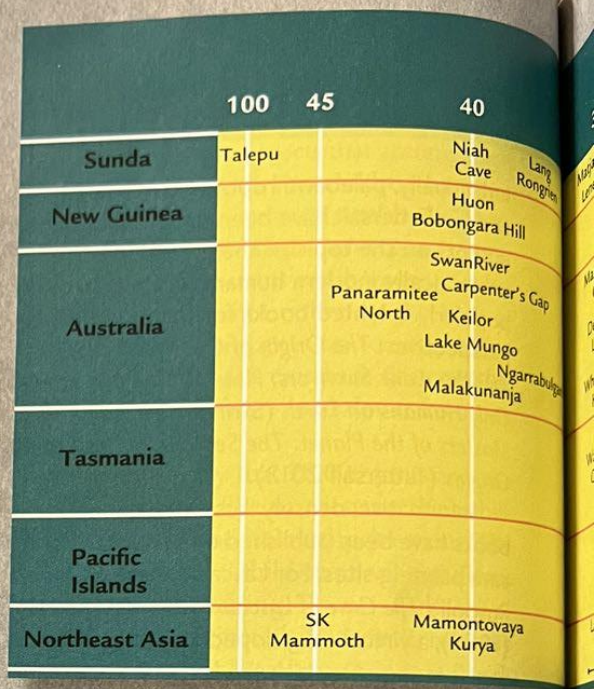
7

Expanding Geographic Horizons

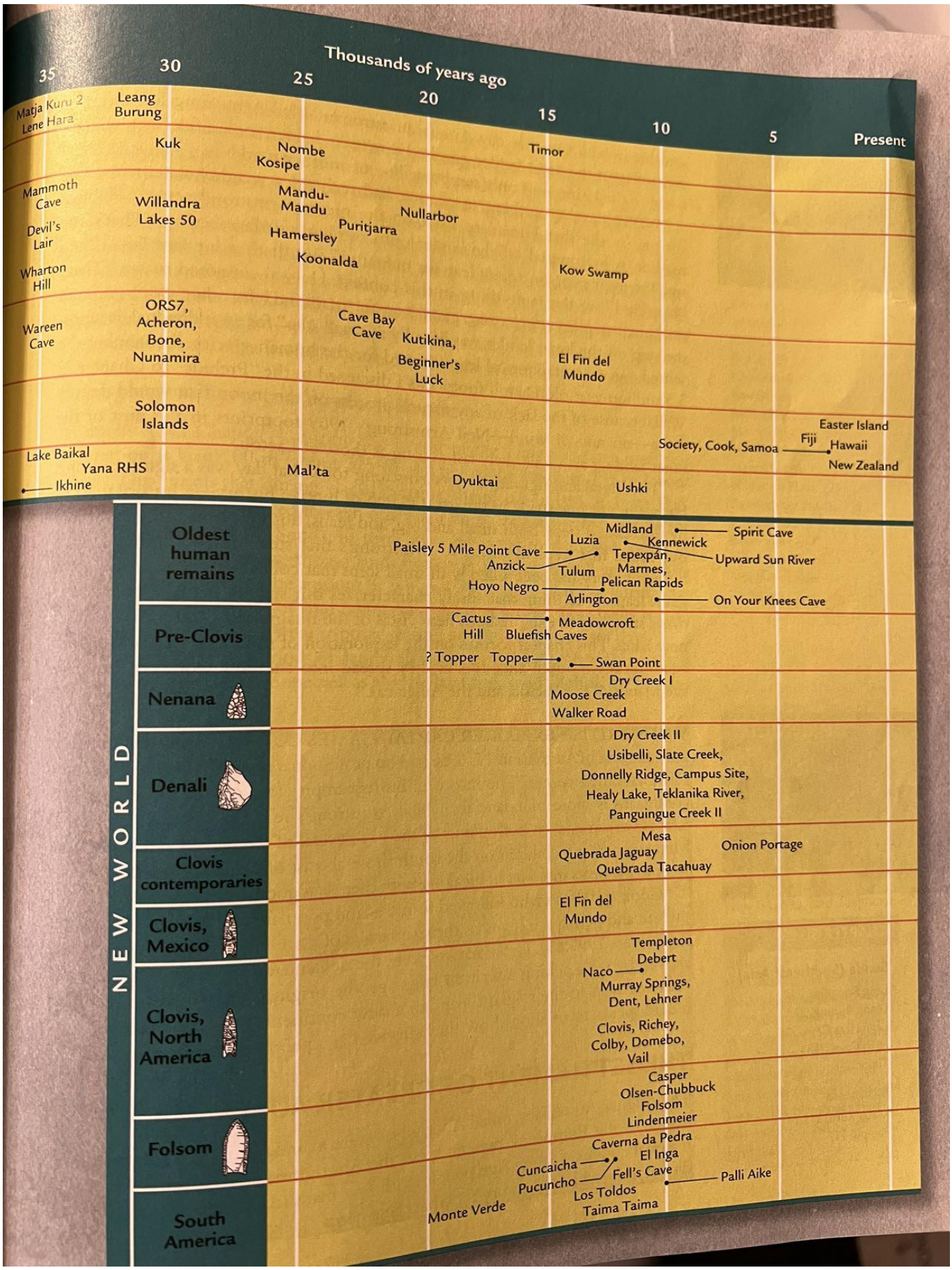
New Worlds



CHAPTER OVERVIEW

After 50,000 years ago, human population expanded beyond Africa, Europe, and Asia and into the rest of the habitable world. Sahul (Australia/New Guinea/Tasmania) exhibits clear evidence of human occupation by about 50,000 years ago. The islands of western Melanesia were populated beginning about 35,000 years ago. Micronesia and Polynesia also show evidence of occupation after 3,500 years ago as human population expanded eastward into the Pacific.

An enormous body of land called Beringia, joining northeast Asia and northwest North America, was exposed during periods of lowered sea level that accompanied the expansion of glacial ice during the Pleistocene. Inhabitants of northeast Asia expanded into the interior and along the coast of Beringia and, ultimately, into the New World, probably by about 20,000 years ago. Some migrants may have traveled along the coast, reaching as far south as Chile by 18,000 years ago. Others seem to have migrated through the interior, reaching the American southeast perhaps as early as 15,000 years ago. Though the dates of the earliest sites in the New World are controversial, the archaeological record provides unequivocal evidence of a highly successful human adaptation to the Late Pleistocene world of the Western Hemisphere at least as early as about 12,500 years ago.


Thousands of years ago
35
30
25
20
15
10
5
Present
Matja Kuru 2
Lene Hara
Leang Burung
Kuk
Nombe
Kosipe
Timor
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Cave Bay Cave
Kutikina, Beginner's Luck
El Fin del Mundo
Solomon Islands
Easter Island
Fiji
Hawaii
Society, Cook, Samoa
New Zealand
Lake Baikal
Yana RHS
Ikhine
Mal'ta
Dyuktai
Ushki
NEW WORLD
Oldest human remains
Midland
Spirit Cave
Luzia
Kennewick
Paisley 5 Mile Point Cave
Tepexpán, Marmes, Pelican Rapids
Upward Sun River
Anzick
Tulum
Hoyo Negro
Arlington
On Your Knees Cave
Pre-Clovis
Cactus Hill
Meadowcroft
Bluefish Caves
? Topper
Topper
Swan Point
Nenana
Dry Creek I
Moose Creek
Walker Road
Denali
Dry Creek II
Usibelli, Slate Creek, Donnelly Ridge, Campus Site, Healy Lake, Teklanika River, Panguingue Creek II
Clovis contemporaries
Mesa
Quebrada Jaguay
Onion Portage
Quebrada Tacahuay
Clovis, Mexico
El Fin del Mundo
Clovis, North America
Templeton
Debert
Naco
Murray Springs, Dent, Lehner
Clovis, Richey, Colby, Domebo, Vail
Folsom
Casper
Olsen-Chubbuck
Folsom
Lindenmeier
South America
Caverna da Pedra
El Inga
Cuncaicha
Fell's Cave
Pucuncho
Palli Aike
Los Toldos
Taima Taima
Monte Verde

PRELUDE

SUNDAY, JULY 20, 1969, WAS A momentous day in human history: For the first time in the existence of our species, a human being walked on the soil of another world. On that day, American astronaut Neil Armstrong left the relative safety of the lunar lander, climbed down the ladder, took a final step off, and became the citizen—if only temporarily—of another world.

NASA, leaving nothing to chance, had scripted a weighty statement to be spoken by the first human to walk on the moon. Armstrong actually flubbed his line as he jumped off the lander onto the lunar surface, saying: "That's one small step for man, one giant leap for mankind." But that's redundant; "man," and "mankind" are the same thing in this context. He was supposed to say, "That's one small step for *a* man, one giant leap for mankind." In other words, though the step off the lunar lander was literally a "small step" for an individual, it represented a giant metaphorical leap forward for the human species. Remember the 3.5 million year old Laetoli footprints I discussed in the "Prelude" to Chapter 3? Well, because of the lack of any natural process on the moon that would destroy them—no rain or wind—Neil Armstrong's 1969 footprints in the dust of the lunar landing area will likely last as long as those at Laetoli.

The literal and figurative step Armstrong took that day was a significant one, but really just one stride in the great march of human history—a history marked by uncounted steps, both small and big, and leaps, both modest and great. From our literal first steps in Africa to Armstrong's first step onto the lunar surface, human history has been filled with small steps that collectively have added up to giant leaps. One thing that surely characterizes our species is the desire to take those steps and to explore both new vistas of the imagination and actual vistas of new lands. This chapter focuses on the exploration of such new horizons by our anatomically modern ancestors as they spread into the new worlds of Australia, the islands of the Pacific, and the Americas.

CHRONICLE

WHEN BRITISH EXPLORER CAPTAIN JAMES COOK'S ship made landfall on the east coast of Australia in 1770, he had no professional speechwriters to help commemorate the occasion. The record of his first impressions on encountering native Australians is more mundane than Neil Armstrong's remarks: "Sunday 29th April. Saw as we came in on both points of the bay Several of the natives and a few hutts. Men, women and children on the south shore abreast of the Ship, to which place I went in the boats in hopes of speaking with them" (as quoted in A. G. Price 1971:65).

Cook and those who followed found a land populated by more than a quarter million and perhaps as many as three-quarters of a million people (Mulvaney and Kamminga 1999:69). Those natives were the descendants of settlers who had also arrived by sea. Lacking a written language, the original settlers left no record of their reaction to their "giant leap" to a new continent. Only the archaeological record speaks to us about how they survived as a people in their new world.

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Lene Hara Cave, 218
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Indonesia

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THE SETTLEMENT OF GREATER AUSTRALIA

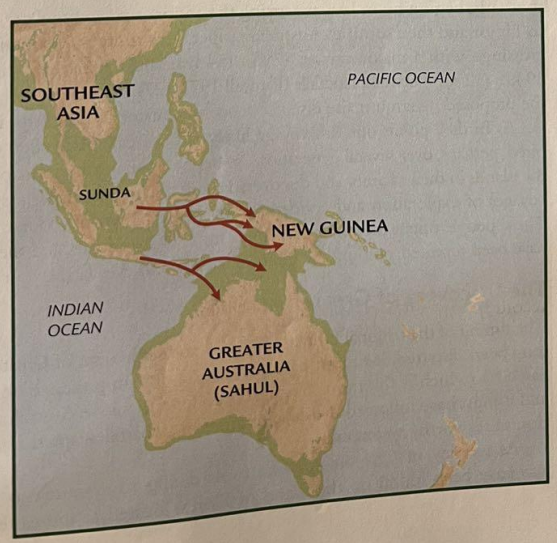
The original Australians, called Aborigines, were an enigma to the European colonizers. In the Europeans' myopic view, the Aborigines seemed primitive in their material culture, a Stone Age people with few material advances, throwbacks to a distant time in human history. Yet what these people lacked in things, they more than

made up for in ideas. They possessed a range of sophisticated social systems; the individual Aborigine had a far denser web of relations and was far more knowledgeable of his or her social connections than was the average European. These supposedly primitive people also had a richly detailed mythology and oral history and a sophisticated knowledge of their natural surroundings. Australian Aborigines also produced a deeply textured artistic tradition, painting fantastical images of the animals they encountered in their environment, as well as the ancestors, heroes, and spirits that inhabited their spirit world (Gray 1996; Mulvaney and Kamminga 1999). As different as they were from the European settlers, these native Australians shared at least one thing with the newcomers; as already mentioned, they had arrived by watercraft (Birdsell 1977; Jones 1989, 1992; J. P. White and O'Connell 1982). Their voyages of exploration and migration—a series of small steps adding up to one giant leap to a new world—occurred at least 40,000 years before the arrival of the Europeans.

Paleogeography in the Western Pacific

As discussed in Chapter 4, during the height of the Pleistocene sea level was lowered by at least 100 m (about 325 ft) and perhaps as much as 135 m (about 440 ft). This means that during glacial maxima, the islands of Java, Sumatra, Bali, and Borneo were connected to each other in a single landmass called **Sunda** (or **Sundaland**; Figure 7.1). Sunda, in turn, was connected to mainland southeast Asia. The oceans separating these islands from one another, as well as from Asia proper, are not as deep as the amount by which sea level was depressed during glacial maxima. Wide swaths of land connecting these territories, now many meters under the ocean's surface, were exposed during periods of lowered sea level.

During these same periods of depressed sea levels, Australia, New Guinea, and Tasmania were similarly connected as a single landmass, called **Sahul,** or "Greater



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Hamersley Plateau, 221
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Sunda (Sundaland): The combined land mass of the modern islands of Java, Sumatra, Bali, and Borneo. These islands became a single, continuous land mass during the Pleistocene.

Sahul: The land mass of "Greater Australia" including Australia proper, New Guinea, and Tasmania.

FIGURE 7.1
Map showing the current coastlines of Australia, New Guinea, and southeast Asia as well as the coastline during glacial maxima. Arrows show proposed migration routes from Sunda (the combined land mass of the islands of southeast Asia) to Sahul (Greater Australia).

Wallace Trench: An undersea chasm located between New Guinea/Australia and Java/Borneo. Nearly 7,500 m deep (almost 25,000 ft).

Wallacea: Name given to the sea over the Wallace Trench.

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Australia" (see Figure 7.1). Unlike Sunda, however, Sahul was never connected to mainland Asia. Even when the Pleistocene glaciers were at their most extensive and sea level was at its lowest, Sahul was still separated from Asia by a water barrier. In fact, Greater Australia has been separated from Asia since the two were separated through continental drift more than 100 million years ago. This long-standing isolation of Australia has resulted in that continent's unique native fauna of kangaroos, wallabies, wombats, and koala bears—which are marsupials (primitive mammals that give birth to very immature young that complete their gestation in pouches)—and platypuses, echidnas, and spiny anteaters—which are monotremes (egg-laying mammals).

The **Wallace Trench,** located between New Guinea–Australia and Java–Borneo, is an enormous undersea chasm, nearly 7,500 m (25,000 ft) deep. Though the distance between the shores of Sunda and Sahul lessened as sea level became depressed during glacial maxima at 65,000 years ago, then 53,000 years ago, and again at 35,000 years ago, the islands never coalesced, kept apart by the deep waters of **Wallacea**, the sea over the Wallace Trench (Glover 1993).

The Road to Sahul

Oceanic islands in Wallacea, like Timor and Sulawesi, would have served as stepping stones between Asia and Australia during the Pleistocene. Anthropologist Joseph Birdsell (1977) has suggested a series of possible routes from Sunda to Sahul during periods of lowered sea level (see Figure 7.1). During glacial maxima and the concomitant lowering of sea level, one viable route starts on the eastern shore of contemporary Borneo, continues east through Sulawesi, and includes several island hops to northwest New Guinea. The longest interisland gap would be about 70 km (43 mi); the mean of the eight gaps in this route is only about 28 km (17 mi; Birdsell 1977:127). An alternate route suggested by Birdsell is more southerly, beginning in Java, traversing the Indonesian archipelago, crossing south to Timor and then south to Australia proper. This route also contains eight ocean crossings, with a maximum of 87 km (54 mi) and a mean of a little more than 19 km (12 mi) between landfalls (Birdsell 1977:127). When sea level is not as low as the proposed maximum, the distances become greater and the trip more difficult.

