

The Origins of *Homo sapiens sapiens*

And how am I to face the odds
Of man's bedevilment and God's?
I, a stranger and afraid
In a world I never made.

A. E. Houseman¹

Viewed from space, earth's green and blue beauty is framed by the black infinity of the universe. This perspective has compelled many astronauts to reflect on our common humanity. A similar contemplation of community should arise when we look back archaeologically through the millions of years of our common human ancestry and meditate on the evidence in the fragmented bones and crude stone tools of our primate ancestors.

It is tempting to lapse into a sentimental vision of our ancestors pluckily fighting their way up a long dangerous road, and finally to "succeed"—to become "us." But human evolution was not like this. As in most evolutionary equations, the most intense competition was between individuals of the same species—we are all the progeny of people who "won," in the sense that their genes made it through the unforgiving sieves of time and circumstance, to reside in us. But chance, randomness, seems to have affected the biological universe in profoundly incalculable ways since the beginnings of our planet; we seem to be here by virtue in part of a chain of improbable accidental events.²

We can see traces of our origins in all the earth's ancient life-forms, from the earliest marine creatures through early mammals that lived tens of millions of years ago to our later primate ancestors—but only in the crucial interval of two to one million years ago did our genus, *Homo*, become the dominant primate in the world; and not until just a few hundred thousand years ago did humans appear whom we accord the honor of calling them, too, *Homo sapiens*. We reserve the ultimate accolade of "people like us," *Homo sapiens sapiens*, for only some of the humans who lived after about 150,000 years ago, and it was not until about 30,000 years ago that we alone came to constitute humanity.³

To follow the Socratic dictum to know ourselves, we must ask, what were the forces and circumstances that produced us, modern humanity, from the pre-human forms of our ancestors, and what does this knowledge tell us about ourselves and our future?

HUMAN EVOLUTION AND RADIATION: 1.8? MILLION TO CIRCA 300,000 YEARS AGO

When we left our African ancestors in chapter 3, at about 1.5 million years ago, some of them had cranial capacities approaching the low end of the normal modern range, they could make and use a variety of efficient stone tools, and some of them may have already been living far outside of Africa. Several localities outside of Africa are beginning to show quite convincingly that early hominins were able to leave the African continent and disperse into at least some areas of Eurasia; by shortly after a million years ago, our ancestors had colonized most of the southern edge of the Old World, from Africa to Indonesia. These were the habitats—rich in flora and fauna and with few seasonal differences in the availability of food—to which we, as tropical animals, were best adapted. But while our hominin ancestors were extending their range in the hot savannas of Africa and the warm margins of Europe and Asia, great fertile tracts of the world lay unknown and untouched by humans.

At some time between about one million and half a million years ago, however, humans were beginning to colonize more temperate northern environments. If there is any answer as to why they would begin to move out of the tropical environments they had evolved in, it probably lies in the nature of the hunting-gathering band. Ethnographic studies suggest that human hunting-gathering bands with primitive technologies need large areas to support themselves, and also that one response to growing populations is for bands to split and for “daughter” groups to establish themselves in open territories on the original group’s boundary.

Hundreds of thousands of years of this process of band division, coupled with slow evolution in the efficiencies of tools, would have populated the warmer ranges of the



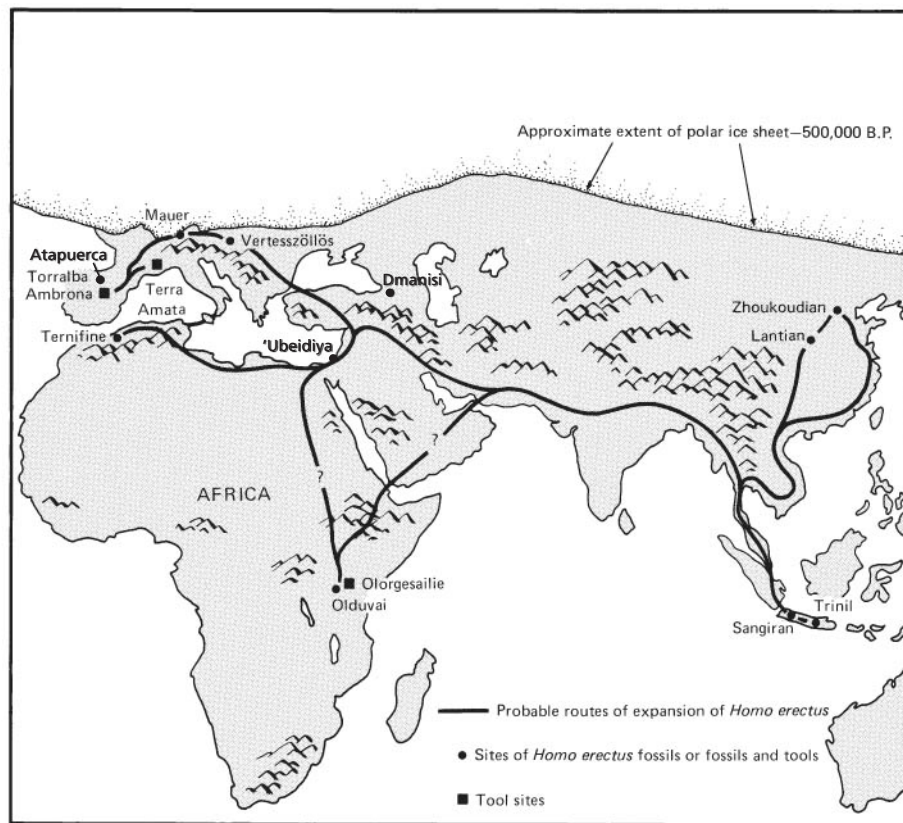


FIGURE 4.1 Distribution of *Homo erectus* sites. *Homo erectus* was the first hominin to invade temperate climates. Land bridges, now submerged, facilitated *Homo erectus* movements.

Old World and positioned human groups for colonization of more temperate latitudes (Figure 4.1).

Let us begin with the problem of which hominin actually did make the first forays into the Middle East and Asia, and then into the north. The most likely candidate would seem to be the hominin that, until recently, was commonly known as *Homo erectus*. Individuals generally classed as *Homo erectus* averaged just over five feet tall (about 1.5 meters), walked fully erect (though its body and legs differed in various proportions and shapes from ours), and had a cranial capacity that ranged between about 850 and 1,300 cm³.⁴ Compared to us, these hominins had low foreheads, large brow ridges, thick cranial bones, and almost no chins (Figure 4.2).

Alas, physical anthropologists have had a great crisis of faith with regard to the species designation of "*Homo erectus*":

Does *Homo erectus* exist as a true taxon or should it be sunk into *Homo sapiens*? Is it a palaeospecies that exists . . . as a segment of the line that emerged from *Homo habilis* and gave rise to *Homo sapiens*? Is *Homo erectus* an extinct form that had no part to play in the

