries, as groups spread farther from one another, they began to settle into different areas and local populations began to expand (Meltzer 2009). As they did, the ties between different groups that had been so vital when there were few people on the landscape and they needed to keep in contact with one another began to break down. So too, the need to maintain common artifacts and cultural bonds. And so, by 12.5 kya (10.5 kya bp) across much of North and South America, the early, nearly pancontinental cultures were replaced by a variety of regionally distinctive groups. These were more restricted geographically, often had new adaptive strategies and new technologies, and more restricted mobility. By then, the initial colonization of the Americas was complete; the process of settling in had begun.

SEE ALSO: 9 The human colonization of the Americas: population genetics

Note

1 Radiocarbon years are provided in parentheses, followed by bp (before present). This is done because the time period under discussion falls partly within the Younger Dryas Chronozone, when amounts of atmospheric radiocarbon fluctuated significantly, leading to calibrations that often have multiple intercepts and thus are imprecise. Calibration curves have improved over the years, but as they are likely to change in the future including radiocarbon ages provides a measure of constancy, and they can be recalibrated with each new calibration iteration.

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