As Birdsell points out, this voyage likely did not take place all at once but transpired, perhaps, over several generations, as people with a marine adaptation explored the islands in their vicinity and discovered more distant islands, perhaps by intentional voyages of exploration and accidentally by being blown off course during storms. These people might then have settled on some of the islands, and the process would have been repeated, pushing the limits of their world ever farther out along its edges.

The Discovery of Greater Australia

The timing of the original human discovery and settlement of Greater Australia has long been disputed. It cannot have preceded a human presence on coastal southeast Asia (which is the most logical source for the native Australian population), and it must have followed the development of a coastal adaptation and the invention of seaworthy watercraft.

As we saw in Chapter 4, stone tools dating to as much as 900,000 years ago have been found on the island of Flores, located at the eastern end of the

Indonesian archipelago (Morwood et al. 1998). With the lowered sea level of that time period, Flores was separated from the mainland by only about 19 km (12 mi) of open water. Nevertheless, this indicates that even at this early date, hominins were capable of surviving at least short deepwater crossings. Recent research at the Talepu site on the island of Sulawesi in the western Pacific revealed the presence of stone tools there in a stratigraphic context that indicates an age of more than 100,000 years (van den Bergh et al. 2016).

It should come as no surprise, therefore, that anatomically modern humans were capable of crossing the wide stretches of open ocean separating Greater Australia from Sunda by about 50,000 years ago. Unfortunately, however, only a very few archaeological sites have been found thus far at the most logical points along the presumed island pathway (Figure 7.2).

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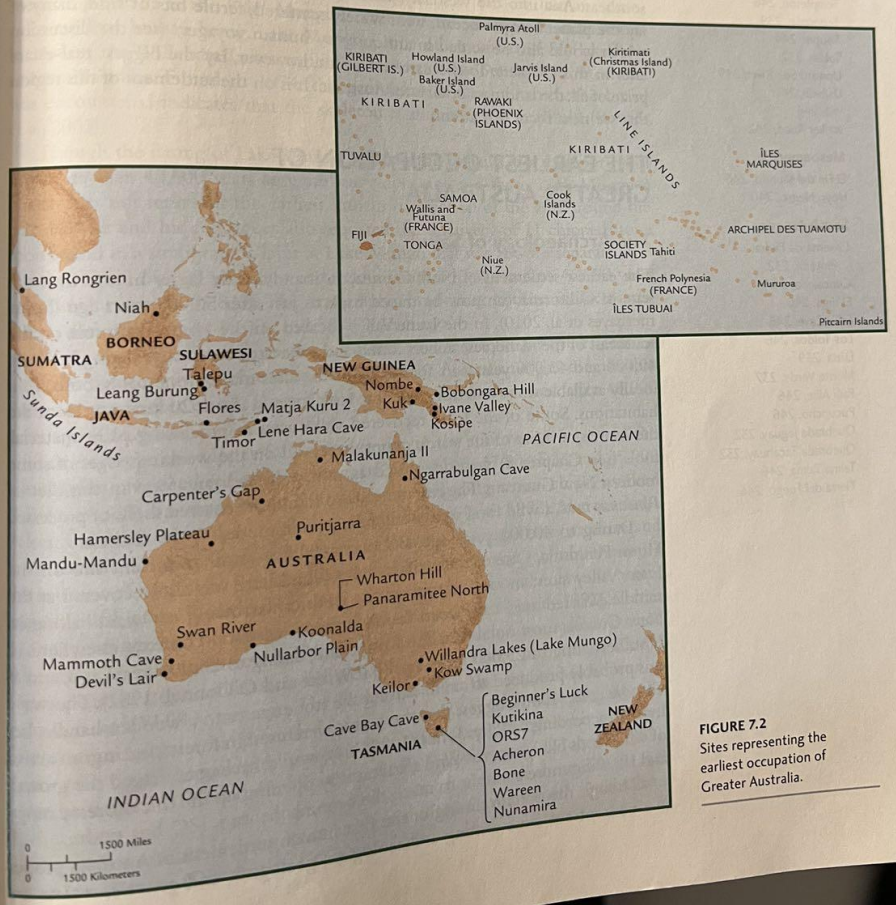

FIGURE 7.2
Sites representing the earliest occupation of Greater Australia.

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Mesoamerica

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South America

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Cuncaicha, 247
El Inga, 246
Fell's Cave, 246
Los Toldos, 246
Luzia, 239
Monte Verde, 237
Palli Aike, 246
Pucuncho, 246
Quebrada Jaguay, 232
Quebrada Tacahuay, 232
Taima Taima, 246
Tierra del Fuego, 246

One of the older sites in southeast Asia is located in Niah Cave on the island of Borneo. Newly derived radiocarbon dates firmly place the earliest human occupation of Niah Cave at around 46,000 years ago. The site was occupied until about 34,000 years ago, and a fully modern, lightly constructed human skull recovered at the site has produced a uranium series date of 37,000 years ago (Holden 2007).

The human settlement of Timor can now be traced back to 35,000 years ago at Lene Hare Cave (Holden 2001) and Matja Kuru 2 (O'Connor et al. 2014). At the latter site, researchers recovered a beautifully made, sophisticated bone spear-point with a series of notches and the residue of an adhesive at the base. That adhesive was likely used to fix the point to a wooden shaft.

The archaeological evidence found on these Indonesian islands supports the idea that they served as stepping-stones in a wave of human population east from southeast Asia into the western Pacific. Even farther east and toward the north lay the planet's largest ocean, with widely scattered, fertile bits of land, many of which would also be settled in antiquity by human voyagers (see the discussion later in this chapter). To the east and south, however, lay the biggest real-estate prize of all: the landmass of Greater Australia. It is on the settlement of this region that we next focus our attention.

THE EARLIEST OCCUPATION OF GREATER AUSTRALIA

The Archaeology of Sahul

The earliest settlement of New Guinea, an island a little larger in area than the state of California, can now be traced back to just after 50,000 years ago (Summerhayes et al. 2010). In the Ivane Valley, located on the Huon Peninsula on the southeast of the island, researchers found and excavated seven sites dating between 49,000 and 43,000 years ago. Residents of the sites made stone tools, both from locally available stone and from volcanic rock located about 20 km away from the habitations. Some of the tools recovered were used in processing plant material; the source of some of the starch grains preserved on the working edges of some tools (see Chapter 8) were identified as yam, an important food in the diet of modern New Guineans. The researchers also found the charred shells of processed *Pandanus* nuts, a wild food source still relied on in modern New Guinea.

Dating to 40,000 years ago, Bobongara Hill is another ancient site on the Huon Peninsula. One of the artifact types found here was also recovered at the Ivane Valley sites: an axelike tool with a distinct narrowing or "waist" along its middle. Waisted axes have been found in archaeological contexts elsewhere in New Guinea, most notably at the Kosipe site, dating to 26,000 years ago, and at Nombe, dating to 25,000 years ago (J. P. White and O'Connell 1982). The waist was probably produced to aid in hafting the stone axe onto a wooden handle. Les Groube et al. (1986) suggest that these axes were used in forest clearing, an activity that, according to Rhys Jones (1989:764), would have encouraged the growth of wild foods like yams, taro, and sugarcane by opening up the thick forest canopy and allowing more sunlight to reach the ground.

Though the precise timing of the first human settlement of Australia proper is a contentious issue among archaeologists, geologists, and geneticists data are

converging on this issue. A recent analysis of the genome of an aboriginal Australian man (conducted on a lock of hair collected in the early twentieth century) shows that, when compared to other Eurasians, the Australian line appears to have separated sometime between 62,000 and 75,000 years ago (Rasmussen et al. 2011). This supports the scenario proposed in Chapter 5 with an ancestral line of anatomically modern Africans spreading into the Middle East more than 100,000 years ago, then east from there into southern Asia sometime around 74,000 years ago, after the Toba eruption. The genome study just cited suggests that the aboriginal Australians split off from the people in southern Asia sometime after that. That doesn't mean they made it to Australia at that early date. The archaeological record for Australia indicates the first human occupation of that continent occurred no earlier than about 50,000 years ago.

Crucial in the debate about the timing of the earliest human settlement of Australia is the Lake Mungo 3 skeleton, the remains of an anatomically modern human being. Lake Mungo is one of a number of dry lake beds located in the Willandra Lakes region of western New South Wales in southeastern Australia. Found in 1974, the geological deposit in which the burial was encountered indicates that the skeleton is about 40,000 years old (Bowler et al. 2003).

Though the dating of Lake Mungo 3 places the remains at a time period of not more than 40,000 years ago, the story does not end there. Lake Mungo 3 burial does not represent the earliest human occupation of the area around the lake. Bowler and his colleagues also reported the discovery of 11 chipped stone tools found in a stratigraphic layer at Lake Mungo that was above a separate level dated to about 50,000 years ago and below another level dated to 46,000 years ago (Bowler et al. 2003:839). The stratigraphic bracketing of these artifacts indicates a date of between 46,000 and 50,000 years ago.

While the precise dating of sites in Australia older than 40,000 years continues to be debated, there is broad agreement among Australian archaeologists that there are many sites on the Australian continent that date to soon after 40,000 years ago (O'Connell and Allen 1998).

For example, the Upper Swan Bridge site in the southwestern part of the country has produced radiocarbon dates of 39,500 B.P., 37,100 B.P., and 35,000 B.P. in association with about 200 artifacts, including stone chips, worked flakes, and flakes with edges exhibiting wear patterns (Jones 1992). Also in southwest Australia is Devil's Lair, with a series of hearths, stone and bone artifacts, and the remains of kangaroos that had been killed, butchered, and eaten by the cave's human inhabitants. Radiocarbon dates place occupation of the cave at before 32,000 years ago and perhaps as much as 38,000 years ago (Jones 1992). Eleven kilometers (7 mi) northwest of Devil's Lair is Mammoth Cave, where burned bones, possible stone artifacts, and charcoal have been dated to between 31,000 years ago and 37,000 years ago. The Keilor site, near the city of Melbourne in southeastern Australia, has produced some quartzite flakes that were intentionally struck off a core. The soil layer in which the artifacts were recovered is estimated to be between 36,000 and 45,000 years old (J. P. White and O'Connell 1982). Radiocarbon and OSL procedures mutually support a date of about 37,000 B.P. for the earliest artifact-bearing strata at Ngarrabulgan Cave in north Queensland in eastern Australia (David et al. 1997).

Willandra Lakes

A second burial at Lake Mungo, Lake Mungo 1 (a cremated female), was located just 450 m (about 1500 feet) away from Lake Mungo 3 (Bowler, Thorne, and Polach 1972). After her death, her body was burned, her bones were pulverized, and then she was interred. About 25% of the Lake Mungo 1 skeleton was recovered, and enough recognizable cranial fragments were found to partially reconstruct the skull. Much like the Lake Mungo 3 remains, the young woman was fully anatomically modern and rather **gracile** physiologically, lacking the large brow ridges or heavy buttressing bone typical of modern Australian natives (Bowler et al. 1970). Lake Mungo 1 has dated by radiocarbon to 24,710 years ago.

acile: Lightly nstructed, referring to e overall appearance of a minin skeleton.

The Willandra Lakes skeleton was recovered just north of Lake Mungo. Dating to between 20,000 and 30,000 years ago, Willandra Lakes 50 (as the skeletal remains are designated) is far different in appearance from the Lake Mungo remains, exhibiting enormously thick cranial bones (some seven times thicker than the Lake Mungo specimens). As Australian archaeologist Rhys Jones (1992) has pointed out, in these three specimens (Mungo 1 and 3 and the Willandra Lakes 50 cranium) from sites just a few miles apart, there is a greater difference in cranial bone thickness than within and among modern human populations! For Jones, such a difference is not possible within a single population. He sees two biologically distinct populations inhabiting the same region of Australia at different times. However, as archaeologists J. Peter White and James O'Connell (1982) point out, this conclusion is difficult to support with such a small sample of crania for an entire continent and with so many differing habitats that people adapted to over such an extensive period of time. In their view, variations in cranial form merely reflect regional differentiation among native Australians, who can be derived from a single population wave from Asia more than 40,000 years ago.

THE SPREAD THROUGH AUSTRALIA

The Australian sites discussed so far are located in a ring around the perimeter of the continent (see Figure 7.2). As archaeologist Sandra Bowdler (1977, 1990) points out, the initial human population entered Australia from the north and then spread primarily east and to a lesser degree west along the coast, focusing on those areas with tropical coastal environments most like those of the source areas from which it migrated. When the migrants moved inland, they always did so along major river systems, enabling a shift in their subsistence foods from marine to riverine resources.

This pattern makes sense when you consider that the first inhabitants of Australia were almost certainly a coastally adapted people. This coastal adaptation, including the use of watercraft, enabled their discovery of Sahul and their migration onto its landmass in the first place. People with a history of coastal subsistence would have been wise to spread along the coast of their newly found home. And, as shown, the oldest human sites in Australia are located along the modern coastal rim or in formerly wetter interiors drained by rivers or dotted with lakes.

primitive Stone Age society, forever limited by their harsh environment. But the archaeological record shows clearly that such a stereotype is inadequate to characterize Aboriginal culture. Rather, the ancestors of the native people of Australia arrived by watercraft by at least 40,000 years ago in what had to have been, at least in part, a planned, intentional migration. Beginning with an adaptation to a tropical, coastal environment, they managed by 20,000 years ago to have adapted to the myriad habitats of Greater Australia. Coastal people maintained many of their original maritime adaptations, but others adjusted to the temperate regions of the interior, and some even developed cultural strategies for coping with environments as diverse as the Great Sandy Desert in the interior—one of the hottest, driest places on earth—and the sub-Antarctic tundra of south-central Tasmania.

And the lives of these people extended far beyond the quest for subsistence. In Koonalda Cave, located near Australia's south-central coast, is some fascinating, ancient artwork, a series of meandering lines made by human fingers as much as 24,000 years ago—a sort of finger painting in the soft limestone of the cave's ceiling (Johanson, Johanson, and Edgar 1994). As mentioned in Chapter 6, potentially even older art has been dated at Wharton Hill and Panaramitee North, where microscopic vegetable matter recovered from within the grooves of petroglyphs of geometric figures has been dated to 36,000 B.P. and 43,000 B.P., respectively (Bednarik 1993).

The lesson of the earliest settlement of Australia is not one of the persistence of a primitive, backward people but of the nearly infinite capacity of human groups for adaptive flexibility. It is a lesson we will see repeated in the initial discovery of and migration to the Americas.

EAST INTO THE PACIFIC

As mentioned earlier in this chapter, as population expanded from southeast Asia to the east, a more southerly route brought human beings to the enormous landmass of Greater Australia. A more northerly route brought migrants out into the vast unexplored world of the Pacific Ocean. Covering more than one-third of the earth's surface, the Pacific stretches 15,500 km (9,600 mi) from north to south and 20,000 km (more than 12,000 mi) from east to west (Figure 7.3). Its total area is about 180 million km^2 (70 million mi^2). Europeans, considered relative latecomers, did not cross the Pacific until Ferdinand Magellan's circumnavigation of the globe in A.D. 1519–1522. Close to 1,000 of the 25,000 islands scattered across the ocean were already inhabited by people—and had been for a few thousand years—by the time of Magellan's voyage.

A Pacific Islander "Age of Exploration"

The fascinating story of the initial exploration and settlement of the Pacific belies the cultural conceit that the "age of exploration" began and ended in the European Renaissance. The successful exploration and colonization of Pacific islands by a people long before and without some of the technological advantages of European explorers (such as quadrants, sextants, compasses) is all the more remarkable when you consider the following: The total landmass of the 25,000 Pacific islands

The Australian Interior

The earliest inhabitants of Australia seem to have avoided, at least initially, the vast, harsh, dry interior of the continent (J. P. White 1993). Not until 20,000 to 25,000 years ago did human groups begin to penetrate the dry core of central Australia. For example, evidence from the Puritjarra Rockshelter in the Cleland Hills of central Australia shows that the cave was first occupied 22,000 years ago and then intermittently until 12,000 years ago (M. A. Smith 1987). The stone-tool assemblage included primarily large flake tools but also some small flakes and cores. Other interior sites of similar antiquity include two rockshelter sites from the Hamersley Plateau in western Australia—dated at 21,000 B.P. and 26,000 B.P., respectively—and evidence of flint mining in the Nullarbor Plain dated to 20,000 years ago (Jones 1987).