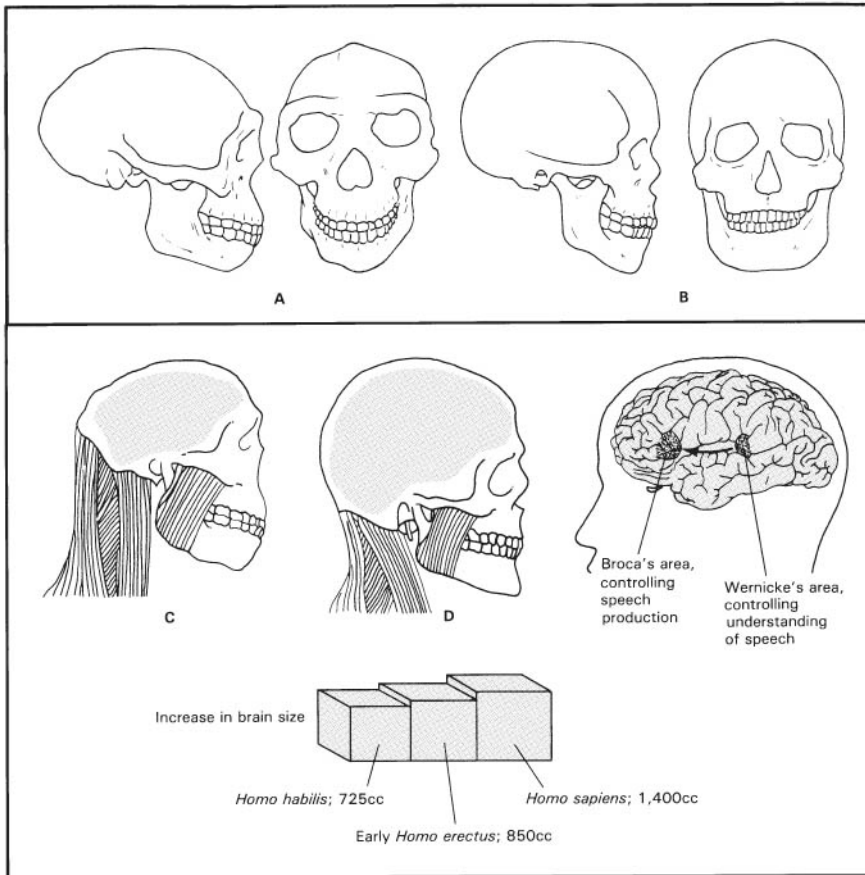


FIGURE 4.2 The *Homo erectus* skull (A) was long and low, with heavy brow ridges, no chin, and protruding jaws, compared to modern humans (B). In the transition from *Homo erectus* (C) to modern humans (D), the brain enlarged and the muscles controlling the head and neck were changed.

evolution of *Homo sapiens*? Is *Homo erectus* a good example of a “stasis event” . . . with little or no change in its form during its existence? Is there a clear cut example of *Homo erectus* in the European fossil record of man? Finally, are the Asian forms so far removed from the evolution of *Homo sapiens* in Africa to call into question the existence of *Homo erectus sensu stricto* in Africa at all?⁵

In view of these and other problems, some anthropologists have hypothesized that *Homo erectus* consisted of only the east Asian hominins who branched off from the main *Homo* line in Africa at about 1.5 million years ago, and that the African humans of this period should be called *Homo ergaster*.⁶ Others classify almost all Asian, African, and European hominins of between about 1.5 and 0.5 million years ago as *Homo erectus*.

In what follows here, all of the humans who lived between about 1.5 and 0.5 million years ago are called *Homo erectus*, but this designation is likely to change as these taxonomies are refined.



FIGURE 4.3 The Narikotome boy (KNM-WT 15000) from West Turkana, Kenya, a *Homo ergaster* hominin (*Homo erectus* grade).

Early Radiation and Migrations of *Homo*

By 1.5 million years ago, “culture” by any definition was present. Hominins with brainsizes on the low end of our own range had a stone tool repertoire indicating they could produce different forms for different purposes—often out of materials that had to be brought many kilometers to the place where the tools were made or used.

The 11-year-old boy who died on the western shore of Lake Turkana in northern Kenya about 1.6 million years ago, and whose skull and nearly intact skeleton (known as KNM-WT 15000) represent one of the best preserved and earliest *Homo erectus* individuals, seems to tell us much about our ancestors of this age (Figure 4.3). He was 1.6 meters (5 feet, 3 inches) tall—taller than many modern 11-year-olds. His cranial capacity, however, was 880 c³, somewhat more than half our size, and his brow ridges were very thick. His skeleton appears very similar to ours, though, and this suggests that our ancestors developed a body much like ours long before their mentalities equaled ours.

No stone tools were found with this individual, but Acheulian-style (named after the French site at St. Acheul) stone tools associated with *Homo erectus* in Europe at a much later date (c. 600,000 years ago at the earliest) were apparently already present in many other East African sites more than a million years ago.⁷ For example, at Koobi Fora, on Lake Turkana in Kenya, *Homo* remains and animal bones with what seem to be butchering marks have been found in substantial numbers, and there are small clusters of stone tools, some in concentrations about 5 to 10 m in diameter with from about 10 to 100 artifacts.⁸

The hand-axes and other stone tools associated with the early African *Homo erectus* are a major improvement on the tools associated with the australopiths of the previous million years, and this developing technology may have enabled hominins to radiate from warmer latitudes into colder, more demanding climates. The “Acheulian hand-axe” may not seem like a marvelous bit of technological advance, but it has several features that seem to reflect human intellectual evolution (Figure 4.4). First, it requires more processing—more actual steps of manufacture—than did the Oldowan chopper-style tools. Again, this might not seem like some major technological breakthrough, but in a rather abstract sense the Acheulian hand-axe requires that the maker “see” the possibilities of striking off numerous flakes—a sort of intuitive feel for the physics and geometry involved. Also, Acheulian hand-axes came in a variety of sizes and shapes. As we shall see, in some cases the best use of basalt, quartzite, flint, and other hard stones is to knock off a series of flakes, use them until the edges dull, and then strike off more flakes. In such a substantial tool it may have been functionally efficient and effective to get the proportions as close to the ideal size as possible. If one is simply going to smash open a cow femur for marrow, any rock not too heavy to lift or too small to transmit much force would be adequate, but one interpretation of Acheulian hand-axes suggests that they were beginning to converge on functionally optimal proportions and overall size.

What these functions were, however, remains unclear. Possibly these tools were used for a great variety of tasks, or they may have simply been cores to produce sharp-edged flakes; other archaeologists think they are specialized tools. Many are too heavy to have

been hafted (attached to a spear or other piece of wood) easily, yet they are often found in association with animal bones. It is barely possible that this association with animal bones is accidental, but it seems more likely that one function of this tool was as a primary butchering tool.

Since Acheulian hand-axes are usually found with other types of stone tools (and were presumably used with a wide variety of wood and bone tools that did not preserve), and although they may not have been the “Swiss Army” knives of their generation, they were certainly an important tool. Their distribution is particularly impressive. They have been found (Figure 4.5) over most of western Europe, Africa, and India, and are also occasionally reported from China.

The economy of all humans of this time period remains more a matter of speculation than hard evidence and continues to be the source of sharply different interpretations. Some think *Homo erectus* was primarily a hunter and that the demands of the hunting way of life partially “drove” human evolution toward ourselves; others doubt *Homo erectus* did much more than scavenging and opportunistic hunting.

An interesting site in this dispute is Olorgesailie, near Nairobi, Kenya (Figure 4.6). Here many small concentrations of stone tools and bones are spread out along a peninsula in an extinct lake. Most of the tools are cleavers and hand-axes, and some show considerable chipping and blunting wear. Mixed in with them are bones from several species of large mammals, including a hippopotamus and, curiously, 63 individuals of an extinct species of baboon (but no hominins). Potassium-argon dating of the Olorgesailie formation yields an age of about 480,000 years.⁹

Glyn Isaac suggested that ancient hominins encircled a troop of baboons here, perhaps at night, spooked them by making a lot of noise, and then systematically clubbed them to death as they tried to escape. Pat Shipman, too, has interpreted this site as the result of a hunting episode.¹⁰ If Olorgesailie is a case of hominins hunting baboons, as some suggest, we may have been underestimating the linguistic and physical prowess of *Homo erectus*. It is instructive to try to imagine oneself about two-thirds our size, going out at night with stones and clubs to kill 63 baboons.