TASMANIA

Located to the south of Australia's southeast coast, Tasmania is the last "new world" in Sahul to be occupied by human beings. A human population first entered what is today the island of Tasmania when it was still connected to the Australian continent. The earliest people of Tasmania lived farther south and closer to Antarctica than did any other human group to that point. The environment was entirely different from any faced previously by Australian Aborigines—a frozen tundra not unlike that of Upper Paleolithic Europe (see Chapter 6).

Tasmania shows archaeological evidence of occupation as early as 35,000 years ago at Wareen Cave and 30,000 years ago at the ORS7 site as well as at Acheron, Bone, Bluff, and Nunamira Caves in south-central Tasmania (Cosgrove, Allen, and Marshall 1990). Archaeologists Richard Cosgrove, Jim Allen, and Brendan Marshall (1990) conducted a survey of south-central Tasmania, locating 41 sites occupied between 30,000 and 11,000 years ago. Sites like Cave Bay Cave, located on Hunter Island off the northwest coast of Tasmania, date to about 23,000 B.P. (Bowdler 1974). On Tasmania proper there is Beginner's Luck Cave and Kutikina Cave (formerly Fraser Cave), both initially occupied at 20,000 years ago. Kutikina is extraordinarily rich, with over 75,000 stone flakes and tools recovered from less than a 1% sample of the site (Kiernan, Jones, and Ranson 1983). Most of the tools are steep-edged scrapers, similar in appearance to those recovered at Lake Mungo. The faunal assemblage is dominated by the remains of the large wallaby, which is a member of the kangaroo family, and the wombat, a sizable, heavyset, burrowing marsupial (Kiernan et al. 1983:30). Interestingly, there are no remains of the larger, now extinct animals that typified the Pleistocene of Australia. This Australian Pleistocene megafauna probably was already extinct by the time humans first penetrated Tasmania.

GREATER AUSTRALIA: A BROAD RANGE OF ADAPTATIONS

In the stereotype, the Australian Aborigines were a homogeneous group, possessed of a simple technology, barely eking out a living in the great arid desert of central Australia. In this view, they had become stuck in time, holdovers from a

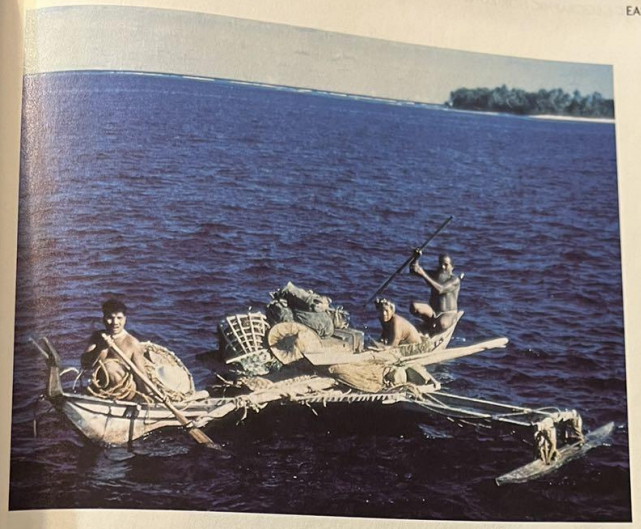


FIGURE 7.3
Polynesians sailing a double-hulled boat near the coast of an island. *(Image #K6306, American Museum of Natural History)*

represents only 0.7% of the total area of the ocean, and average island size is only about 10 km by 6 km (6 mi by 4 mi; Terrell 1986:14). Some of the inhabited islands are far smaller. Though many of these islands are geographically clustered and "intervisible" (visible one from the other), the individual clusters are often separated by hundreds, even thousands, of kilometers. Simply finding such island clusters while sailing a small canoe required great skill and not just a little luck. Finding one's way home and then returning to settle the newly discovered island was nothing short of miraculous.

Yet, discover, explore, and colonize many of those islands is precisely what settlers from southeast Asia and New Guinea did. And they accomplished this largely as the result of intentional geographic expansion. Certainly, serendipity played a role in the peopling of the Pacific. Though countless sailors must have been blown off course and died before making it to safe haven, some lucky ones may have made accidental landfall on uninhabited islands and become their permanent settlers. But this cannot be the primary way in which Pacific islands were colonized. Just as Europeans in the fifteenth century began deliberately to explore the oceans, the southeast Asians and New Guineans must have been doing the same many years before. As archaeologist Geoffrey Irwin (1993:7) points out, "We know colonisation was deliberate, because explorers took with them the plants and animals, women and men necessary to establish viable settlements." Computer simulations conducted by anthropologist John Moore support this assertion. Moore shows pretty clearly that for a colonization to be successful there need to be at least five to ten men and five

to ten women in the founding group (Balter 2007b). In other words, colonization of the Pacific was largely planned, and colonists brought with them the people and things necessary for the successful establishment of new communities.

Pacific Geography

Melanesia: Islands located north of New Guinea in the western Pacific.

Micronesia: Small islands in the western Pacific, east of New Guinea.

Polynesia: Islands of the central and eastern Pacific. Polynesian islands are volcanic in origin.

The Pacific islands are usually divided into three groupings: **Melanesia**—the so-called black islands of New Guinea and smaller islands to the east, including the Solomon Islands, the Bismarck Archipelago, Santa Cruz, New Caledonia, Vanuatu, and Fiji; **Micronesia**—the "small islands" north of Melanesia; and **Polynesia**—"many islands," including a broad triangle of islands demarcated at its points by Hawaii to the north, Easter Island to the southeast, and New Zealand to the southwest.

Pacific Archaeology

Some of the larger islands of Melanesia, including New Britain and New Ireland in the Bismarck Archipelago, were settled by seafaring explorers from Australia by at least 35,000 years ago, not that long after the initial settlement of the island continent (O'Connell and Allen 1998). Even farther to the east, Buka, in the Solomon Island chain, was discovered and settled no less than 28,000 years ago. At a distance of 180 km (110 mi) from the Bismarck Archipelago, the initial settlement of the Solomons is proof of sophisticated navigational skills on the part of the settlers. The Melanesian islands farther to the east and in deeper water, as well as all the islands of Micronesia and Polynesia, were settled much later in a second wave of exploration and migration beginning probably little more than 3,500 years ago (Irwin 1993).

If you draw a line connecting Hawaii to Rapa Nui (Easter Island) to the southeast, from Rapa Nui west to New Zealand, and then northeast back to Hawaii, you've delineated a triangular swath of the Pacific with about the same surface area as North America within which there are about 500 islands whose combined land area is only a tiny fraction of that continent. As Janet Wilmshurst and her colleagues characterize Polynesia, it represents the "last prehistoric expansion of modern humans" (Wilmshurst et al. 2008:1815).

The spread of people through Polynesia was accompanied by a common culture. Because they were a maritime people, fishing played a significant role in their food quest. They also were food producers, who brought non-native agricultural staples with them as they colonized islands, including pig, as a major source of animal protein, and domesticated root crops, especially yams. They also brought a common pottery style, called **Lapita** (Figure 7.4). In fact, the earliest occurrence of a human population on the inhabited islands of Polynesia is invariably marked by the appearance of Lapita pottery. The Lapita designation is now applied to the entire cultural complex of Polynesia and includes a maritime adaptation, the raising of pigs, the growing of certain root crops and fruit trees, the use of shell in producing tools and ornaments, and the manufacture of Lapita pottery.

Lapita: Pottery style known from the inhabited Pacific Islands.

The Lapita complex is absent from Australia or the islands of Micronesia. It appears first in the archaeological record of the Bismarck Archipelago and, perhaps, Fiji a little more than 3,500 years ago (Irwin 1993:39). Expansion proceeded eastward, with large island groups like Tonga at 2,800 years ago (Burley and Dickinson 2001) and Samoa and the Cook Islands (2,500 years ago).

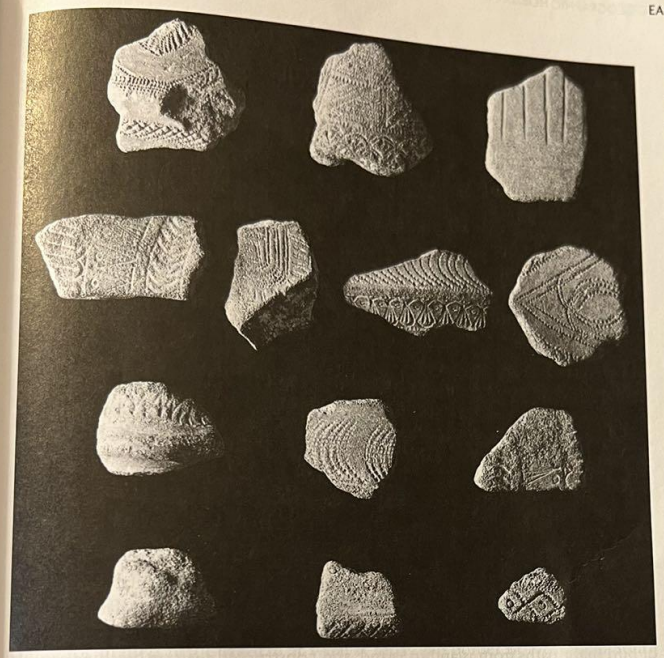


FIGURE 7.4
Lapita pottery is found virtually everywhere Polynesians explored and settled after 3500 B.P. *(Courtesy of Dr. Richard Shutler, Jr., and Dr. Mary Elizabeth Shutler)*

The rest of the islands of Polynesia were inhabited much more recently, less than 1,000 years ago. The results of a detailed examination of more than 1,400 radiocarbon dates conducted by Janet Wilmshurst and her colleagues are presented in Table 7.1 (taken from Wilmshurst et al. 2010 and Wilmshurst et al. 2008; and see Figure 7.2).

TABLE 7.1 *Earliest Dates for the Settlement of Central and Eastern Polynesia and New Zealand*

ISLAND GROUP	OLDEST RADIOCARBON DATE RANGE (ALL DATES A.D.)
Society	1025–1121
Rapa Nui	1200–1253
Marquesas	1200–1277
Hawaii	1219–1266
New Zealand	1230–1280
Southern Cook	1250–1281

The dating of the earliest human settlement of New Zealand is an interesting case. Most people carry a lot of baggage when they travel, walk about, or migrate, packing the stuff they're going to need. However, not everything in that baggage is intentionally packed; wherever we go, we bring along accidental hitchhikers in the form of bacteria, viruses, insects, and even animals.

In a visual cliché of maritime shipping, a rat scurries up the ropes attaching a ship to the dock in order to enter the hold, not because it desires a sea voyage, but to feast on the food stored within. If the rat stays too long, it finds itself hours, days, weeks, or even months later alighting on a foreign shore. If it's lucky, it will find that others of its kind have previously made the same accidental voyage, it will find mates, and bouncing baby rats will result in this new world.

Archaeologists can take advantage of this common scenario and attempt to trace the movement of human groups who have unintentionally packed rats and other species in their baggage as they traveled the world. Janet Wilmshurst and her colleagues (Wilmshurst et al. 2008) have done just this to determine the timing of the earliest human settlement of New Zealand. Rats are not indigenous to New Zealand, but arrived there when people, almost certainly unintentionally, brought them there. Radiocarbon dating of rat bones at archaeological sites and sites where owls killed and ate them clearly shows that New Zealand was first settled by stow-away rats—and, therefore, by the sailors on whose craft they stowed away—no earlier than the middle of the thirteenth century A.D. That's a very good estimate for the first human settlement of New Zealand.

We know from the ethnographic record that the native peoples of the Pacific were brilliant navigators. They built up a substantial reservoir of knowledge about currents and wind patterns. Even without navigational devices, the native navigators of the Pacific could reckon by the stars, were familiar with cloud patterns indicating that land was nearby, possessed a detailed knowledge of bird flight paths from island to island, and constructed seaworthy ships capable of journeys across wide stretches of open ocean.

COMING TO AMERICA

On Thursday, October 11, 1492, a sea voyager had an encounter that forever affected the trajectory of human history—another one of those small steps that resulted in a giant leap in the march of human history. Documenting the ship's arrival, the journal of the captain of that momentous voyage reads: "When we stepped ashore we saw fine green trees, streams everywhere and different kinds of fruit. . . . Soon many of the islanders gathered around us. I could see that they were people who would be more easily converted to our Holy Faith by love than by coercion" (Cummins 1992:94). Though it didn't quite work out that way, thus begins Christopher Columbus's narrative of the first contact between Europeans and American natives since the series of short-lived, brutal incidents on Newfoundland in Canada that were recorded in the Viking sagas about 1,000 years ago (Magnusson and Paulsson 1965).

Thinking he had discovered a series of islands off the coast of Asia, Columbus called the people he encountered *los Indios*, or Indians. After his initial voyage, Columbus returned three more times, always expecting that the Asian continent lay just beyond the limits of his previous exploration.

Though Columbus never accepted it, most European scholars concluded that he had happened on not a cluster of islands immediately off the coast of south Asia but, as Amerigo Vespucci was to characterize it in 1503, a "new world," populated by peoples unknown to and not even conceived of by Europeans. This New World consisted of two entire continents that make up almost 28.5% of the world's land surface, with a native population estimated to have been in the tens of millions and speaking more than 1,500 different languages and dialects. Over centuries and millennia, descendants of the small bands of hunters and gatherers who initially entered into the New World developed successful adaptations to nearly all of the countless habitats of the Western Hemisphere, from frigid arctic tundra to arid sandy deserts, from luxuriant tropical rain forests to temperate woodlands, from seacoasts to mountains, from river valleys to plateaus. And they lived ways of life as varied as did people inhabiting the "known" continents: hunters and gatherers in small, nomadic bands foraging for food in a seasonal round; fisherfolk in established villages, harvesting the plentiful natural resources of river and shore; farmers in huge adobe apartment complexes, tending the kinds of crops that even today feed the population of the planet. There were great kingdoms with impressive cities, splendid monuments of pyramids and palaces, and powerful hereditary rulers, not unlike King Ferdinand and Queen Isabella of Spain, the monarchs who had funded Columbus's expedition.

THE SOURCE OF *LOS INDIOS*

When first encountered by Europeans, there was broad speculation concerning the source of the Native American population (Feder 2014), and quite early on some scholars recognized a connection between the natives of the New World and the people of Asia. For example, Giovanni de Verrazzano, an Italian navigator sailing for France, made landfall at what is today the border of North and South Carolina. Sailing north along the coast, he entered Delaware Bay and the mouth of the Hudson River, sailed along Connecticut's coast, entered and explored Narragansett Bay in Rhode Island, and followed the shore of Cape Cod on his way home. In the report he prepared for his benefactors, Verrazzano noted that, in the color and texture of their hair and in the shape of their eyes, the people he encountered looked like the people of Asia.

Modern biological evidence is unequivocal; the source for the native population of the New World is Asia. Evidence in the form of mitochondrial DNA and comparison of the Y-chromosomes of living northeast Asians and Native Americans shows conclusively that they share a genetic heritage. All five mtDNA groupings (**haplogroups** A, B, C, D, and X) found among the native people of the New World can be traced to populations living in northeast Asia (Bolnick et al. 2012); in fact, all five variants are found among a group of Asian natives living along the shores of Lake Baikal in central Siberia (Derenko et al. 2001). Further, two specific mutations seen on the Y-chromosome of Native American males are also found only among human populations found in central Siberia (Bolnick and Smith 2007; Bortolini et al. 2003).

Haplogroup: A cluster of DNA variants that are found together in individual members of a population.

But how close was Asia to North America, and where was the most plausible point of entry for Asians to enter the New World? In 1732 two Russian

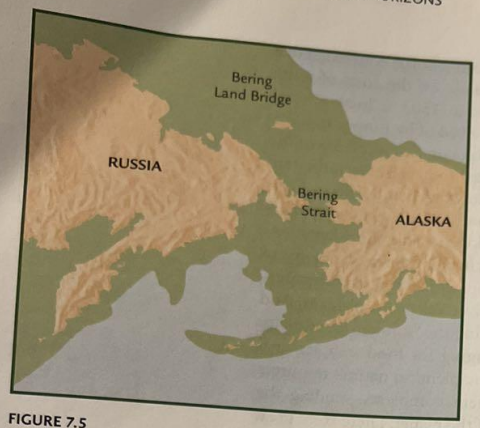


FIGURE 7.5
Map of the modern coastlines of northeast Asia and northwest North America as well as the projected coastline of Beringia during glacial maxima.

traders, Ivan Fyodorov and Mikhail Gvozdev, discovered what the native people of northeast Asia and northwest America already knew, that Asia and America were separated by only about 85 km (53 mi) of sea, a geographical feature now called the Bering Strait (Figure 7.5).