But Lewis Binford has questioned whether Olorgesailie—and most other early hominin sites—were places where hominins killed and butchered animals.¹¹ He suggests that the evidence from Olduvai and Olorgesailie may well be remains left by hominins who scavenged the kills of other animals, mainly for bone marrow, which they obtained by smashing bones with stone tools. He sees no evidence that early hominins shared food in complex patterns like humans or that they foraged from home bases.¹²

Again, the non-anthropologist might wonder why anthropologists take so seriously these debates about how people made a living in Africa half a million years ago, but from a certain perspective, we really *are* what we eat, and not only that, as modern humans we are very much a product of the natural selective forces that applied over the millions of years of our past and especially to such basic matters as to how we and our ancestors got our food.



FIGURE 4.4 Examples of Acheulian hand-axes from the Abydos Survey for Paleolithic Sites project, Egypt.

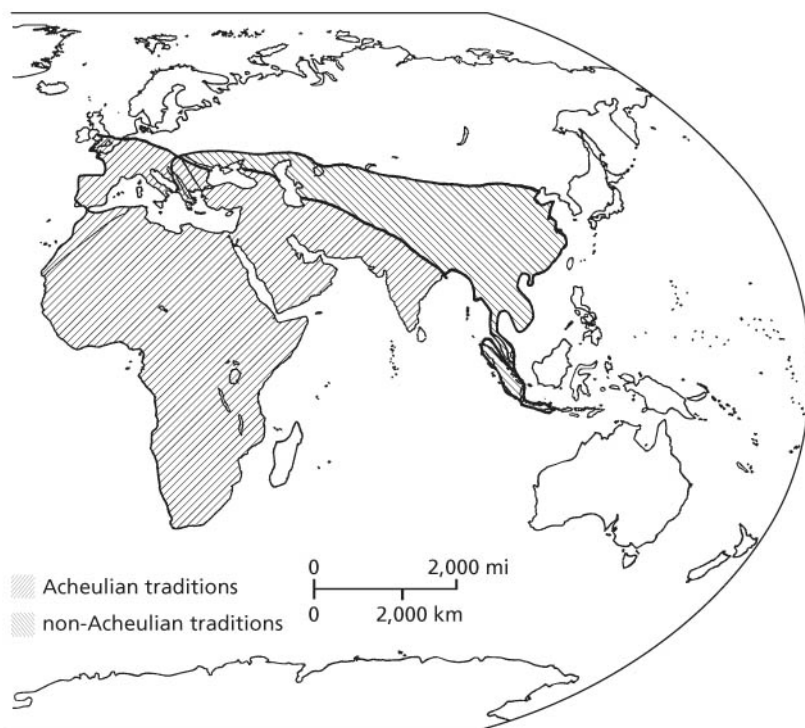


FIGURE 4.5 The distribution of Acheulian and non-Acheulian traditions in the Old World.



FIGURE 4.6 Aerial view of Olorgesailie, Kenya, an area with Early and Middle Stone Age sites.

The Invasion of Temperate Ecozones

One of the most interesting discoveries about these early *Homo*, however, is that some groups of them left Africa, apparently very soon after they first appeared there.

Finds from Israel, the Republic of Georgia, Pakistan, China, Java, and Spain indicate that hominins were distributed across the warmer regions of the world as early as 1.7 million years ago. The lowered seas of the Pleistocene would have facilitated this, opening rich coastal niches far out into the Southeast Asian archipelagos.

At various times in the past million years the climate of northern Europe and Asia was much warmer than it is at present. So warm were areas of Germany and France about

800,000 or 900,000 years ago that monkeys swarmed through dense forests there. But at other times the icy fingers of glaciers drew down out of the Alps and other mountain ranges, and great expanses of northern Europe were tundra.

One can imagine human groups probing northward during warmer periods—some of which lasted tens of thousands of years—and then their descendants being faced with equally long-term cooling trends. Probably no individual was conscious of the change, since it was so gradual, but kilometer by kilometer, year by year, they would have had to retreat or adapt. For our ancestors to invade the more northern climates, and to survive there during periods of expanding glaciers, would have required some form of clothing, seasonal hunting, and perhaps the use of fire.¹³ If these early hominins had the use of fire, it could be used for keeping warm, cooking food, and evicting bears and other carnivores from caves and rock shelters—the safest and warmest places to live in northern latitudes.

Climate has had a strong impact on people physically and culturally until very recently, when modern technology began to moderate its direct effects. In the Pleistocene, moving into

northern climates depended on people becoming whiter and stouter over many tens of millennia, through natural selection: Up to 80 percent of the energy value of food goes simply to maintain body temperatures, and it is an inescapable fact of physics that spheres lose heat more slowly than any another shape of equal volume. Even with the pervasive migrations of people during the last century, the relationship between body shape and mean temperature—as epitomized by the East African Watusi and the Arctic Inuit (“Eskimo”)—is strong.¹⁴

The white skins of northern peoples have to do most directly with their dependency on vitamin D, which is present in some foods but can also be synthesized in humans by the action of sunlight on skin. But whiter shades of skin are also more susceptible to cancer, acne, and psoriasis than are darker tones, so for northern Europeans the selection for whiter skins—necessary to maintain vitamin D production in the long dark northern winters—was a mixed blessing.

The problems of living in northern climates go beyond simply keeping warm. In winter most of the plants suitable for human consumption die, and an animal like ourselves has only two ways to get food: store it—or hunt, fish, or scavenge other animals who *can* find suitable nutrition. On the African savannas and in other warm environments, women supply most of the food in hunting and gathering cultures, and even pregnant women, children, and the aged can gather much of their own food all year long. But such self-reliance would not have been possible in northern latitudes, where snow covered the ground for five to six months of the year. Clearly, strong social systems in which food-sharing and cooperative efforts were common would be important in adapting to these demanding temperate environments.¹⁵

The best evidence for hominins outside of Africa before one million years ago is found in four widely separated areas: the Republic of Georgia, China, Java, and Israel.

Ongoing work at the site of Dmanisi in the Republic of Georgia has yielded a treasure trove of early hominin remains.¹⁶ The fossils (Figure 4.7) are very similar to the African *Homo ergaster* rather than Asian hominins. Numerous animal bones (which help provide a relative date for the site) and some stone tools similar to the Oldowan industry (chopper-chopping tradition) were also found, but Dmanisi is not a “living site”

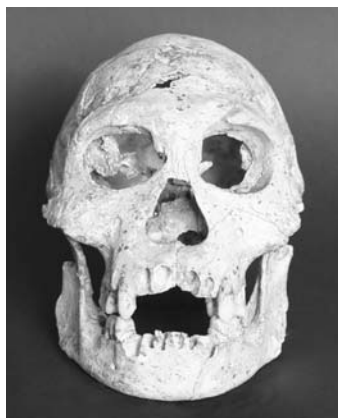


FIGURE 4.7 One of the *Homo ergaster* hominins from Dmanisi, Republic of Georgia, dating to about 1.7 million years ago.

—it represents materials that were redeposited from elsewhere in the landscape. Perhaps the most surprising discovery is the age of the site—the fossils are in deposits that are age bracketed between 1.77 and 1.85 million years ago. Dates for the underlying basalt layer (1.85 million years ago) were obtained using the potassium argon method and paleomagnetism (see chapter 2), which measures the magnetic fields of strata of rocks. The earth's magnetic field is known to have reversed polarity several times and the irregular timing of these events is well established. The overlying sediments at Dmanisi yielded paleomagnetic information that can be correlated to a change in the earth's magnetic poles from normal to reversed polarity at 1.77 million years ago.

The recent discovery of the northern Chinese site of Majuangou shows that hominins were present in this colder and drier area by 1.66 million years ago—thus making this site nearly as old as the evidence from Dmanisi.¹⁷ No hominin fossils were found, but Majuangou was a lakeside site with stone tools such as cores and flakes (a chopper industry similar to the Oldowan), as well as animal bones including horse, hyena, rhinoceros, deer, gazelle, and ostrich. Some of the horse and deer bones were broken open with stone tools to extract the nutritious marrow.

The *Homo erectus* remains found in Java by Dubois are also comparably old. After redating the sediments where the finds were supposedly made, plus some sediments that had adhered to the fossils themselves, de Vos and colleagues are now confident that these remains date to about 1.7 million years ago.¹⁸ But there will always be questions about these dates because the exact location these finds were made is not known with absolute certainty,

and even sediments adhering to fossils might have come from older formations that had nothing to do with the fossils themselves. One of the most frustrating things about the record of *Homo erectus* in Java is that not a single fossil of this hominin has been found there in good association with stone tools.

'Ubeidiya (Figure 4.8), 3 km south of the Sea of Galilee in what is now Israel, comprised about 14 distinct archaeological assemblages, all probably dating to no later than 640,000 years ago, and perhaps much earlier, before 1.2 million years ago (and some dates on animal remains are as high as 2 million years).¹⁹ The tools found here seem very similar to those from Middle and Upper Bed II at Olduvai Gorge, being mainly choppers, spheroids (rounded stones), hand-axes, and used flakes. Richard Klein notes that at different times in the Pleistocene, the eastern Mediterranean can be considered part of Africa—in the sense that the climate and animals there very closely resembled nearby areas of Africa.²⁰

It is clear that early hominins were able to inhabit a great diversity of environments—they were a successful genus, expanding into new niches. The most conservative view and probably the most accurate one is that hominins evolved bipedalism, then tool-using and other cultural behavior in Africa, and then spread out along the warmer margins of the Old World in a long slow process of population growth



FIGURE 4.8 Ofer Bar-Yosef at the Lower Paleolithic site of 'Ubeidiya, Israel. Note the extremely tilted stratigraphic deposit.

and very gradual movements, as groups split and moved short distances away from one another, until hominins could be found from southern Africa to Java.

After one million years ago, there is widespread evidence of hominins in many areas outside of Africa, including, for the first time, in western Europe.

If *Homo* had reached northern China well before a million years ago, there seems to be no obvious environmental reason why they could not have invaded southern temperate Europe as well. Klein notes that some scholars believe that humans colonized most of temperate Europe only after

500,000 years ago, but recent human fossils found in Spain, at Cueva Victoria and Gran Dolina, “suggest that humans in fact arrived in Europe nearer to 1 million years ago.”²¹ At Gran Dolina (a cave site at a place called Atapuerca; Figure 4.9), for example, Eudald Carbonell and other Spanish scholars found what could be the oldest known European humans.²² About 36 human bones, including cranial fragments, teeth, jaw, hand, and foot bones were recovered, representing at least four individuals, including an adolescent and a child. These fossils’ ages were estimated using paleomagnetic dating. The Atapuerca fossils were found just below a magnetic reversal that is known to have happened 780,000 years ago.

If this date is accurate—and many scholars consider it to be—these fossils raise many questions. The bones do not seem to be very similar to *Homo erectus*. The Spanish researchers who found the fossils say they do not closely resemble any known form of human but could represent ancestors of the Neandertals (see later in this chapter). The Atapuerca fossils may represent one of many unsuccessful attempts to colonize Europe, as time after time people migrated into the area but did not persist, in the face of the severe winters and other challenges of Pleistocene Europe.

Another well-dated early European site is Isernia La Pineta, in central Italy, where volcanic deposits overlie deposits of stone tools associated with animal bones. Stone choppers, flakes, and scrapers were found here amidst bones from elephants, bison, and other animals, and the animals and volcanic deposits indicate a date of about 500,000 years ago and possibly much earlier.²³ A human thigh bone from Boxgrove in southern England has also been dated to about 500,000 years ago, and various other sites in Europe date to this age. For people to have colonized this far north, into England by 500,000 years ago, we might expect that they began to move out of the Mediterranean area by 600,000 years ago or earlier, and it is certainly possible, given the vagaries of preservation, that people were in northern Europe in substantial numbers by 700,000 years ago, or earlier. But based on



FIGURE 4.9 Excavations at the Lower Paleolithic Gran Dolina site at Atapuerca, Spain.

the available evidence it seems likely people did not regularly and significantly inhabit northern temperate Europe until about 500,000 years ago.

If people were in Java 1.7 million years ago, however, we might expect dense concentrations along the routes out of Africa and along the southern coasts of Asia that date to this same period, but there is little evidence of this. A few stone tools found at Ban Mae Tha, Thailand, appear to date to 700,000 years ago, and the Lan-t'ien and Q'en-Xia-wo sites in central China contained fragments of *Homo erectus* that date to about 600,000 years ago, but there simply is little other credible evidence of human occupation of these more southern areas before about 900,000 years ago. It is possible that such factors as the sea level rise at the end of the Pleistocene drowned most of the pre-1-million-year-old sites along the southern approaches to Java, but it is also possible that the 1.7-million-year-old dates for the Indonesian *Homo erectus* hominins are wrong.

An important site for analyzing human colonization of temperate environments is Zhoukoudian (literally “Dragon Bone Hill”), a cave located 43 km southwest of Beijing. Using explosives, excavators managed to blast out and examine thousands of cubic meters of collapsed cave debris at the site between 1927 and 1937, and these excavations and later research revealed the remains of more than 40 hominins, as well as over 100,000 stone tools, countless animal bones, and many hearths and ash layers, all well stratified in a deposit that is an astonishing 50 m deep. Not all this was cultural debris—cave bears and other animals alternated with hominins in occupying the cave, and these other animals probably brought in many of the animals. But Zhoukoudian has more superimposed occupational layers than any other known *Homo erectus* site. Analysis of the fauna and hominins and various forms of dating (including fission track, uranium-thorium, paleomagnetism, and thermoluminescence) have produced conflicting age estimates. In a recent summary²⁴ of these dates, Wu Rukang and Jia Lampo conclude that the uppermost layers date to 230,000 years ago and the earliest levels to about 700,000 years ago.

The 14 skullcaps, 6 skull bones, 10 jaw fragments, 147 teeth, and assorted arm, leg, and hand bones found at Zhoukoudian all appear to have come from *Homo erectus*. Brain volumes average about 1,040 cm³ and range between about 775 and 1,300 cm³—somewhat larger than the *Homo erectus* from Java—and teeth sizes fall between ourselves and australopiths (actually, they are only slightly larger than contemporary native Australian populations). Based on the few leg-bone fragments recovered, it is estimated that the Zhoukoudian hominins averaged about 5 feet, 1 inch in height—which may seem short, but is only an inch or two less than the average height of most people of just a few hundred years ago.

Wu and Lampo note that every *Homo erectus* upper incisor found in China, including those from Zhoukoutian, Yuanmou, Yunxian, and Hexian, is “shovel-shaped”—that is, in cross section the tooth is curved like a shovel. They note that this feature is found in nearly as high frequencies in living Mongoloid populations, whereas it is at much lower frequencies elsewhere, and thus they conclude that the Chinese *Homo erectus* are the genetic ancestors of contemporary Chinese. This point is discussed at greater length later.