Today the Bering Strait is only 30 m to 50 m (100 ft–165 ft) deep. But during periods of glacial maxima in the Pleistocene, sea level was depressed by far more than this, by as much as 135 m (440 ft), exposing a platform of land connecting Russia and Alaska that was as wide, perhaps, as 1,500 km (1,000 mi) from north to south, a land area of more than 2 million km^2 (770,000 mi^2). During long periods in the Pleistocene, people in northeast Asia could have walked into the New World across the body of land today called **Beringia**, or the **Bering Land Bridge** (see Figure 7.5).

WHEN DID THE FIRST MIGRANTS ARRIVE?

Though most anthropologists accept a Beringian route for America's first human settlers, there is still great controversy over the timing of their arrival. To find out when people first entered the Americas from Siberia, we need to know three things:

1. When was Beringia exposed and open for travel?
2. When was eastern Siberia first inhabited (the source population for New World migrants)?
3. What is the age of the earliest New World sites?

Beringia, Bering Land Bridge: A broad connection of land more than 1,500 kilometers (1,000 miles) across connecting northeast Asia with northwest North America during periods of sea level depression in the Pleistocene.

When Was Beringia Exposed and Open for Travel?

If Australia's first settlers could have populated their "new world" more than 40,000 years ago (remember, there was no land bridge between Sunda and Sahul; they had no choice but to arrive by boat), then northeast Asians might have done the same thing during periods when no land bridge was present between Asia and North America. And even without a land bridge, during periods of extreme cold, the Bering Strait would have frozen, producing an ice bridge between the two hemispheres.

Nonetheless, a 1,500-km-wide land connection between the two continents certainly would have been very convenient, facilitating the movement of animals and people either through the interior of northeast Asia, then through the middle of the exposed land bridge, and then into the interior of Alaska, or else along the Pacific coast of northeast Asia, then along the southern Beringian coast, and finally south along the coast of northwest North America (see Figure 7.5).

Beringia was exposed several times during the Pleistocene and was above water more or less continuously from the period beginning about 35,000 until

about 11,000 years ago. Beringia was at its peak during a period called the **Late Glacial Maximum (LGM)**, now dated to between 28,000 and 18,000 years ago (Hoffecker, Elias, and O'Rourke 2014). During this time, Beringia may have been at its most geographically extensive, covering an area about twice the size of Texas (Pringle 2014). Recent research (based on pollen and insect remains recovered from the seafloor under the modern Bering Sea) indicates that Beringia presented a very rich shrub tundra habitat—an ecological refuge during harsh Late Pleistocene conditions—teeming with wildlife, particularly horse, elk, mammoth, and caribou. It was an altogether attractive habitat for people living in Siberia, who would have been able to explore and settle the territory, wholly unaware that to the east lay a new world as yet uninhabited by human beings. One hypothesis presents a scenario in which human groups expanded their territories from Siberia into Beringia about 28,000 years ago and more or less stayed put for 10,000 years until the climate shifted at the end of the LGM, 18,000 years ago. As the herds moved east in search of food, human groups dependent upon those animal resources followed them, becoming, in fact, the first Americans. Radiocarbon dating of peat deposits that now reside beneath the Bering Sea but that must have been produced on dry land shows that the land bridge was still exposed, at least in part, until shortly after 11,000 years ago (Elias et al. 1996). So, in fact, the land bridge was available for the movement of animals and people for much of the time between about 35,000 and 11,000 years ago.

Late Glacial Maximum (LGM): The period toward the end of the Pleistocene, between 28,000–18,000 years ago, when glacial conditions were at their peak.

When Was Eastern Siberia First Inhabited?

Just as the most likely source area for the original migration of people into Australia is poorly known archaeologically, so too is the most likely source area for the original migration of people into the New World. Eastern Siberia is a difficult place to do archaeology, and relatively little work has been done there. Archaeologist David Meltzer (2009) points out that even after decades of work in Siberia it remains difficult to say with any certainty which site or culture may be ancestral to the earliest migrants to America.

Anyone entering the New World from the Old through Beringia must have possessed an adaptation to the extreme climate of the region in which it was located. The timing of the earliest human adaptation to the Arctic and sub-Arctic, therefore, serves as a limiting factor in our discussion of the timing of human movement into and across Beringia. This cannot have occurred before humans had developed the highly specialized adaptation necessary to survive the rigors of life in the far north (Figure 7.6).

The oldest archaeological evidence of a human presence in the Arctic has been found far from Beringia, at the SK Mammoth site in the central Siberian Arctic. Here, hunters dispatched an adult woolly mammoth about 45,000 years ago (Pitulko et al. 2016). The skeleton exhibits numerous wounds that had likely been inflicted by spears. Moving east, sites in the Arctic are younger than this. The Yana RHS site provides the oldest evidence of human occupation of the Arctic in eastern Siberia (Pitulko et al. 2004). Here, people living along the banks of the Yana River at 70° N latitude subsisted primarily by hunting large game animals like reindeer, bison, woolly mammoth, and musk-ox between 33,500 and 31,500 years

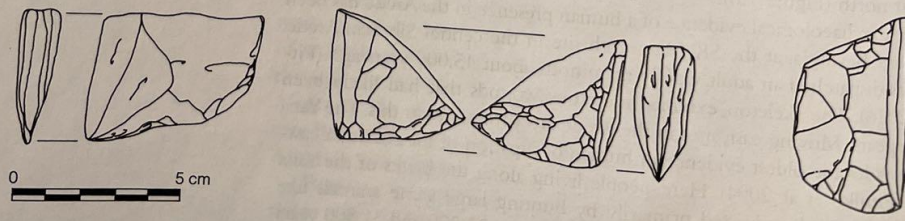
FIGURE 7.6
Map showing the locations of a number of important localities in Russia mentioned in the text that may provide important information related to the migration of human beings from the Old World to the New in the Late Pleistocene.

Wedge-Shaped Cores: Cores shaped like wedges from which blades were struck; found as part of the Paleo-Arctic tradition in northeastern Asia and also found as part of the Denali Complex in the American Arctic.

ago. Researchers have excavated the remains of at least 31 woolly m the site, and suggest that the hunters there were at least as interested in they were the meat (Nikolskiy and Pitkulo 2013). Farther south, radio indicate that central Siberia, for example, around the area of Lake Baik pied no earlier than about 34,000 years ago. Dyuktai Cave, located ne River in central Siberia, was occupied 14,000 years ago (Figure 7.7 an The **wedge-shaped cores** from which the inhabitants produced bla similar in appearance to cores found in Denali Complex sites in Alas 10,700 years ago and discussed later in this chapter. (See Figure 7.12 a it to Figure 7.7.)

In far eastern Siberia, the lowest stratigraphic levels at sites around Ushki Lake on the Kamchatka Peninsula have now bee about 11,300 B.P. (Goebel, Waters, and Dikova, 2003). The stone- try seen in the oldest Ushki Lake component included small, f stemmed, bifacially flaked spearpoints. Bifacial points are also a hall

FIGURE 7.7
Stone tools from the Dyuktai culture, eastern Russia, at about 18,000 B.P. Note the preponderance of so-called wedge-shaped cores. These are small stone cores of the implied shape from which sharp microblades were removed. *(From "The Dyuktai Culture and New World Origins" by Seon-bonk Yi and Geoffrey Clark, University of Chicago Press, 1985)*



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ago. Researchers have excavated the remains of at least 31 woolly mammoths at the site, and suggest that the hunters there were at least as interested in the ivory as they were the meat (Nikolskiy and Pitkulo 2013). Farther south, radiocarbon dates indicate that central Siberia, for example, around the area of Lake Baikal, was occupied no earlier than about 34,000 years ago. Dyuktai Cave, located near the Aldan River in central Siberia, was occupied 14,000 years ago (Figure 7.7 and Table 7.2). The **wedge-shaped cores** from which the inhabitants produced blades there are similar in appearance to cores found in Denali Complex sites in Alaska dating to 10,700 years ago and discussed later in this chapter. (See Figure 7.12 and compare it to Figure 7.7.)

In far eastern Siberia, the lowest stratigraphic levels at sites like those around Ushki Lake on the Kamchatka Peninsula have now been dated to about 11,300 B.P. (Goebel, Waters, and Dikova, 2003). The stone-tool industry seen in the oldest Ushki Lake component included small, finely made, stemmed, bifacially flaked spearpoints. Bifacial points are also a hallmark of the

FIGURE 7.7
Stone tools from the Dyuktai culture, eastern Russia, at about 18,000 B.P. Note the preponderance of so-called wedge-shaped cores. These are small stone cores of the implied shape from which sharp microblades were removed. *(From "The Dyuktai Culture and New World Origins" by Seon-bonk Yi and Geoffrey Clark, University of Chicago Press, 1985)*

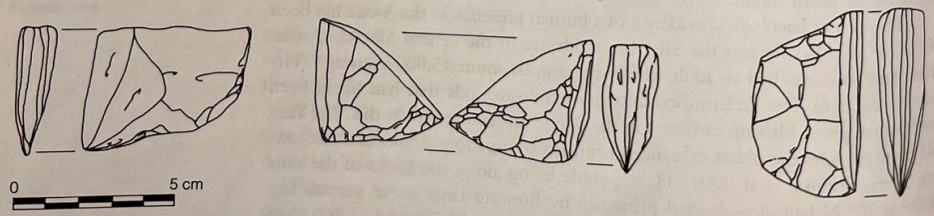


TABLE 7.2 *Sample of Sites in Russia Occupied at Times of Possible Human Population Movement into North America*

SITE NAME	LOCATION	AGE	ARTIFACTS
Berelekh	Lower Indigirka Valley	12,000–13,000 years ago	Bifaces
Ushki Lake	Kamchatka	11,300 years ago	Bifaces, burins, microblades, unifaces
Ust'-Mil II	Central Siberia	11,500–35,000 years ago	Wedge-shaped cores
Dyuktai Cave	Central Siberia	After 18,000 years ago	Wedge-shaped cores, bifaces
Ikhine	Southern Siberia	31,000–34,000 years ago	Burins, cores
Ezhantsy	Central Siberia	35,000 years ago	Wedge-shaped cores, biface fragments
Mamontovaya Kurya	Arctic Russia, Ural Mountains	40,000 years ago	Mammoth, horse, reindeer, and wolf bones; unmodified flakes; bifaces
Yana RHS	Yana River	32,000 years ago	Stone flakes, rhino horn

Clovis culture found in the New World, discussed later in this chapter. One point form found at Ushki is a small, rounded triangle, sort of tear-dropped in shape, highly reminiscent of a point type called **Chindadn** found in Nenana Complex sites in Alaska (Meltzer 2009; discussed later in this chapter).

It is clear that people were living in Siberia, on the western edge of Beringia, practicing stone-tool technologies that at least could be ancestral to those first technologies seen at the other end of the land bridge between Asia and the New World. Considering the age of the oldest Siberian sites, it seems likely that the movement of people into the New World from Siberia occurred probably no more than about 20,000 years ago. This time period, you will remember, represents a glacial maximum, with attendant maximum sea-level decline, during which the land bridge was at its largest.

Clovis: Fluted point type of the Paleoindians. Large, laurel-leaf-shaped stone blades exhibiting a channel or "flute" (as in a fluted column) on both faces to aid in hafting the stone point onto a wooden shaft. Clovis points date from about 13,200 to 11,900 years ago (compare to Folsom).

Chindadn: A teardrop-shaped spearpoint found in the Nenana Complex in Alaska. Chindadn points are similar to a form found in the Ushki sites located on the Kamchatka Peninsula of eastern Siberia.

What Is the Age of the Earliest New World Sites?

When Beringia became exposed as sea level fell, people adapted to the interior habitats of northeast Asia would have been able to expand their territories by moving east through the interior of the land bridge and then into the interior of northwestern North America. At the same time, people living along the Pacific coast of northeast Asia could have moved along the coast of the land bridge as it became exposed. As sea level continued to fall, the growing coasts of northeast Asia and northwest North America finally coalesced, creating a single coast from northeast Asia, across the newly exposed land bridge coast, and then along the coast of northwestern North America. Over several generations, northeast Asians expanding east along this coast would have found themselves in the New World, where they might have continued the process of expansion south along its coast.

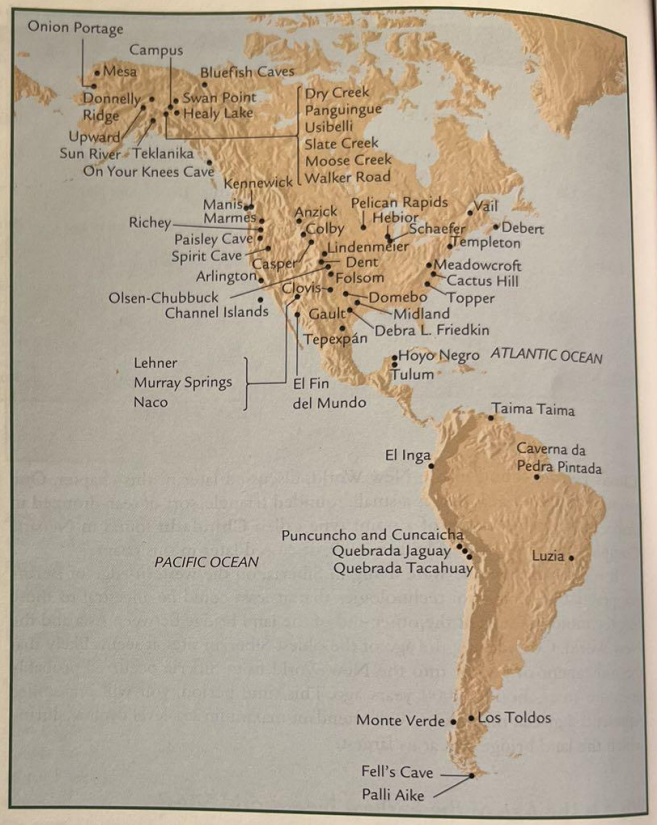


FIGURE 7.8
Sites representing the earliest occupation of North and South America.

These migrants, moving through the interior as well as along the coast, would have had no sense that they were moving into a "new world": They merely would have been taking advantage of additional, newly accessible territory (Figure 7.8).

THE FIRST HUMAN SETTLEMENT OF AMERICA

The legend of the midnight ride of Paul Revere tells us that one or two lamplights placed in the window of the Old North Church steeple would signal the mode of the British attack on Boston: "One if by land, and two if by sea." Regarding the first "invasion" of America by human beings, there also are two possible modes of movement: The first migrants may have been an interior-adapted people taking an interior land route, or they may have been a coastally adapted people taking a sea

route along the coast. Obviously, to assess which of these is correct—or whether both routes were used simultaneously by different groups—we need to locate the oldest sites in the New World.

It would be convenient if the oldest sites in the New World were located near the point of entry, either in the interior of Alaska for a group arriving by land or along the Alaskan coast for a group arriving by sea. Unfortunately, the Alaskan interior can be a very inhospitable place to conduct archaeology, and many places along the coast that might have provided shelter for a people living and moving within sight of the sea have been inundated by sea-level rise after the last glacial period.

One If by Land

A few ancient sites in northwestern North America have provided evidence of an interior adaptation. The inhabitants of these sites may represent the descendants of people who came from the interior of northeast Asia and then crossed through the interior of the land bridge. For example, Bluefish Caves in western Canada, reasonably close to the Beringian point of entry, has produced artifacts in a level that has been dated to between 15,000 and 12,000 years ago (Cinq-Mars 1978). The oldest firmly dated occupation of Alaska is the Swan Point Site in central Alaska. When the site was occupied (about 14,000 years ago) it was located in what, effectively, was the eastern margin of Beringia (Goebel, Waters, and O'Rourke 2008). These dates make sense if the scenario presented earlier concerning the settlement of Beringia is correct. If Bering was settled after 28,000 years ago and the settlers moved east only after 18,000 years ago as a result of climate change and shifts in big game animal movement at the close of the Late Glacial Maximum, they could easily have arrived in Alaska by 15,000 years ago and, actually, even earlier.

Most of the evidence for the late Pleistocene occupation of the interior of the New World, however, has been found far to the south of Alaska. Before we can bring the transplanted Asians from Alaska, south into the rest of the New World, there is an additional environmental issue that must be considered. During the Pleistocene, there were two primary centers of glacial expansion: the **Laurentide** ice sheet in northeastern North America, which spread south, east, and west and covered much of the northern latitudes of this continent, and the **Cordilleran** ice sheet, whose center was in the Rocky Mountains. During glacial maxima, when sea level was at its lowest and the land bridge at its largest, the Laurentide continental glacier reached its western limit and the Cordilleran mountain glacier reached its eastern limit. Though the two major ice bodies did not wax and wane in synchrony (Catto and Mandryk 1990), it is likely that they coalesced, at least in some places, for periods of time as they simultaneously expanded. We know, for example, that by about 24,000 B.P. the two major ice fields coalesced beginning in northern Canada, producing an impenetrable barrier to human migration to the south (Goebel et al. 2008).

In other words, the periods when it was easiest for human groups to migrate across Beringia from northeast Asia into what is now Alaska may have coincided with the periods when it was difficult and maybe impossible for them to spread farther south because their way was blocked by an impenetrable ice barrier a few kilometers high. That being the case, people may have migrated into the New World—specifically, the interior of Alaska—only to be stuck there until

Laurentide: The massive continental ice sheet of Pleistocene North America, centered in central northeastern Canada.

Cordilleran: The Pleistocene mountain ice mass in North America centered in the Rocky Mountains.

FIGURE 7.9
Map showing the proposed boundaries of the Cordilleran and Laurentide ice sheets of North America. Though the two ice sheets may have coalesced in some localized areas during glacial maxima, it is suggested that an ice-free corridor existed for long periods. Such a corridor might have allowed the migration of people south of Alaska into North America south of the ice sheets. *(Courtesy of David Meltzer)*

Ice-Free Corridor: A proposed route of safe passage in North America between the farthest west extent of the Laurentide ice field and the farthest east extent of the Cordilleran glacier. Also called the McKenzie Corridor.

Debitage: Waste flakes produced during the process of making stone tools.

the merged ice sheets to the south split apart. Retraction of the glaciers and the opening of an **ice-free corridor** (sometimes called the **McKenzie corridor**) is now dated to 14,000 years ago (Figure 7.9).

That relatively late date presents a bit of a problem, as there now are firmly dated sites south of the corridor that appear to predate its existence. For example, the lowest cultural levels at the Debra L. Friedkin site in central Texas have produced more than 15,500 artifacts, the vast majority of which are **debitage** flakes, broken bits of stone produced when tools are being made (Waters, Forman, Jennings et al. 2011). Among the 56 actual stone tools recovered in what researchers are calling the Buttermilk Creek Complex are bifacially flaked tools including one that is "lanceolate" (oval shape and pointed on both ends, like a lance), a discoidal core, sharpened flakes, and blades, all made of locally available chert (Figure 7.10). Analysis of the shape of the tools, the configuration of their working edges, and an examination of the wear patterns left behind on those edges as the result of use suggest that the folks at the site were hunting and butchering animals, and perhaps processing hides and cutting wood.

Along with being an artifactually rich site, the occupation levels are clearly delineated by stratigraphy. The primary layer in which the Buttermilk Creek Complex artifacts were recovered has been dated to 15,500 years ago by optically stimulated luminescence (see Chapter 2), making Debra L. Friedkin perhaps the oldest firmly dated site in North America. Far south of where migrants would have emerged from an ice-free corridor, this site implies that even older sites should yet be found to the north.

FIGURE 7.10
An assortment of stone tools that reflect the Buttermilk Creek Complex defined at the Debra L. Friedkin site in central Texas, including part of a spearpoint, an adze, and lots of flakes and blades likely used to perform tasks involving cutting and scraping. The tools were recovered from a stratigraphic level dated to 15,500 years ago. *(From "The Buttermilk Creek Complex and the Origins of Clovis at the Debra L. Friedkin Site, Texas" by Michael R. Waters et al., Science 331:6024. Reprinted with permission from AAAS.)*

Though stone artifacts may be the most common objects available to answer questions about the timing and nature of the earliest human settlement of the New World, they are not the only source of information. In a number of cases, the osteological remains of now-extinct animals exhibiting apparent butchery marks made by stone tools have contributed to the discussion. For example, the remains of apparently hunted and butchered woolly mammoth have been excavated in Wisconsin at the Schaefer and Hebior sites. Schaefer is dated to 14,200 years ago (Joyce 2006). Hebior is somewhat older, producing a date of 14,800 years ago.

The Manis site, in the state of Washington, also provides us with the remains of a killed animal, in this case a mastodon (another form of extinct elephant; based on their tooth surfaces, it looks like mammoths were browsers of leaves while mastodons were grazers). The Manis site mastodon revealed something else; embedded in one of the animal's ribs is the weapon that may have killed it: a sharpened bone spear tip (Figure 7.11; Waters et al. 2011). A radiocarbon date of the mastodon's remains indicates that it lived and died about 13,800 years ago.

Located in western Pennsylvania, south of the ice sheets and thousands of miles from Beringia, is Meadowcroft Rockshelter, one of the oldest and most deeply stratified archaeological sites ever excavated in North America. Within the natural rock enclosure, human beings made tools, cooked food, and threw away trash, taking advantage of the natural protection the small cave afforded.

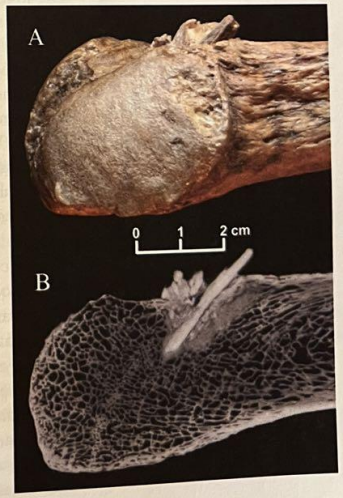


FIGURE 7.11
It's not often that an archaeologist can claim that he or she found what amounts to a "smoking gun." Just such a discovery was made at the Manis site in Washington State. Shown here in both a regular photograph and in a radiograph is one of the ribs of an ancient mastodon that had been pierced by a bone spearpoint. Radiocarbon dates the mastodon to 13,800 years ago. *(From "Pre-Clovis Mastodon Hunting 13,800 Years Ago at the Manis Site, Washington" by Michael R. Waters et al., Science 334:6054. Reprinted with permission from AAAS.)*

FIGURE 7.12
Stone tools from the earliest indisputable cultural layer at the Meadowcroft Rockshelter in western Pennsylvania. The layer in which the tools were found dates to more than 12,800 years ago. Meadowcroft is considered by many to pose a good case for a pre-Clovis settlement of the New World. *(Courtesy of James Adovasio, Mercyhurst Archaeological Institute)*

Moving back in time, the excavators of Meadowcroft have chronicled the human occupation of western Pennsylvania, covering a time span of thousands of years (Adovasio et al. 1979–80a,1979–80b; Adovasio, Donahue, and Stuckenrath 1990; Carlisle and Adovasio 1982). And at the base of the sequence brought to light by these researchers is one of the oldest radiocarbon dates associated with human-made material south of Alaska. Six dates earlier than 12,800 B.P. have been associated with stone tools near the base of the Meadowcroft sequence. Sealed beneath a rockfall from the roof of the shelter dated to 13,400 B.P. were some 400 lithic artifacts, including blades, knives with retouched edges, and a bifacial projectile point (Figure 7.12).

The stratigraphy at the Cactus Hill site in Virginia indicates the presence of an ancient settlement of the American southeast. Here, a stone-scraping tool, stone blades, and the core from which the blades were struck were found by archaeologist Joseph McAvoy and his group in an undisturbed soil layer. When specialists have examined the Cactus Hill blades, they note substantial similarities with the tools recovered at the oldest levels at Meadowcroft Rockshelter (Bonnichsen and Schneider 2001–02).

Pre-Clovis: Sites in the New World that pre-date Clovis, that are, as a result, more than 13,000 years old.

At Cactus Hill researchers were able to recover enough organic material for a date. The remarkable result: The **pre-Clovis** layer has been radiocarbon dated to about 15,000 years ago (Bower 2000; though there is some question whether the date was derived from older charcoal that had mixed with a younger archaeological deposit).

As you certainly realize, Texas, Wisconsin, Pennsylvania, and Virginia aren't anywhere close to Beringia, and the dates of some of the sites located in these locations are earlier than those derived for the existence of an ice-free corridor. Because the inhabitants of these sites could not have parachuted into their habitation, the necessary implication is that we should be able to find an extensive archaeological trail of sites successively older still, leading from their locations back to Beringia, reflecting the movement of people through an ice-free corridor, south of the glaciers, and then east. This archaeological trail does not yet exist, but it's fair to say that we are seeing the evidence converging on a scenario of human migration from northeast Asia into the New World sometime after about 20,000 years ago.

Two If by Sea

Though not located on the coast, the Paisley 5 Mile Point Caves in Oregon may represent an interior settlement of early Beringian coastal migrants (Gilbert et al. 2008). There, researchers found what they have identified as 65 coprolites—deposits of preserved feces in the caves. I'll spare you jokes about "endangered feces." Although there was some contamination (DNA most likely from the excavators was found in the coprolites along with DNA from a wolf or fox), the coprolites definitely contained human DNA that has been identified as belonging to the Native American haplogroup A (Jenkins et al. 2012; and see the discussion of the contribution of DNA to this discussion later in the chapter.). Researchers obtained 190 radiocarbon dates on organic material in the cave including some of the coprolites. The oldest of these dates suggest an age of about 14,300 years for the earliest settlement of the caves (Jenkins et al. 2012). Spearpoints made in the style called the Western Stemmed Tradition were found in the caves in strata dated to as much as about 13,250 years ago. This makes this style of spearpoint contemporary with the Clovis points found all across North America, as discussed later in this chapter.

At a site that more directly relates to a coastal route into the New World from Beringia, paleontologist Timothy Heaton found substantial evidence of plant and animal life in the ancient layers of On Your Knees Cave, specifically in strata that dated to the late Pleistocene (Dixon 1999). This discovery indicates that even with glaciers all around it, there were places where human beings could have found sufficient resources for survival. And, in fact, at On Your Knees Cave there is direct evidence for that, at least late in this story. A human skeleton was found in the cave and dated to about 10,500 years ago. Isotope analysis of the bones indicated the individual's diet consisted almost entirely of marine foods; in fact, the isotope calculations performed on this person's bones were similar to the same calculations performed on the bones of marine mammal carnivores like ringed seal and sea otter (Dixon 1999:118). The point is, even in Alaska, it seems that there were havens for a maritime people and that the coastal route may have offered a feasible pathway into the New World.

Farther south along the coast, archaeologist Jon Erlandson and his colleagues have reported the results of their excavation of three sites located on the Channel Islands, just off the coast of southern California near Santa Barbara (Erlandson et al. 2011). Radiocarbon dating places the earliest occupation of the islands at between 12,200 and 11,200 years ago. Erlandson recovered finely made stone tools including stemmed points somewhat similar to those at Paisley 5 Mile Point Caves and interesting crescent-shaped knives (Figure 7.13). Most were made of locally available chert, but the source for an obsidian (volcanic glass) artifact found there is more than 300 km away, in eastern California.

There was excellent organic preservation at the island sites and a clear maritime focus is exhibited in the faunal assemblage. The Channel Island residents caught myriad species of fish (rock fish, greenling, sculpin, surfperch, and herring); they collected several different kinds of shellfish (abalone and mussel, as well as crab); they caught sea birds (albatross and cormorant) and migrating fowl (Canada goose and snow goose); and they hunted marine mammals. This kind of subsistence focus matches our expectations for a people adapted to and migrating along a coastal route.

If we skip ahead far to the south we come to the Monte Verde site, located on Chinchihuapa Creek in Chile (Dillehay 1987, 1989, 1996, 1997; Dillehay and

FIGURE 7.13
An array of spearpoints and knives found on the Channel Islands off the coast of southern California near Santa Barbara. Mostly made of locally available raw materials, the tools were found in strata that date back as much as 12,200 years, showing that a maritime adaptation has deep roots in North America. *(From "Paleoindian Seafaring, Maritime Technologies, and Coastal Foraging on California's Channel Island" by Jon M. Erlandson et al., Science 331:6021. Reprinted with permission from AAAS.)*

Collins 1988). In addition to finding hundreds of stone artifacts, including long, slender spearpoints and cutting and scraping tools, the excavators of the site, led by archaeologist Tom Dillehay, found wooden lances and stakes that likely held down the bases of the inhabitants' hide-covered tents. The wet peat that covered the site produced an environment in which the bones of animals killed and butchered at the site, and even pieces of meat and skin tissue (identified as mastodon) and fragments of almost 70 different plant species, were preserved. Thirty radiocarbon dates firmly date the site to at least 12,500 years ago. Marine algae and seaweed adhering to the working edges of stone tools found at Monte Verde produced radiocarbon dates close to 14,600 B.P. (Dillehay et al. 2008). Recently stone tools, along with plant and animal remains, were found in a stratigraphic layer dating to as much as 18,500 years ago. Clearly, Monte Verde is a very ancient human occupation of South America.

Located near the coast, Monte Verde might best be explained as the remains of a community whose distant ancestors had entered the New World along the Beringian coast more than 18,500 years ago. Archaeologist David Meltzer suggests that the age of the Monte Verde site implies a time of entry into the New World along the Beringian coast before 20,000 B.P. (1997:755). These coastal migrants traveled south along the Pacific coast of the New World—virtually all of their sites would have been submerged by rising sea level and cannot be found. Eventually, these people reached the southern coast of South America, fully 16,000 kilometers (nearly 10,000 miles) from the Bering Land Bridge entrypoint, where they then moved into the interior, leaving the remains at Monte Verde.

First Skeletons

The oldest human skeletons yet found in the New World date to no more than about 13,000 years ago. The Arlington Spring bones from Santa Rosa Island in California

(Owen 1984) have been dated to 13,000 B.P., making them among the oldest human remains in the New World. The cranium called "Luzia," found in Brazil, north of Rio de Janeiro, has a proposed age of slightly more than 13,000 years. A skeleton from Midland, Texas, originally called "Midland Man" but now known to have been a female, has been dated by uranium series to 11,600 years ago (Hoppe 1992).

The remains of a cremated child buried beneath a house floor have been found at the Upward Sun River site in central Alaska. The burial has been dated to 11,500 years ago (Potter et al. 2011). A small number of other human remains have been dated, with varying degrees of certainty, to the period between about 11,500 and 10,500 years ago: the Tepexpan skeleton from Mexico; the Pelican Rapids find (known as "Minnesota Man," another misidentified female); and the Marmes skull from Washington State. Somewhat more recent are the remains of Spirit Cave Man in Nevada, dating to about 9,400 years ago, and the remains of Kennewick Man in Washington state, dating to some time between 8,400 and 8,700 years ago. The recent recovery and analysis of his DNA shows that he was, in fact, closely related and ancestral to modern native people living in the American Northwest (Rasmussen et al. 2015).

The skeletal remains of human beings, as well as those of our hominin ancestors, can be enormously informative. Your life history, including injuries, nutritional deficits, and disease, is written on your bones. Just as you may resemble your parents, grandparents, and siblings on the outside, you likely also resemble them on the inside, and the morphology of your bones may reflect family resemblances. But there's more: As we've seen in the analysis of and comparisons among anatomically modern human ancestors, modern people, and premodern humans, we can trace the genetic and evolutionary connections among them. The same holds true for modern people, and this kind of analysis has helped us trace the origins of the first Americans.

GENETIC ECHOES OF THE FIRST AMERICANS

In Isaiah 11:6 in the Old Testament of the Bible, there is a discussion of a future world where "the wolf shall dwell with the lamb," and "the leopard shall lie down with the young goat." That passage ends by stating "and a little child shall lead them." It turns out that in our discussion of the earliest human settlement of the New World, not one, but two little children, both of whom died tragically young, are now leading us to a more complete view of how and when that settlement took place.