About 100,000 stone tools were retrieved from Zhoukoudian, most of them simple flakes and choppers made from quartz, but with some more specialized tools, as well, including flakes, drills, and augers. Over the course of the site's occupation, the simple chopper tools of the 700,000-year-old initial occupation were replaced by a variety of tools that included retouch and prepared core flaking.²⁵

Zhoukoudian may have been a base camp from which hominins hunted and to which they brought back their kills to be cooked and eaten. The site includes hundreds of thousands of animal bones, mainly from deer, but also from elephants, rhinoceroses, beavers, bison, boars, and horses. The large quantities of charred hackberry seeds found at Zhoukoudian suggest that they were a dietary staple, and pollen analysis indicates that nuts from walnut, hazelnut, and pine would have been available. Such finds remind us that we see only a distorted picture of early hominin diets: They probably ate vastly greater quantities of plant foods than meat, but only when they used fire to cook plants do we find the traces of vegetable foods, and although pollen can show that some plants were available, many plant foods simply were not preserved in archaeologically recognizable forms.

Not a single skull from this site had an attached face, and the base of each skull was broken, perhaps to get at the brains. But numerous scholars have questioned the idea that these bone alterations indicate cannibalism.²⁶ Arens, for example, also rejects the notion that cannibalism was a common practice for very long in any culture, ancient or recent.²⁷ He may well be right, since ecologically, systematic cannibalism is a poor food-procurement strategy.²⁸ Compared to almost any other animals, people are hard to catch in relation to the amount of food they represent, and one risks depleting the stock extremely quickly if cannibalism is at all frequent.

Some of these questions about the Zhoukoudian humans could be answered if we still had their bones, but all the hominin remains disappeared while being transferred from Beijing to an American ship during the Japanese invasion of China prior to World War II. Although there are some mysterious indications that they have survived, to date no progress has been made in locating any of the fossils.²⁹ Fortunately, at the time of their discovery the great German anatomist Franz Weidenreich made excellent plaster casts of them all and described them in superlative detail.

Perhaps our best evidence of European adaptations hundreds of thousands of years ago comes from Torralba and Ambrona, located about 1.5 km apart in a deep valley 150 km northeast of Madrid (Figure 4.10). Given the many difficulties of discriminating between human scavenging and hunting, no single site can be taken as a convincing evidence of the general nature of early human life in Europe. But many regard Torralba and Ambrona as evidence that at least some groups in Middle Pleistocene Europe engaged in big-game hunting. Excavations at Torralba in the early 1960s by F. Clark Howell exposed about 300 m² of stratified archaeological deposits, from which were

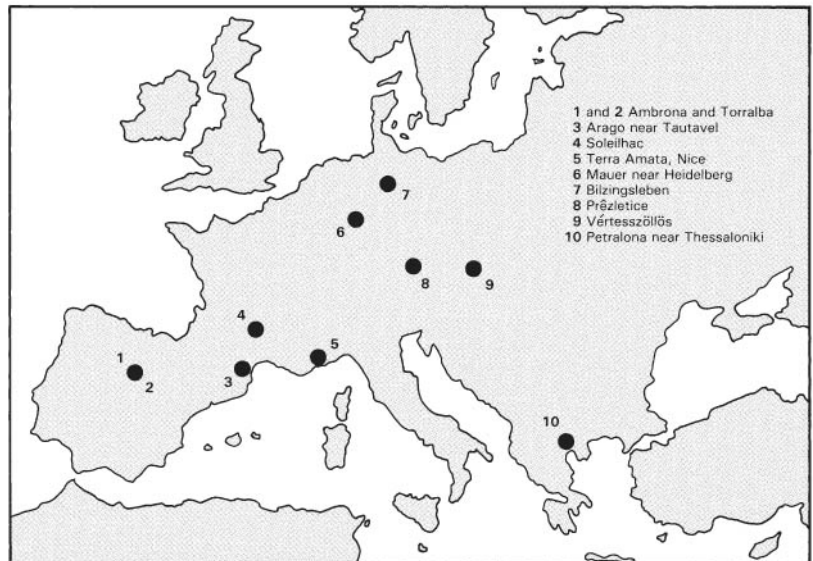


FIGURE 4.10 Some important *Homo erectus* sites in Europe.

collected hundreds of pollen samples, several thousand stone tools, and countless animal bones (but no human remains). The kinds of pollen found in these remains have convinced some scholars that Torralba dates to about 400,000 years ago, but some think it is only about 200,000 years old. Pollen analysis indicates the area was a cool, swampy valley when the site was inhabited.³⁰

The remains of at least 30 elephants were found at Torralba, as well as about 25 deer, 25 horses, 10 wild oxen, and several rhinoceroses. The original interpretation of activities at this site suggested that most of the animals here were killed and butchered by hominins, based on the presence of disarticulated skeletons, the lack of elephant skulls and other meat-bearing bones which could have been carried elsewhere, and charcoal—possible evidence of setting fires to drive game—found mixed with bones and stone tools.

The process of driving animals into the swamps and killing and butchering them would have been quite a spectacle, with great clouds of smoke, shrieking, demented animals, and running, shouting hominins. But how could these ill-equipped people have killed these huge animals? Not a single obvious stone spear-point was found at the site, but Freeman suggests that the animals were either stoned to death with the many fragments of rock found amid the bone or dispatched with wooden spears.³¹ It is a bit difficult to envisage any human, let alone *Homo erectus*, about to stone three or four large elephants to death, or to kill them with long-since-rotted wooden stabbing spears,³² but if they did, it would have been a fantastic Hitchcockian scene played out in this Spanish valley hundreds of thousands of years ago.

As intriguing a picture as this ancient hunt may be, our better understanding of taphonomic processes in the formation of sites (see chapter 3) has led to a reinterpretation of Torralba. Some of the patterns in the disarticulated bones are almost certainly the result of the actions of slow-moving water, and at least some of the smashed and split animal bones are due to scavenging animals such as hyenas. The widely scattered charcoal is most likely due to a naturally occurring brush fire, not a fire set to drive game into the swamps.

That said, the stratigraphy at Torralba is complex, and the site may represent not one, but many different hunting episodes for some of the animals found there.³³ Those animal bones with no signs of butchering may be natural deaths or deaths due to nonhuman predation. The few animals with evidence of butchering may be what remains to us from those occasional hunting episodes, added to the “background noise” of natural deaths and other predators in the landscape.

Another important central European site is Vértesszöllös, a rock quarry west of Budapest, Hungary. A recent series of uranium dates put the site at about 185,000 years B.P.,³⁴ but it could be as old as 350,000. When the site was first occupied, it was on the banks of some hot springs, and several layers of human occupational debris have been found near these springs. Excavations in the 1960s uncovered about 3,000 stone tools, many smashed and burned animal bones, and the occipital bone from one hominin and a few teeth from another. The estimated cranial capacity of between 1,115 and 1,437 cm³ is large for a *Homo erectus*, and some consider this fossil to be an archaic form of *Homo sapiens*. No hearths have been found at the site, but burned bones here indicate the use of fire.

Nearly all the evidence reviewed to this point seems clear in indicating that some form of early *Homo* left Africa and colonized Europe and Asia between 1.7 and 0.5 million years ago; and most scholars see patterns of regional evolution, with some commonalities but also some differences appearing in human groups as they made their living in highly varied ways, exploiting small areas in a complex mosaic of adaptations that reached from England to southern Africa to Indonesia.

This consensus of scholarly opinion on our ancestors up to about 300,000 years ago evaporates, however, when the question of “what happened next?” is considered.

HOMO SAPIENS: MODELS OF ORIGINS

In their tool use, social systems, and economies, *Homo* of several hundred thousand years ago, as we know them from Zhoukoudian, Torralba-Ambrona, and the other sites described in the previous section, seem to have been similar to modern hunters and gatherers in many ways, yet there is something alien about these creatures. We look for artifacts expressing ritual or complex symbolism, but not a single figurine,³⁵ wall painting, rock carving, or even an elaborately made stone tool can be securely attributed to *Homo erectus*. Later, beginning at least 40,000 years ago, people made exquisitely crafted stone tools, some so delicately worked that even moderate use would ruin them—tools that must have been made in part simply for the pleasure of creating something beautiful. But the tools of *Homo erectus* are undeviatingly simple, efficient, utilitarian objects.

Perhaps even more revealing, there are no known *Homo erectus* burials or ritual dispositions of corpses. For at least the last 30,000 years, death has almost everywhere been an occasion for the outpouring of human emotion, and even the simplest hunters and gatherers during this span usually disposed of their dead by digging a hole and placing a few stone tools or bits of shell in with the body; but not a single *Homo erectus* anywhere in the world appears to have been even intentionally buried, let alone sent off to the next world with a few provisions and expressions of goodwill.

These various absences of stylistic behavior among *Homo erectus* can be interpreted in several different ways. *Homo erectus*, with his brain about two-thirds the size of our own, may simply have lacked the mental equipment to generalize and symbolize his experiences as we do. *Homo erectus*'s language skills, in particular, may have been quite limited.³⁶ On the other hand, *Homo erectus* may have had the potential for stylistic, religious, and social impulses but lived in circumstances that did not elicit such expressions. As Randall White has observed, the ethnographic record of material forms of representation like that of Pleistocene “art” suggests that these aesthetic expressions are about political authority and social distinctions,³⁷ and it may be that the social conditions in which such distinctions are important were just beginning to appear in the Middle and Late Pleistocene.

It is difficult to overstate the importance of the evolution of the capacity for aesthetic, ritual, and social feelings, for as we will see, it was precisely these mental characteristics that made possible the rise of great civilizations. Thus, we are particularly concerned in this chapter with the conditions under which these feelings first appeared (as reflected in the archaeological record) and with their concurrent important cultural developments. Richard Klein,³⁸ for example, suggests that the “explosion” of art about 30,000 years ago, in the form of figurines and highly stylized stone tools, as well as other evident cultural change, reflects the migrations of anatomically modern peoples throughout the world—the first people, he suggests, to have these mental powers.

The obvious question is: How were our ancestors changed by time and circumstance in these highly significant ways? To consider this question, we must turn to the contrasting hypotheses about modern human origins.

“I can’t believe that!” said Alice. “Can’t you?” the Queen said. . . . “Try again: draw a long breath, and shut your eyes.” Alice laughed. “There’s no use trying,” she said: “one can’t believe impossible things.” “I daresay you haven’t had much practice,” said the Queen. “When I was your age, I always did it for half-an-hour a day. Why, sometimes I’ve believed as many as six impossible things before breakfast.”

Lewis Carroll³⁹

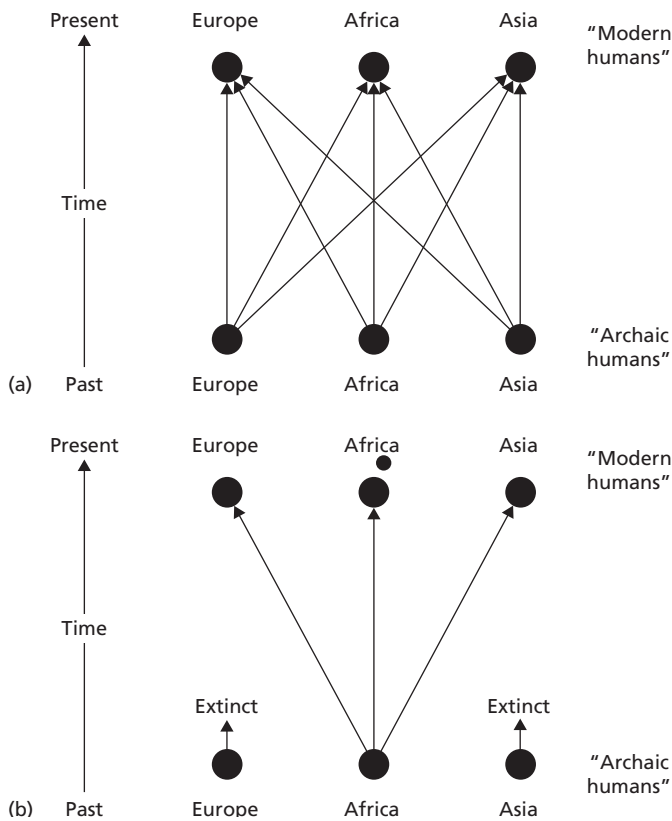


FIGURE 4.11 Two models for the origins of modern humans. a) Multiregional model. This model proposes that the ancestry of modern humans is from both African ancestors and archaic human populations outside Africa beginning about 150,000 years ago. b) Replacement or out-of-Africa model. This model proposes that the ancestry of modern humans is only from African ancestors about 150,000 years ago. All archaic humans outside of Africa became extinct and African modern humans replaced these archaic populations in areas outside of Africa.

The major contemporary “models” (that is, sets of linked assumptions, hypotheses, and interpretations of data) about how we changed from early African hominins into us, *Homo sapiens sapiens*, all require one to believe scenarios that, if not exactly impossible to believe, do require some dramatic leaps of faith.

Most models of modern human origins are variants of two basic contrasting hypotheses. One of these, which has become the majority view, is described variously as the *African Origins*, *Total Replacement*, *Noah’s Ark*, or *Eve* model.⁴⁰ It stipulates that modern humans evolved first and only in Africa and only a few hundred thousand years ago or less, and then migrated to the rest of the world, replacing all other hominin forms, and with little or no genetic interchange with these other forms (Figure 4.11).

An alternative model, commonly known as the *Continuity*, *Multiregional Evolution*, or *Candelabra* model,⁴¹ traces all modern populations back to what was ultimately an African source (but to a time when people lived only there), through a web whose genetic contributions to the present varied from region to region and from time to time (see Figure 4.11).⁴² Thus, this model proposes that archaic humans in Africa and outside Africa contributed to the ancestry of modern humans. The basic idea of this hypothesis is that sometime between about one and two million years ago a generic *Homo* ancestor of ours spread out across the warmer latitudes of Africa, the

Middle East, Asia, and possibly the southernmost fringe of Europe. With the passage of the millennia these groups began to diverge somewhat as they adapted to local and different environments, but across the whole range of *Homo* they were evolving toward *Homo sapiens* as a result of “genic exchange” (i.e., gene flow through mating and migrations) that connected all human groups to some extent; and because they were under similar evolutionary selective forces, as generalized hunter-foragers, they all emerged in the last 30,000 years as one species, *Homo sapiens sapiens*—but with some of the physical differences that distinguish many modern Europeans, Africans, and Asians from each other.

These different views of the origins of modern humans have long histories. Louis Leakey, for example, argued⁴³ an African origins hypothesis in the 1960s against the then-predominate multiregional view, such as that advanced in the 1930s by Franz Weidenreich.⁴⁴ Weidenreich suggested that modern humans exhibit physical features that reflect continued gene flow throughout the world, but from at least four centers where the genetic continuity was sufficient to produce the differences observable in today’s major “races.”⁴⁵

These competing models require some difficult assumptions. Since relatively few nonhuman species have evolved from one species into another over a wide range in a “convergent” fashion, for example, why would we expect humans to be different? One answer might be that if humans actually did evolve in the convergent worldwide pattern imagined by Weidenreich it was because they all shared a similar ecological niche—that is, “culture.” If we ask how many migrants per generation would be required to sustain the gene flow to keep regional evolution convergent, estimates range as low as just one migrant per generation, but many scholars doubt that migrations and matings and convergent evolution were enough to produce *Homo sapiens sapiens* at about the same time and in about the same form in such widely separated areas as, for example, northern China and southern Africa.