The first is a boy who died 24,000 years ago, when he was only about four years old, near Lake Baikal in south-central Siberia, at a place today called Mal'ta (Raghavan et al. 2014). An analysis of that boy's DNA shows a very close affinity with both western Eurasians and modern Native Americans. In fact, the researchers estimate that about one-third of modern Native American DNA is traceable to the people represented by the Mal'ta boy. Interestingly, he is not closely related to modern east Asians, but actually is closer to modern people in west Asia and even eastern Europe. This may indicate that his people originated in western Eurasia, spreading from there west into Europe and east into Siberia. Raghavan et al. (2014) suggest that at some point after the boy died, his people interbred with aboriginal people in eastern Siberia, who contributed two-thirds of the DNA that today makes up Native Americans. So, the genome of the little boy at Mal'ta does not make him a Native American; but he certainly represents a population

ancestral to most modern Native Americans. Those sixteenth-century European explorers who, as mentioned earlier in this chapter, noted apparent physical similarities between the people of the New World and east Asia were right, after all.

The other little child leading us in our quest for Native American origins was even younger, only about a year old, when he died more than 12,500 years ago on land owned today by the Anzick family in Montana. In a remarkable turn of events, Sarah Anzick, who was only two years old herself when the one-year-old boy's skeleton was found on her family's farm in 1968, grew up to be a genome specialist at the U.S. National Institutes of Health. She was a key person in arranging for the genetic study of the boy and participated in the analysis (she's one of the co-authors of the paper announcing the results of that study (Rasmussen et al. 2014)).

The boy's skeleton was found under a layer containing about 100 ochre-covered stone tools that have been identified as belonging to the Clovis culture, a very well-known archaeological group discussed later in this chapter. The boy's genome was reconstructed from a sample recovered from his skeleton and then compared to the genomes of 143 modern non-African populations, including 52 Native American groups. The ancient boy's genome was a very close match to that of the Native American groups, which included people from both North and South America. The boy's genetic signature also showed a close affinity to people in Siberia including the Mal'ta boy; in fact, the Anzick boy matches modern Native Americans in possessing about one-third of the Mal'ta boy's genome.

Here's what this all means. The Mal'ta boy's people lived in south-central Siberia about 24,000 years ago. At some time after this, they interbred with local, native people in east Asia who, as we've seen archaeologically, had been living in Siberia since about 40,000 years ago. The descendants of these mixed people spread east across the Bering Land Bridge, probably sometime after 20,000 years ago, eventually entering into the New World by about 17,000 years ago. They are the ancestors of the vast majority of Native Americans encountered by Europeans entering the Americas after about A.D. 1000. Reich et al. (2012) call this wave "the First Americans." The Anzick boy is, essentially, an ancestor to the vast majority of Native Americans today living across the broad geographic extent of both North and South America.

The genomes of the Mal'ta and Anzick boys have been reconstructed from their nuclear DNA, the genetic instructions that make you a human being. You've probably learned about nuclear DNA in your high school biology class. But there's another kind of DNA that's housed in the mitochondria of your cells. Unlike the nuclear DNA that you inherit equally from your mother and father, your mitochondrial DNA (mtDNA) is passed down to you only from your mother.

There are lots of subtypes of mtDNA, called haplogroups, and these types cluster in genetically related people who, certainly in the ancient past, tended to cluster geographically. There are five mtDNA groupings (haplogroups A, B, C, D, and X) found among the native people of the New World. The Anzick boy bears haplotype D. Another child, who fell to her death into a limestone sinkhole called Hoyo Negro in the Yucatan Peninsula, Mexico, more than 12,000 years ago, also bore haplotype D (Chatters et al. 2014).

All of the haplogroups found in Native Americans can be traced to populations living in central Siberia (Bolnick et al. 2012); in fact, all five variants are found among a group of Asian natives living along the shores of Lake Baikal in central Siberia (Derenko et al. 2001). The genetic evidence is abundantly clear

at this point: The nuclear and mitochondrial genomes of modern Native Americans match those of the skeletal remains of the first Americans, and are a good match for those of ancient and modern aboriginal inhabitants of Siberia.

ALASKA

Back in Alaska, close to the Beringian point of entry, are a number of sites dating to before 11,000 B.P. As archaeologists William Powers and John Hoffecker (1989) point out, it is now clear that there was a widespread tradition of producing small blades from wedge-shaped cores in northeast Asia and northwest North America at the end of the Pleistocene. Sites with wedge-shaped cores and **microblades** have been excavated in Siberia, China, Japan, and Mongolia, as well as in Alaska and northwestern Canada (Morlan 1970). These sites are older in the Old World than in the New World, and a "genetic" connection between the industries of western and eastern Beringia seems clear. Conceivably, these sites may represent a separate wave of population movement from the Old World to the New.

Microblade: Very small stone blade, often with a very sharp cutting edge. Microblades often were set in groups into wooden, bone, or antler handles.

Denali and Nenana

Sites exhibiting tools of the locally designated **Denali Complex** of wedge-shaped cores, microblades, bifacial knives, and **burins** have been excavated in the Nenana Valley, about 100 km (62.5 mi) southwest of Fairbanks, in east-central Alaska (Figure 7.14; Powers and Hoffecker 1989). Sites such as Dry Creek (Component II), Panguingue Creek (Component II), Usibelli, and Slate Creek in the Nenana Valley are assigned to the Denali Complex; Dry Creek has produced a radiocarbon date of about 10,700 B.P. (Powers and Hamilton 1978). Denali

Denali Complex: A lithic technology seen in the Arctic consisting of wedge-shaped cores, microblades, bifacial knives, and burins. Dating to about 10,000 years ago.

Burin: Sharp and durable stone tool used in engraving.

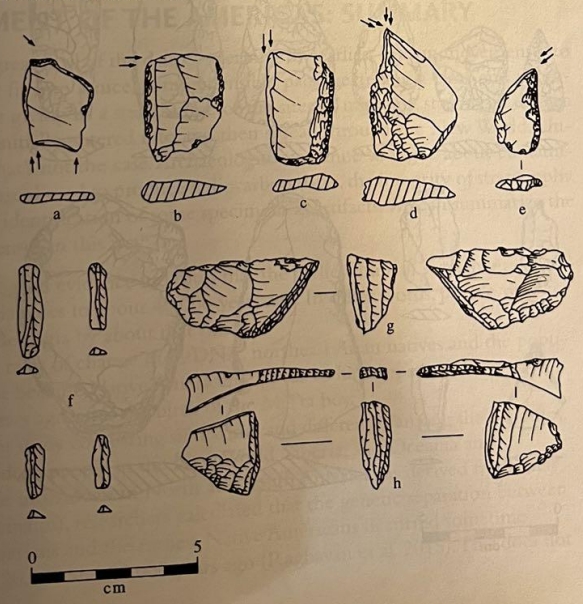


FIGURE 7.14
Stone tools from the Denali Complex of Alaska dating to after 11,000 B.P. Note the presence of wedge-shaped cores here (g and h), suggesting a derivation from the older wedge-shaped cores in Asia. *(Courtesy of William Powers)*

Complex sites outside of the Nenana Valley include Donnelly Ridge in central Alaska, the Campus site near Fairbanks, the Teklanika River sites in Mt. McKinley National Park, and Healy Lake (West 1967). These all date to around 10,000 years ago (West 1975). A very different-looking industry of microblades and cores has been found in the earliest levels at the Onion Portage site (Akmak) in western Alaska, also dating to around 10,000 B.P. (D. D. Anderson 1968, 1970).

All of this seems to provide a very neat and simple answer to questions surrounding the first human settlement of the Americas: Beginning some 18,000 years ago, microblade-making northeast Asians like those at the Dyuktai site slowly made their way across Beringia, ending up in Alaska by about 10,700 years ago or a few hundred years earlier. The problem is that Denali Complex sites are not the oldest in the New World; they're not even the oldest in Alaska. There is a cultural level at Dry Creek (Component I) earlier than the Denali level at the same site, and the Moose Creek and Walker Road sites have produced radiocarbon dates ranging between 11,000 B.P. and 11,800 B.P. in their lowest levels. The stone-tool assemblages at these sites—classified as the **Nenana Complex**—show no evidence of Denali Complex wedge-shaped cores and look very little like the stone-tool assemblage at Dyuktai. Instead, these assemblages include bifacially flaked spearpoints (Figure 7.15).

Nenana Complex: Perhaps the oldest stone-tool complex identified in Alaska dating from 11,800 to 11,000 B.P. Nenana includes bifacially flaked, un-fluted spear points.

The stone tools representative of the Nenana Complex bear a general resemblance to those found in the lowest stratigraphic level at Ushki Lake, in Kamchatka, mentioned previously. Both the Nenana and Ushki Lake (Component 7) industries consist of small, bifacially worked knives and unifacially retouched flakes

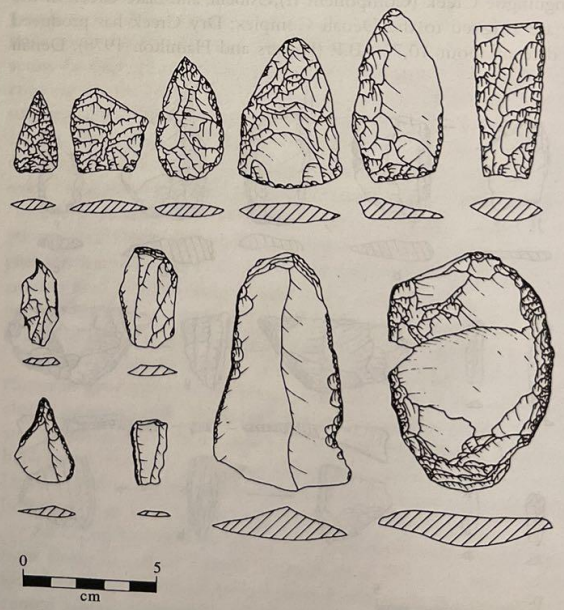


FIGURE 7.15
Stone tools from the Nenana Complex of Alaska, dating to 11,800 B.P. The lack of wedge-shaped cores, the presence of bifacially flaked tools, and dates that are older than those associated with the Denali Complex suggest a different and older migration of northeast Asians into the New World. *(Courtesy of William Powers)*

and blades; both lack microblades (Dikov 1978; Goebel et al. 2003). As previously mentioned, the teardrop shape of the Neanana Chindadn point is similar in form to a spearpoint found at Ushki. Interestingly, Component 6 at Ushki Lake, dating to 10,000 B.P., has a stone-tool industry quite similar to Denali; both are characterized by the presence of microblades (Goebel et al. 2003).

The Nenana Complex may be derived from the industry seen at Ushki in Kamchatka, representing an early movement of Asians (about 12,000 B.P.) across the Bering Land Bridge into the New World. Following the hypothesis of West (1981), Powers and Hoffecker (1989) suggest that the Siberian microblade industry seen at sites like Dyuktai and Ushki Component 6 may be at least indirectly ancestral to the later Denali Complex (dated to about 11,000 B.P.) and other early New World microblade industries. Denali, in this view, represents a migration subsequent to an earlier movement of Siberians with a bifacial industry like that seen at the Ushki and Nenana Complex sites.

As Powers and Hoffecker see it, the Denali Complex was restricted to the far north. However, in their view, possessors of the earlier Nenana stone-tool tradition were able to expand to the south. Archaeologists Ted Goebel, Roger Powers, and Nancy Bigelow (1991) point out that, with the exception of fluted spearpoints (to be discussed shortly), the Nenana stone-tool assemblage is virtually identical to that seen to the south and associated with these points. Descendants of these people, Powers and Hoffecker argue, made a small technological step in spearpoint form—the so-called **fluted point**—that allowed for an enormous adaptive leap and the successful occupation of two continents.

Fluted Point: Projectile points made by Paleoindians in the New World between about 13,200 and 10,000 B.P. The points exhibit a distinctive channel or "flute" (as in the flutes in a fluted column) on both faces.

SETTLEMENT OF THE AMERICAS: SUMMARY

It would be great if all of the data concerning the earliest human movement into the Americas fit into a nice, comprehensible package, telling a clear and unambiguous story giving us a straight line of the sites of migrants, starting in eastern Asia as they initially entered into and then spread through the New World. Unfortunately, that's not the case. Archaeologists continue to argue about contamination of material used to produce radiocarbon dates, the integrity of stratigraphy, and even the identification of some specimens as artifacts. We can summarize the current consensus in this way:

1. Archaeological evidence indicates that the earliest human settlement of eastern Siberia dates to about 40,000 years ago. In other words, people were in western Beringia by about that time.
2. Based on rates of change in mtDNA, northeast Asian natives and the population that became Native Americans appear to have separated soon after 24,000 years ago, after the birth of the Mal'ta boy.
3. In a recent study comparing similarities and differences among the genomes of 31 modern people in the New World, Siberia, and Oceania and 23 ancient individuals in North and South America (as derived from their skeletal remains), researchers calculated that the genetic separation between native Siberians and the earliest Native Americans occurred sometime between 20,000 and 23,000 years ago (Raghavan et al. 2015). This does not

necessarily date the actual migration of these first Americans into the New World from northeast Asia, only their genetic isolation and physical separation from other Siberians. Perhaps they had become geographically isolated in Beringia. Perhaps they had already arrived in Alaska. Only additional archaeological research can resolve this issue. These same researchers also showed that Native Americans in the southern part of North America and in South America show some genetic differences with their ancestral group to the north, suggesting that they had genetically diverged from their ancestors in the far north by about 13,000 years ago.

In other words, a single group of Siberians became genetically isolated by about 20,000 years ago, maybe a few thousand years before that. All Native Americans, both ancient and modern, are derived from this single migration wave with the exception of the **Inuit** (Eskimos), who arrived separately and later. These first peoples likely stayed put in the northern reaches of the New World, unable to move south, their path blocked by glacial ice. Then, a little before 15,000 years ago, as the glacial ice dissipated, some of these people spread south and began genetically diverging from their ancestors. This genetic evidence fits very nicely with the timing of deglaciation and a change in the landscape that would have made expansion into the Americas south of the Arctic far more feasible.

Inuit: An alternative term used to identify people more commonly called "Eskimo." Some Inuit people (especially in Canada and Greenland) view "Eskimo" as a pejorative term and reject its use.

In a fascinating turn, two research teams—Raghavan and her colleagues (2015) and Skoglund and his (2015a)—simultaneously and independently found an additional, though weak, genetic input apparently derived from Australo-Melanesians. In all likelihood, this was the result of later gene flow through northeast Asia; there is no evidence for the direct movement of Australo-Melanesians into the Americas in antiquity.

4. Analysis of the Y-chromosomes of modern northeast Asians and Native Americans suggests a separation date at about the same time, sometime between 22,500 and 20,000 years ago.
5. As glaciers waxed and waned at the end of the Pleistocene, a possible migration route along the Pacific coast of North America became available south of Beringia by about 15,000 years ago.
6. Archaeological evidence far to the south of Beringia, in Monte Verde, Chile, supports an initial migration along the coast route around 15,000 years ago and as much as 18,000 years ago.
7. An interior route from eastern Beringia (interior Alaska and northwestern Canada) south of the glaciers, through an ice-free corridor between the Laurentide and Cordilleran ice fields into the American Great Plains became available for animal and human movement by about 14,000 years ago. This date is problematic at this point, as sites dating to before this time have been found in the interior of North America.
8. Archaeological evidence recovered at Meadowcroft Rockshelter in Pennsylvania may reflect a habitation by migrants who passed through the ice-free corridor into the interior of North America at this time. Cactus Hill and Topper may be too old to fit this model, but in some interpretations of their dates, these too could be less than 14,000 years old and supportive of the scenario presented here.

There's one more thing. The movement of people from the Old World into the New, from Siberia into the American Arctic, did not cease at the end of the Pleistocene. Geneticist David Reich and his colleagues (Reich et al. 2012) conducted an analysis of the DNA of a sample of living Native Americans representing 34 different populations or tribal groupings spread across North and South America. A statistical analysis showed that the people in the sample could be broken down into three distinct genetic clusters: Most could be grouped into what the researchers called "First American," and these people were spread across much of the New World. Modern Inuit (in Alaska, Canada, and Greenland) and Aleuts (people from the Aleutian Islands of Alaska) formed a second genetic cluster, and the Chipewyan people of Canada constituted a third group. Based on their distinct genomes, the Inuits and Aleuts are not the descendants of the Mal' ta boy's group and, as a result, also not closely related to the Anzick boy. Archaeological evidence suggests that these residents of the Arctic arrived much more recently, perhaps only a thousand years ago, representing an additional pulse of migration from the Old World Arctic into the New long after the First American group represented genetically by Anzick. As will be discussed later, these newcomers actually displaced the original settlers of the Arctic who may have been the descendants of yet another population movement from the Old into the New World.