This presumed pattern of convergent human evolution over a wide area and through great spans of time remains a problem for the Multiregional Evolution model, but, as we shall see, the African Origins model also requires some assumptions.

Whatever the ultimate accuracy of these models, different scholars using the same data have come to very different conclusions about which of these models best fits the data. Resolution of intellectual debates sometimes comes as much from a change in perspective (e.g., Darwin) as from additional data. Fundamental research continues on the nature of evolutionary processes, and this research, along with discoveries of new fossils and tools, will probably resolve these debates.

Molecular Biological Evidence of Modern Human Origins

The skulls and skeletons of our ancestors may seem the most direct evidence to assess hypotheses about human origins, but these bones are usually just mineral casts of formerly living individuals, and arguments about the meaning of subtle differences in size and shape of their features are endless and largely irresolvable. An alternative approach is to work backward—in effect, to look at today’s people and see how their degree of biological relatedness fits various ideas about our origins.

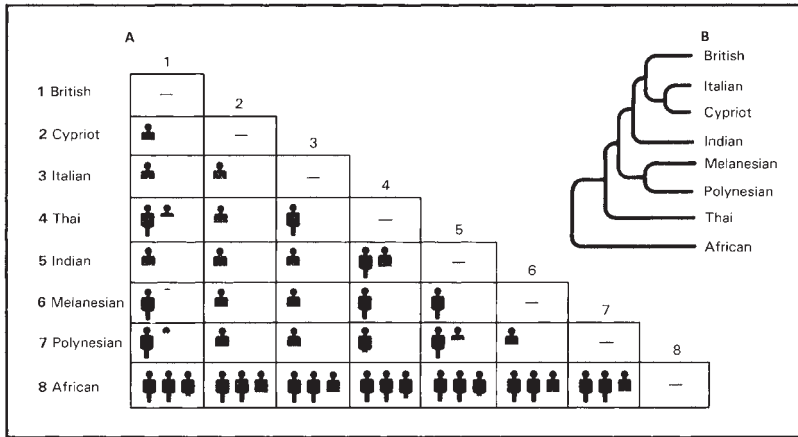


FIGURE 4.12 (A) Analyses of DNA have been used to suggest genetic distances among contemporary groups of people. In this figure the genetic distances between groups is based on a sample of 600 individuals from eight groups. Between any two groups, the fewer the symbols the shorter the genetic distance and the closer the presumed relationship. In (B) these data are arranged in a family tree. These data suggest all modern humans are genetic descendants of one small inbred group of prehistoric Africans.

Figure 4.12 presents one such form of analysis: It expresses the degree of biological similarity among contemporary peoples of the world. How did such different degrees of relatedness appear, and when, and what do these differences “mean”?

It is an inescapable fact of genetics that all the people alive in the world are genetically related and that at some point an individual existed whom we can all claim as an ancestor. The only points of debate are how long ago that ancestor lived, and where. Some scholars have argued on the basis of genetic evidence that all of us alive today have a common female ancestor who

lived less than about 200,000 years ago. This African Eve model is based on the study of DNA taken from the mitochondria, which are features in human cells where energy to keep the cell functioning is produced. The term “mtDNA” stands for mitochondrial DNA; mtDNA is different from nuclear DNA in that it is all in the mitochondria of the mother’s egg and therefore is not affected by the sperm’s contribution to genetic inheritance as implanted during fertilization. Thus, mtDNA is inherited only through the mother. MtDNA is subject to random mutations at a higher rate than nuclear DNA, and these are expressed as minor mistakes in copying the genetic code that are then passed on to the next generation. Thus, we would not even expect two people from, for example, the same small isolated group of hunter-foragers in, for example, highland New Guinea to have identical mtDNA. And we would expect that differences in mitochondrial DNA would increase the longer any two people are separated in terms of a common ancestor, since the minor genetic mutations in mtDNA accumulate over time.

An analogy to accumulation of changes in mtDNA is the fate of last names in many Western cultures, where a child’s last name usually comes only from the father. If a man does not have children or has only female children, his individual perpetuation of that last name is “lost” (although, of course, there are usually many others with that last name). Similarly, mtDNA is “lost” if a woman has no children or has only sons.⁴⁶

In an early study to test the relatedness of contemporary human groups, Cann, Stoneking, and Wilson collected the placentas of 147 women in the United States, Asia, Europe, the Middle East, New Guinea, and Australia, and then separated the mtDNA from these samples and compared them. They concluded that everyone living today is descended from an African woman, a “mitochondrial Eve,” who lived between 140,000 and 290,000 years ago—probably about 200,000 years ago. They identified Africa as the home of this woman because mtDNA is most variable in today’s Africa, and thus these mtDNA

differences appear to have been accumulating longest in Africa. If the estimate of about 200,000 years ago for a common maternal ancestor is correct, it is highly unlikely that the people who lived in Europe and Asia before about 200,000 years had anything to do with us, in terms of our biological ancestry. Since this study, other researchers have increased the sample of people studied and used various other methods of calculating genetic similarity (reviewed by Aiello⁴⁷), and some have concluded that, indeed, the evidence shows that everyone in the world today is descended from a few Africans who lived a few hundred thousand years ago.

But many scholars have questioned these mtDNA and related studies. For these estimates to be accurate, at least three things must be true: (1) The generation time (i.e., the average number of years between mother and daughter's ages) must be accurately estimated; (2) the molecular "clock," in the sense of the rate at which genetic differences accumulate, must run equally as fast for us, the *Hominini*, as for other mammals; and (3) nucleotide substitutions must be constant over time. Each of these assumptions has been attacked by recent scholars, and, in any case, Don Melnick and Guy Hoelzer strongly caution about the use of the mtDNA clock, suggesting that various problems with it "render mtDNA unreliable for dating past evolutionary events."⁴⁸ Frayer and others⁴⁹ also strongly criticize assumptions about the mutation rate of mtDNA, and they argue that if the starting date of the "clock" is pushed back to 800,000 years ago for the origins of the mtDNA we now all share, then there would be a better fit between the molecular evidence and the fossil and archaeological records.

The details of these debates about the interpretation of graphs of genetic relatedness based on mtDNA are beyond the scope of this book—and beyond the grasp of those without specific kinds of mathematical expertise. Various mathematical techniques are required to measure similarity and to arrange these patterns of similarity in patterns that show descent and genetic relatedness, and disputes about the appropriateness of these techniques continue. Frayer and his colleagues⁵⁰ conclude, for example, that "There is no statistically reliable mtDNA evidence for an African, or any other single, geographically centered origin for Eve."

Although these debates have raged on in the literature for a couple of decades now, new genetic studies appear to be putting this argument to rest. Perhaps the best recent genetic support for the "Out of Africa" scenario has come from studies of mtDNA recovered from Neandertal (discussed later) fossils.⁵¹ These appear to show that Neandertals differ from modern humans in more than 20 mtDNA mutations. Coupled with the mitochondrial clock for mutation rates, this degree of difference suggests that Neandertals cannot be related to modern humans. If true, then Neandertals, and likely most other archaic *Homo* forms outside of Africa, did not contribute to the gene pool that constitutes us.

To evaluate these opposing models of human origins and interpretations of the genetic evidence, we can at least consider the ambiguous and fragmentary record of their bones and stone tools.