Paleoindian: Period and culture in the New World dating from about 13,200 to about 10,000 B.P. Fluted points are the most distinctive element in the Paleoindian stone-tool kit.

CLOVIS

Called **Clovis** for the site in New Mexico where the distinctive spearpoints that characterize the tool assemblage were first recognized, **Paleoindian** sites number in the hundreds and are found throughout the continental United States. Where dates have been derived through ^{14}C, almost all Clovis sites fit into a narrow range, between 13,200 B.P. and 11,900 B.P., appearing virtually simultaneously across much of the New World (Haynes 1982, 1987, 1992).

FIGURE 7.16
Fluted points are characterized by channels or "flutes"—as in "fluted columns"—on both faces. The flutes likely aided in hafting the spearpoints onto wooden shafts. Fluted points are a New World invention; they are not found in northeast Asia or, for that matter, anywhere else in the world. The two points depicted here are the Clovis variety. *(Courtesy of R. M. Gramly)*

Clovis Technology

Clovis spearpoints are distinctive in having a channel, or flute, on both faces (Figure 7.16). The channel, made by removing (usually) a single broad flake from both faces of the point, originating at the base and ordinarily extending one-quarter to one-third of the way toward the tip, is assumed to have been an aid in hafting the stone point onto a wooden shaft. As mentioned previously, this small technological step seems to have resulted in an adaptive leap that allowed for the rapid expansion of human groups across the New World. This great leap forward is strictly an American invention. Fluted points are never found in Siberia or anywhere else in eastern Asia, nor are they present in the Nenana Complex in Alaska. Clovis points are, in fact, rare in Alaska altogether and when found there are dated to the late stage of Clovis culture. In other

words, Clovis did not originate in the north but developed somewhere else and moved north only later.

It is, as yet, unclear where Clovis originated, though most archaeologists point to somewhere in the American Midwest or Midsouth. For example, some of the specific chipping patterns seen at the 15,500-year-old Debra L. Friedkin site mentioned earlier in this chapter seem to presage some of the technical aspects of Clovis technology and, in fact, a Clovis component overlies the ancient layer (Waters, Forman, et al. 2011). Another possibility is that Clovis originated even further south, perhaps in Mexico. Fluted points were found in association with an extinct species of elephant, the gomphothere, at the El Fin del Mundo site in the Sonoran desert of Mexico. A single radiocarbon date obtained from site materials indicates it was occupied about 13,390 years ago. Wherever it originated, it is clear that the tradition of making projectile points with concave channels on both faces is both ancient and widespread in the New World.

The rapid, almost simultaneous appearance of fluted points throughout much of the New World is striking. Whereas there are relatively few sites in America dated to before 13,000 years ago (see "Issues and Debates"), there is a virtual explosion of Clovis sites in the American Southwest and beyond dating to after this (Haynes 1992). Stratified sites such as Clovis, Lehner, Murray Springs, Dent, Colby, and Domebo, all in the Southwest, produced fluted spearpoints and dates in that time range (Haynes 1982).

Clovis points are also found throughout Canada, the continental United States, and Mexico. In the Northwest, the spectacular Richey Clovis Cache in central Washington State, an apparent ceremonial interment of huge fluted points as much as 23.25 cm (a bit more than 9 in) in length, has been dated at 11,200 B.P. (Gramly 1993; Mehringer and Foit 1990). In the American Northeast and Southeast, thousands of fluted points have been recovered from hundreds of sites (D. Anderson 1990). Sites may be younger in the East—but not much: The Vail site in Maine has produced radiocarbon dates of 10,300 B.P. and 11,120 B.P. (Gramly 1982); the mean radiocarbon age of the Debert fluted-point site in Nova Scotia is 10,600 B.P. (MacDonald 1985); and Templeton (6LF21) in Connecticut has been dated to 10,190 B.P. (Moeller 1980).

Even at the most distant New World spot imaginable from Beringia, Fell's Cave at the southern tip of South America (Tierra del Fuego), a fluted point in association with the bones of extinct horse and sloth has been recovered from a site dated to 10,000 years ago (Bruhns 1994). Nonfluted fishtail points were also found in Fell's Cave and in other sites dating to this time in South America at sites such as Palli Aike, also in Tierra del Fuego, Los Toldos in Patagonia, and El Inga in northern Ecuador. Long, leaf-shaped El Jobo points were found at Taima Taima in Venezuela, also dating to the late Pleistocene.

Along with being geographically widespread, Paleoindians inhabited a broad diversity of habitats, including those found in coastal regions, deserts, river valleys, and in some of the highest elevations available in the New World. For instance, Kurt Rademaker (et al. 2014) and his colleagues have excavated two sites high in the Andes. When Rademaker was searching for a geological source for the obsidian found at sites lower in altitude in southern Peru, he located the Pucuncho quarry site at an elevation of 4,355 m (over 14,000 ft). He found quarry debris as well as

FIGURE 7.17
Stone tools, including the bases of three fish-tailed points at the Pucuncho lithic workshop (upper left) and a diverse array of stone tools found at the Cuncaicha rock shelter, were recovered at locations high up in the Andes Mountains of Peru. Pucuncho is as much as 12,800 and Cuncaicha is about 12,400 years old. These sites represent both a very early occupation of South America and very early settlements of a high-altitude habitat. *(Courtesy of Dr. Kurt Rademaker. Image credit: Erica Cooper)*

fluted fishtail points at the site (Figure 7.17). The site dates to sometime between 12,800 and 11,500 years ago. Higher still (at 4,480 m or 14,700 ft), in an alpine wetland, Rademaker and his team found the Cuncaicha rockshelter site. This very high-altitude shelter was inhabited some 12,400 years ago; its residents hunted wild game, including the camelid species guanaco and vicuña (we'll talk more about their respective domesticated descendants, the llama and alpaca). Although I spend the great majority of my time at sea level, I have experienced the challenges of high-altitude hiking, having visited sites in the Bighorn Mountains of Wyoming (10,000 ft; see the photograph of the Bighorn Medicine Wheel in Figure 14.26). It's cold at that elevation, and the oxygen levels are considerably lower than they are at sea level, but Paleoindians appear to have thrived under these challenging conditions.

Clovis Subsistence

Though the image of Paleoindians risking life and limb to track down and kill a two-ton, hairy elephant is romantic, they most probably relied on root grubbing, seed gathering, and small-mammal trapping, at least some of the time (Johnson 1991; Meltzer 1993a). Certainly, during some parts of the year, most Paleoindian groups relied on hunting for survival. But once past the glacial and periglacial north and onto the American plains, they could find and exploit many other foods, including seeds, nuts, berries, fish, and small mammals. Away from the glacial front, where animals may have been the only consistent source of food—for example, in the woodlands of eastern North America—Paleoindians were probably "generalist foragers" who not only took big game when the opportunity presented itself but also exploited smaller game and plant foods in their territories (Dincauze 1993).

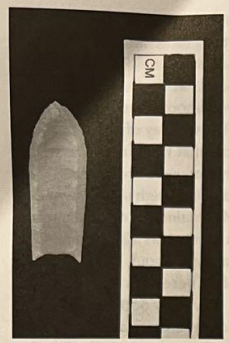


FIGURE 7.18
Paleoindian fluted Folsom point from the Johnson site, Colorado. Folsom points are younger than Clovis points, they are generally smaller than Clovis, and the flute extends nearly the entire length of the point. Where animal bones are found in association with Folsom points, bison clearly was the ancient hunters' choice. *(Courtesy R. M. Gramly)*

Folsom: Fluted point type of the Paleoindians. Generally smaller than Clovis points, Folsom points are later in time than Clovis, dating to after 11,000 B.P. Folsom points are fluted, with the channels commonly extending nearly the entire length of the point (compare to Clovis).

Paleo-Eskimos: Name given the Arctic-adapted migrants to the New World from the Old at about 6,000 years ago.

Dorset: The Dorset were an extremely successful group of Paleo-Eskimos. Their maritime culture, with a heavy reliance on hunting seals through holes drilled in ice, flourished between 3,000 and a little after 1,000 years ago.

Geologist C. Vance Haynes points out that the remains of the two varieties of extinct North American elephants, the woolly mammoth and the mastodon, have been recovered from the majority of Clovis sites in the American West, where animal bones have been preserved (1982:390). There are, in fact, a dozen known Clovis sites where the butchered remains of mammoths or mastodons have been excavated. When these elephants became extinct around 11,000 years ago, the Paleoindians in the western United States shifted their hunting focus to bison. The technology changed, producing shorter spearpoints, but with channels extending almost to the tip. These so-called **Folsom** points (Figures 7.18) are of the culture that bears the same name.

Into the Arctic

Among the second wave of migrants from the Old World to the New were people who had adapted to the harsh conditions of the Arctic. After all, they came, ultimately, from Siberia. Their adaptation to life in the Old World Arctic enabled them to spread across northern Alaska, Canada, and into Greenland, and thrive there beginning as much as 6,000 years ago. We call these people who first entered the Arctic more than 6,000 years ago (in a second migratory migration from the Old into the New World according to Raghavan et al. 2014b) the **Paleo-Eskimos**. The best known of the Paleo-Eskimo cultures—in effect, its flowering—is called the **Dorset**, which spread through the north between 3,000 and a bit past 1,000 years ago.

The Dorset appear to have been supremely well-adapted to life in the Arctic, where they lived for more than 2,000 years. They were consummate hunters of marine mammals, relying primarily upon seals, which they speared through holes in the ice.

Soon after 1,000 years ago, however, typical Dorset material culture with its assemblage of flaked stone tools and weapons disappeared. This occurred during an apparent warming of the Arctic, which may have contributed to their disappearance. Either toward the end of the Dorsets' dominance of the north or soon after they were gone, another people with an entirely different set of tools, made by grinding stone into sharp edges rather than chipping them, appeared in the north (Raghavan et al. 2014b suggest an overlap of between 50 and 200 years). These people had bows and arrows, dogsleds, and animal skin boats, which the Dorset did not, and there is archaeological evidence for their ability to conduct well-organized hunts of whales and walruses, again behaviors not seen at Dorset sites. These newcomers arrived about 700 years ago and spread across the north all the way to Greenland. We call this culture the **Thule** (Figure 7.19).

FIGURE 7.19
An example of a beautiful ivory comb carving produced about 700 years ago by an artist of the Thule Culture of Greenland. *(© Werner Forman/Werner Forman/Corbis)*

Archaeological and now genetic evidence indicates that modern Inuit are the descendants of these

Thule people. Modern Inuit are genetically distinct from almost all other Native Americans; their genomes are quite different from those of either the Mal'ta or Anzick boys discussed earlier in this chapter. It is hypothesized (Raghavan et al. 2014b), therefore, that the appearance of the ancestral Inuit Thule culture represents a recent population wave out of the Old World Arctic and into the New.

WHY WERE THE PACIFIC ISLANDS SETTLED?

Geoffrey Irwin (1993:211–212) lists some of the possible motives for the expansion into the vast and previously uncharted Pacific: curiosity about what lay beyond the horizon, a desire to find areas suitable for habitation and rich in resources, and the need to find new land as a result of overpopulation or warfare. As Irwin points out, motives are not testable archaeologically. And, as John Terrell (1986) indicates, the motives to move out into the Pacific were likely as mixed and as varied as those of Europeans in their own age of exploration.

Whatever the reasons, the many inhabited islands of the Pacific, populated initially by people possessing very few, rather homogeneous cultures, produced a wide array of adaptations once they were settled. Settlers exploited the most valuable resources, developing their own unique adaptations to each island or island chain. On New Zealand, the moa—a large flightless bird unique to that nation—became a major component in the diet of a hunting society. Powerful and complex agricultural societies arose on Hawaii and Tonga (Kirch 1984). The fascinating people of Easter Island arrived there sometime after A.D. 800 and developed great skills at organizing their own labor, which enabled the quarrying, carving, transportation, and erection of about 900 enormous stone sculptures that have generated so much interest and speculation (Figure 7.20). All of today's enormous diversity developed from those first courageous voyages across the vast Pacific Ocean a few thousand years ago.

FIGURE 7.20
Called "moai," there are about 900 of these statues in various conditions and positions on the island. *(Sonja Gray)*

ISSUES AND DEBATES

Thule: The Thule were inhabitants of the northern Arctic and represent a third migration wave from the Old World to the New. They possessed hide boats and spread across the Arctic, from Alaska all the way to Greenland beginning about 700 years ago.

COULD NATIVE AMERICANS REALLY HAVE COME FROM EUROPE INSTEAD OF ASIA?

It can often be a good thing to step back from the "facts" that we all know to be true and consider, at least the possibility, that everything we know is instead wrong. This happened recently when it was proposed that the native people of the New World may have arrived during the late Pleistocene, not from Asia through Beringia but instead by boat from Europe along the margin of the ice-covered waters of the northern Atlantic. This scenario fundamentally calls into question all of our current models of the settlement of the New World based on archaeology, linguistics, biological anthropology, and genetics, but it's still worth a look.

The argument presented by archaeologists Dennis Stanford and Bruce Bradley (2012) is based on perceived detailed and deep technological and morphological similarities between Clovis technology and that of the Solutrean tradition of the European Upper Paleolithic (see Chapter 6). Stanford is an archaeologist at the Smithsonian, and I don't think there is a human being on the planet who knows more about lithic technology than Bradley. Nevertheless, the hypothesis has little to recommend it.

Archaeologist Lawrence Guy Straus (2000) has provided a detailed response to Stanford and Bradley's proposal, providing the perspective of an expert on the Solutrean. Straus rejects the suggestion of a Solutrean/Clovis connection completely, calling the Solutrean an "impossible candidate" as the source for Clovis. As Straus points out, perhaps the biggest problem in attempting to trace Clovis technology to the Solutrean lies in timing. On the one hand, the Solutrean is a short-lived technological tradition that essentially disappeared from Europe by 17,000 years ago. Clovis, on the other hand, didn't develop in North America until nearly 4,000 years later. Attempting to prove a connection between the makers of stone-tool technologies whose homelands are separated by 5,000 km (about 3,100 mi) of ocean is difficult enough. Connecting two peoples separated by 4,000 years seems quite impossible.

Straus also points out the lack of any evidence of maritime abilities on the part of the Solutrean toolmakers that might have made a trans-Atlantic crossing by them feasible, even through a series of island-to-island hops. Furthermore, the Solutrean toolmakers didn't live in the far north of Europe, where movement along the ice-covered Atlantic might have been an option for a maritime people.

Finally, the genetic data presented earlier in this chapter seals the deal. There is no evidence at all for an intrusion of a European genome into the New World among the earliest Americans. The oldest skeletons in the Americas from which nuclear or mitochondrial DNA has been recovered exhibit a clear connection to modern Native Americans and to the native people of central Siberia. Europeans were latecomers, not arriving in the New World until the Norse exploration and brief settlement of northeastern Canada at about A.D. 1000.

WHO—OR WHAT—KILLED THE AMERICAN AND AUSTRALIAN MEGAFAUNA?

Archaeologists, historians, and paleoecologists have long been aware of the curious, apparent correlation between the first arrival of human groups in Australia and in the New World and the massive extinction of large game animals

that occurred in these two regions. In Australia, 88% of large mammalian species became extinct between 51,000 and 40,000 years ago (Barnosky et al. 2004:72). On the island of Tasmania, seven large animal species including a kangaroo weighing in at more than 150 kg (330 lb) became extinct soon after 43,000 years ago (Turney et al. 2008). In North America, 72% of resident large game animals became extinct by about 11,000 years ago (that's 34 separate genera), and in South America, 83% of large game animals experienced extinction at about the same time (Barnosky et al. 2004:72).

Interestingly, the dates for Late Pleistocene megafauna extinctions are close enough to the timing of both the first appearance of human beings in Australia and Tasmania and the age of the first widespread and successful adaptation to North America (Clovis) to raise the obvious question: Were the human migrants in some way responsible for these events?

Ecologist Paul S. Martin's "Pleistocene overkill" hypothesis (P. S. Martin 1967; and see P. S. Martin and Wright 1967) involves a compelling scenario: The first human migrants to the American heartland find a flourishing bestiary that would put any modern African game park to shame. The seemingly limitless food source allows these paleohunters to expand their population at a rapid rate, ultimately filling two continents. Yet the seeds of their destruction are planted in the magnitude of their success. Large game animals, their populations already stressed by the changing climate at the end of the Pleistocene, are overhunted and ultimately suffer extinction. The human hunters at the root cause of this disaster go on to shift their adaptive strategies to other resources, having little choice but to drastically restructure their subsistence and their culture.

In an exciting piece of research, Jacquelyn Gill and her colleagues discovered that a kind of fungus—*Sporomiella*—that thrives on herbivore dung was abundant in North America up until about 14,800 years ago (Gill et al. 2009). After that, the spores produced by the fungus (and, by implication, the fungus itself) declined dramatically. This signifies either that the herbivores happily depositing solid wastes upon which *Sporomiella* thrived became totally constipated 14,800 years ago, or, more likely, they suffered a massive die-off at that point leading, rather obviously, to a decline in the main food source of *Sporomiella* (and making it a lot more pleasant to walk around without your shoes on). Though it's not possible at this point to prove what caused that die-off, it is clear, based on the fungal spore data, that the die-off happened at least a couple of thousand years *before* pollen analysis indicates that the climate changed dramatically. In other words, the Pleistocene megafauna of North America—50% of all mammal species more than 32 kg (70 pounds) and 100% of all species more than 1000 kg (2,200 pounds) (Gill et al. 2009:1100)—had already either become extinct or were on the verge of extintion before they experienced a dramatic climate change. Human beings (bearers of a pre-Clovis culture), however, likely were in North America at about the time of the fungal spore decline, not proving but at least conforming with the notion that it was human activity that led to the extinction of the megafaua.

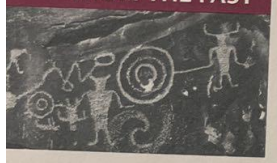
Ultimately, those who support the hypothesis that the widespread extinction of large mammals at the end of the Pleistocene in North America was due to climate change and those who view the impact of human hunting as the primary explanation for those extinctions are both wrong. And both right. In a recent examination of paleoclimatological data, DNA recovered from animal bones, and

radiocarbon dates, researchers concluded that the most likely explanation for the extinction is that large mammal species experienced a period of extreme environmental stress as a result of the severity and abruptness of climate change at the end of the Pleistocene (Cooper et al. 2015). With their populations declining, they became, in effect, the equivalent of modern endangered species. When brutally efficient human hunters entered the scene in North America or when an already existing human population developed new weapons or hunting strategies, their presence represented the nail in the coffin of those endangered populations and pushed them into extinction.

In Australia, as in North America, the data are in the dung. There, too, *Sporomiella* showed a very rapid decline, dropping off virtually to zero at 41,000 years ago (Rule et al. 2012). This timing does not coincide with Late Pleistocene climate change, nor did Rule and her colleagues find a correspondence with other environmental factors, like wide-scale burning. The only thing the drop-off in *Sporomiella* and the deduced disappearance of large animals correlate with is the appearance of human hunters in Australia. In another study, Thomas Prowse and his colleagues (2014) saw no correlation between extinction in Australia and the appearance there of the dingo. The situation on Tasmania was quite the same. For example, the latest dates derived on bones of three species of giant kangaroos on Tasmania correspond precisely with the earliest dates for the human settlement on the island (Turney et al. 2008). Was this a coincidence or did the presence of humans contribute to this extinction?

As of this moment, which factors were key and which were incidental in the extinction of megafauna at the end of the Pleistocene is unclear. As most researchers admit, it will take years of research to solve this puzzle.

MESSAGES FROM THE PAST



THE TRAGEDY OF EXTINCTION

The numbers are horrific. It is estimated that since A.D. 1500, 322 terrestrial vertebrate species have become extinct (Dirzo et al. 2014). Go online and check out photographs of the last of some of these wonderful animals: the Tasmanian tiger (an amazing-looking striped, carnivorous marsupial more properly called the thylacine); the Javan tiger; the black rhinoceros; the quagga (it looks sort of like a cross between a horse and a zebra). There were so many others. The world today is biologically impoverished as a result of all of their extinctions.

And the news isn't a lot better for many species that are still hanging on. Censuses of modern living animal populations, as imperfect as they may be, suggest the following: the past 40 years have seen a general, worldwide decline in the size of wild animal populations by an average of about 25%. Remember, that's just the average (the mean). The numbers for some species are much, much worse. And the statistics for invertebrates is substantially worse still.

You want to get even more depressed? Walk through any modern zoo or animal park and check out the signage many provide, categorizing animals as "common," "threatened," "endangered," or even "critically endangered." Many of the endangered and critically endangered are large, beautiful, charismatic species; they include virtually every subgroup of tigers, orangutans, Amur leopards, snow leopards, giant pandas, and mountain gorillas. For some of these species, zoos will soon be—or

maybe already are—the only places where they will continue to exist. At present 13% of bird species, 26% of all mammal species, and over 40% of amphibian species are currently characterized by the International Union for the Conservation of Nature as "threatened" (Monastersky 2014). "Threatened," in their use of the term, means that, without significant intervention, those species are likely to become "endangered"—and endangered species are heading for extinction.

As we have seen in this chapter, as an enormously successful species that has been able to spread across the face of the globe, human beings have contributed to the extinction of animal species likely as far back as the end of the Pleistocene, and the pace of that extinction is greater now than it ever was in the past.

The cultures of the first Americans changed significantly when the animals on which they subsisted became extinct, but lest we think that, beyond losing animals that are impressive to look at, modern humanity will not be too put out by modern extinctions, think again. Consider these often unanticipated consequences of massive extinctions (Dirzo et al. 2014):

1. 75% of the world's crops are pollinated by insects. A steep decline in the populations of pollinating insects will have an enormous impact on agriculture.
2. A steep decline in the populations of animals that eat insect pests will also affect agriculture and human health.
3. The natural process of decomposition helps recycle materials, transforming them from waste to valuable resources. A decline in the population of organisms that decompose organic waste will have an impact on agriculture.
4. A decline in the population of amphibians will negatively affect water quality, as the result of algal blooms that currently are limited by the activity of those creatures.
5. It is estimated that between 23% and 36% of all bird, mammal, and amphibian species used by humans beings for food and medicine throughout the world are currently threatened with extinction (Dirzo 2014:404).

None of this is good news. We can only hope that the intelligence discussed in this and previous chapters, the intelligence that is the hallmark of our species—our single most important and defining characteristic—will be great enough to allow us to realize the importance of preserving the other species on this planet, species with which we are intricately, intimately, and inextricably connected.

CASE STUDY CLOSE-UP

THROUGHOUT HUMAN HISTORY—AND THAT INCLUDES the part before there was writing—people often have elected to locate their settlements with practical considerations in mind. Folks concerned about aggressive, nasty neighbors may choose to place their communities in secluded, out-of-the-way spots that are hidden and readily defendable. A maritime people might decide to situate their villages along the shores of a protected bay for the gentle harbors such places provide for their boats. A people who rely on long-distance trade can settle near the convergence of a number of streams whose watercourses provide convenient avenues for canoes used to access the distant regions in multiple directions. People may also choose to live near places where useful and valuable resources are readily available, both for convenient access and, perhaps, to be able

to control the access of folks who live elsewhere. For example, in recent history towns have grown around coal seams, oil fields, or gold deposits.

The location of the Gault site in south-central Texas is an example of this kind of practical decision making on the part of Paleoindians 13,000 years ago. The site, one of the oldest in the United States and just 250 meters upstream from the even older Debra L. Friedkin site discussed earlier in this chapter, clearly was situated by its inhabitants to most conveniently exploit a local rock source—Edwards chert—that can be readily and predictably flaked into sharp-edged and durable tools (Figure 7.21; Waters, Pevny, and Carlson 2011).

The artifact assemblage at Gault clearly shows that quarrying the local stone and then manufacturing tools from it were the primary activities conducted at the site. The site was, in fact, as its excavators label it, a "quarry workshop." Lithics were the most abundant remains found during the excavation in 2000, totaling more than 66,500 fragments. The vast majority of these bits of chipped stone was debitage, the waste flakes discarded during quarrying and toolmaking.

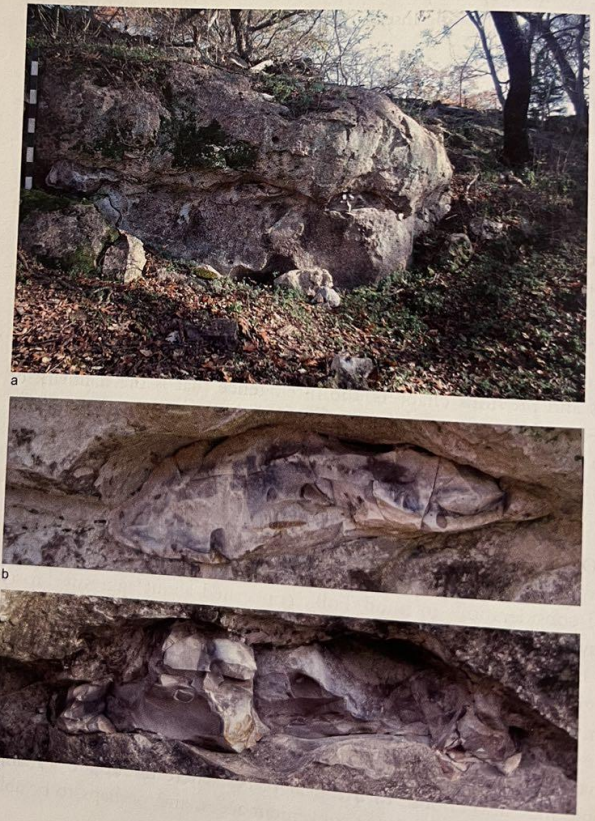


FIGURE 7.21
People, both ancient and modern, choose to settle in certain locations as a result of a constellation of factors including the ready availability of important and valuable natural resources. It is almost certainly the case that the Paleoindians who settled at the Gault site based their decision at least in part on the presence of accessible seams of a very high-quality chert, perfect for making durable and sharp-edged stone tools. *(Courtesy of Michael Waters, Center for the Study of the First Americans)*

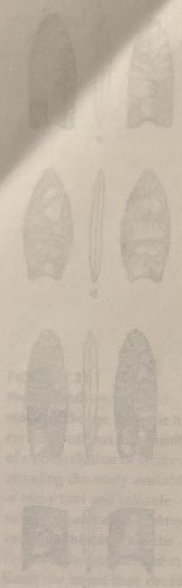
Stone toolmaking is a reductive process; essentially, the knapper is sculpting a tool from a larger chunk of rock. In the process, lots of very small flakes are produced (microdebitage) that are of no use because of their size. I see this all the time in my experimental archaeology course where, even after a few hours of work by a dozen students, the floor of the lab is littered with tiny flakes of unusable stone. It's just the nature of the process. Of the 66,502 flakes recovered in the 2000 dig at Gault, about 62,874 (almost 95%) were microdebitage and most of the rest (3,487 pieces) were larger waste flakes (macrodebitage).

Broken or complete tools and cores and core fragments were also recovered at the site, including fifty-one generic bifaces (tools chipped on both faces in order to produce a straight, sharp edge), forty-four cores and core fragments (these were chert nodules from which blades and flakes were removed), five projectile points, one knife, ten scraping tools, and three preforms (unfinished tools) (Figure 7.22; Waters, Pevny, and Carlson 2011:8). Excavators even found a single quartzite hammerstone, its end battered from striking flakes from the chert cores found at the site. We often use quartzite hammerstones in my experimental archaeology course; the rock is hard and dense and very well suited for peeling sharp flakes from stone cores.

FIGURE 7.22
Within the extensive lithic assemblage of more than 66,000 artifacts at the 13,000-year-old Gault site in central Texas were finished, bifacially flaked tools. Among the bifaces were these exquisitely made fluted points. *(Courtesy of Michael Waters, Center for the Study of the First Americans)*

By closely examining the lithics, researchers identified essentially two reductive pathways taken in toolmaking at the site. Both pathways began with the selection of vaguely rectangular blocks of chert from the quarry. In one pathway, these blocks were reduced to conical or wedge-shaped cores from which blade tools then were produced. In the other manufacturing pathway, rectangular chert blocks were collected from which large flakes were struck. From these flakes the Gault knappers produced bifaces and, ultimately, tools like the projectile points and knives.

Though organic preservation wasn't great at Gault, among the 5,700 mostly small bone fragments recovered, a few species could be identified and at least a part of the Gault residents' diet discerned. Among the species found at Gault were bison, white-tailed deer, rabbit, bear, and turtle. This broad spectrum of animals in the Gault diet reflects a diverse subsistence base and belies the stereotype of Paleoindians existing solely by hunting large game animals. This makes a great deal of sense. The overreliance on one or a very few food sources can be a recipe for disaster if conditions change and those few sources decline in numbers or even



become extinct. The broad subsistence base seen at Gault provided options for its residents when environmental conditions changed.

A single hearth was identified at the site. One can imagine a group of knappers gathered around that hearth, cooking food as they made tools, telling stories of yesterday's hunt, and laughing as one of the toolmakers curses after being cut by a sharp stone blade. It is an evocative image and it dates to a time deep in the history of North America.

SUMMARY

In the late Pleistocene, expanding human populations intruded into new territories and ultimately migrated into three previously uninhabited continents: Australia, North America, and South America. Australia was populated by coastally adapted southeast Asians. Using watercraft, by accident and perhaps through intentional exploration, they moved out into the western Pacific; inhabited the oceanic islands of Borneo, Sulawesi, and Timor; and eventually made landfall on Greater Australia: New Guinea, Tasmania, and Australia proper. Archaeological evidence offers a date for this habitation of 50,000 years ago—during a period of lowered sea level, when the trip by watercraft would have been easier than it is today. The first settlers maintained a tropical/coastal orientation to their economy, initially turning inland only along major rivers. The dry interior of the continent was settled about 20,000 years later.

During the Pleistocene, the New World was intermittently connected to the Old World by a vast land bridge, making it possible for interior-dwelling people in northeast Asia to travel through the interior of the land bridge into the interior of northwest America and for coastal people in northeast Asia to travel along the southern Beringian coast onto the coast of northwestern North America and from there south.

Sites as distant from the land bridge as Monte Verde in Chile (dated to 18,500 B.P.), Meadowcroft Rockshelter in western Pennsylvania (dated to 13,400 B.P.), Cactus Hill in Virginia (dated to 15,000 B.P.), and the Debra L. Friedkin site in Texas (dated to 15,500 B.P.) imply a much earlier time of entry onto the land bridge—20,000 years ago or possibly more—but no definitive archaeological evidence of sites this old in the New World has yet been found. Many sites that would have been evidence of migrants taking a coastal route to the south were long ago inundated by rising sea level at the end of the Pleistocene. Interior sites may be so ephemeral that finding them could be almost impossible. Several early sites in Alaska and the Canadian Yukon date to the period immediately after 12,000 years ago and bear lithic industries analogous to those in Siberia. Some of the early settlers moved south, perhaps through an ice-free corridor, into the American West, where they invented a new projectile point technology. These fluted projectile points allowed these settlers to expand across two continents. These Clovis people may not have been the first arrivals; some sites in both North and South America may be older. But Clovis represents the first broadly successful occupation of the New World.

Web links for this chapter can be found at www.oup.com/us/feder

TO LEARN MORE

For a detailed overview of Australia's past, see John Mulvaney and Johan Kamminga's *Prehistory of Australia* (1999). Two excellent sources on the colonization of the Pacific are John Terrell's *Prehistory in the Pacific Islands* (1986) and Geoffrey Irwin's *The Prehistoric Exploration and Colonisation of the Pacific* (1993).

For the most current popular summary of the issue of who first populated the New World and when, see archaeologist David Meltzer's (2009) *First Peoples in a New World*. For a succinct summary of the earliest settlement of the Americas, read "Coming to America" by Andrew Curry in the May 3, 2012, issue of *Nature*. For a review of the data concerning the role played by human hunters in the extinction of megafauna at the end of the Pleistocene, read the article by Barnosky et al. titled "Assessing the Causes of Late Pleistocene Extinctions on the Continents," in the October 1, 2004, issue of *Science*. For a splendid summary of the archaeology of the Gault site, see *Clovis Lithic Technology: Investigation of a Stratified Workshop at Gault, Texas* (Waters, Pevny, and Carlson 2011).

For a terrific and up-to-date summary of some of the oldest archaeological sites found in North America, take a look at Nikhil Swaminathan's article "America, in the Beginning," in the September/October 2014 issue of *Archaeology Magazine*.

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