Fossil and Archaeological Evidence of Modern Human Origins: Testing the Total Replacement Model

Let us consider the Total Replacement model to be a "null hypothesis," in the sense that we can attempt to demonstrate that it is *not* true. Although some of the most vocal proponents of the Total Replacement model have recently questioned aspects of their

model,⁵² it at least has the virtue of clearly testable implications. If, for example, the Total Replacement model is accurate, we would expect to see various kinds of specific evidence.⁵³

First, the earliest known *Homo sapiens sapiens* should be found in Africa, and there should be evidence that “modern” humans lived only in Africa prior to their appearance in the rest of the world.

A second testable implication of the Total Replacement model is that there should be no anatomical evidence of genetic mixing between the early modern Africans and the people they replaced. That is, except in Africa, there should be an absence of “intermediate” forms of humans—those whose physical forms appear as a blend of early *Homo* and *Homo sapiens sapiens*—in the period between about 400,000 and 30,000 years ago.

Third, everywhere outside of Africa the earliest modern humans should resemble these African ancestors and not the local people who had lived there first. Also, there should be evidence of a “rapid” change from early *Homo* to *Homo sapiens sapiens* in both the fossil and archaeological records as the replacement took place, and in a geographical pattern that reflects the routes they took out of Africa.

Fourth, in areas outside of Africa there should be no evidence of anatomical continuity spanning the time period before and after the replacement occurred: That is, we should not expect to see a pattern of continuous similarity in the physical types who lived, for example, in China at Zhoukoudian 300,000 years ago, 50,000 years ago, and today.

Fifth, we should look for some evidence as to why Africans were able to displace well-adapted hominins all over the Old World. We would expect some evidence in technology, skull size and shape, animal exploitation patterns, site densities and placement, or some other attribute of the archaeological record that would explain why this replacement was both rapid and complete. As Frayer and his colleagues note,⁵⁴ even the European conquest of the Americas, involving as it did far superior technology and the introduction of numerous lethal diseases, left many indigenous Native American hunter-foragers, from Alaska to Tierra del Fuego, and some have persisted even into the present day. So, what evidence is there that the early African *Homo sapiens sapiens* possessed some advantage that allowed them to drive into extinction all other humans?

It is important to note that all of these five categories of evidence are to some degree equivocal: What, for example, would an “intermediate” skull be, and what would “rapid” change look like in the archaeological record?⁵⁵ Different scholars have different ideas about what these kinds of terms mean. Also, given the vagaries of preservation and differences in the intensity of archaeological research (much more work has been done in western Europe, for example, than, say, Pakistan), we could be easily misled by sample biases. Moreover, whatever advantages the early African *Homo sapiens sapiens* had that allowed them to replace other hominin forms, if in fact that is what happened, these advantages may not be visible in the archaeological record, given our current knowledge of that record. If early Africans, for example, simply had a slightly greater fertility rate, perhaps because of some genetic mutation and minor cultural adaptation to this mutation, and no other advantages, it is possible that they could have supplanted all other hominins in a few hundred thousand years—although we would still have to explain why no interbreeding by adjacent groups took place, since such gene flow is the common pattern during the recent past. Finally, the basic logic of science stipulates that hypotheses cannot be “proven.” One attempts to disprove them and in the end all that science can aspire to is pointing us toward the current “best” model—“best” being defined in terms of “fit” to the data and parsimony.

To “test” these five implications of the Total Replacement model requires that we examine a complex array of evidence, and the reader is forewarned that this review ends inconclusively: Reasonable scientists differ on interpretations of this evidence.

THE EVIDENCE FROM AFRICA

One implication of the Total Replacement model is that the earliest modern humans should appear in Africa. Does this appear to be true? Recent fossil discoveries by Tim White and his colleagues in Ethiopia suggest that this may be the case.⁵⁶ Several hominin crania recovered from Herto in the Middle Awash area—dated to between 160,000 to 154,000 years ago—have features that are intermediate between archaic *Homo* in Africa and anatomically modern humans. The combination of the age of these fossil hominins and their morphology may be strong evidence that they are the ancestors of modern humans.

Another example of early *Homo sapiens sapiens* is the fragmentary human remains from the Klasies River Mouth caves in South Africa (Figure 4.13), found in association with many stone tools, animal bones, and other evidence of repeated occupation.⁵⁷



FIGURE 4.13 Overview of the Middle Stone Age site of Klasies River Mouth, South Africa.

Uranium series dates and correlations with dates from marine cores seem to place these remains between 125,000 and 95,000 years ago. Only some elements of the crucially important facial morphology are preserved on just four of the individuals represented by these bones. The scholars who have analyzed the Klasies human remains come to startlingly different conclusions. Some scholars see archaic features in many elements of these bones and little evidence for the “modern” features they would expect if these individuals were part of the population that, according to the Total Replacement model, preceded the appearance of modern *Homo sapiens sapiens* elsewhere in the world. The excavators of this site, R. Singer and J. Wymer, add that the many stone points found at the site indicate substantial hunting with hafted spears.⁵⁸

Early hominin fossils of *Homo sapiens* have also been found at Bodo and Omo (Ethiopia); Laetoli (Tanzania); Kanjera (Kenya);⁵⁹ Kabwe, or Broken Hill (Zambia); Border Cave (South Africa); and several other sites, but in every case at least some scholars consider the dating unreliable or disagree on the degree of modernity evident in these highly fragmented finds.⁶⁰ Other scholars,⁶¹ however, see a pronounced modern appearance in the African human fossils that span the period between about 200,000 and 100,000 years ago and conclude that the evolution of *Homo sapiens sapiens* was slow and continuous and had nearly run its course in Africa by 70,000 years ago.

But the Total Replacement model does not require that *Homo sapiens sapiens* appeared in East Africa as early as 100,000 years ago. Richard Klein has suggested that the *Homo sapiens sapiens* who actually replaced all other humans only appeared in Africa after 50,000 years ago, and perhaps only shortly before 30,000 years ago, when we see the spread across the Middle East and Europe of “art,” in the sense of wall paintings, figurines, shell and bone ornaments, and beautifully crafted tools (see later), and when we also see standardized tool shapes and highly organized activity areas in the remains of archaeological sites:

The fourth and most recent event occurred about 50,000 years ago and it was arguably the most important of all, for it produced the fully modern ability to invent and manipulate culture . . . a genetic mutation that promoted the fully modern brain. . . . [I]t allowed the kind of rapidly spoken phonemic language that is inseparable from culture as we know it today. . . . Fossil, archaeological, genetic, and linguistic evidence all point to Africa as the place where the 50,000-year-old behavioral breakthrough occurred. . . . Had the crucial mutation occurred first in Europe, the earliest evidence for modern behavior would be there, and students of human evolution today would be Neandertals marveling at the peculiar people who used to live in African and then abruptly disappeared.⁶²

One interesting implication of Klein’s hypothesis is that these *Homo sapiens sapiens* could also have replaced the supposedly modern-looking but much more ancient *Homo sapiens*, like those who lived at Herto, Klasies, Omo, and elsewhere in Africa 100,000 or more years ago (Figure 4.14). Klein suggests that the mutation that accounted for the ability of these *Homo sapiens sapiens* to replace all other forms after 50,000 years ago may have been just an increased ability to conceptualize and communicate—as perhaps is evident in “art” and the standardized tools they used and the way they organized their daily activities. Such changes may have had no reflections in the shape or size of human skulls and only very subtle reflections in the ways tools were made, used, and discarded.

Is there any artifactual evidence in African sites after 100,000 or between 50,000 and 30,000 years ago, as Klein suggests, for “art” and other improved conceptual skills? Tantalizing bits of evidence have been produced, but the evidence, as always, is ambiguous.

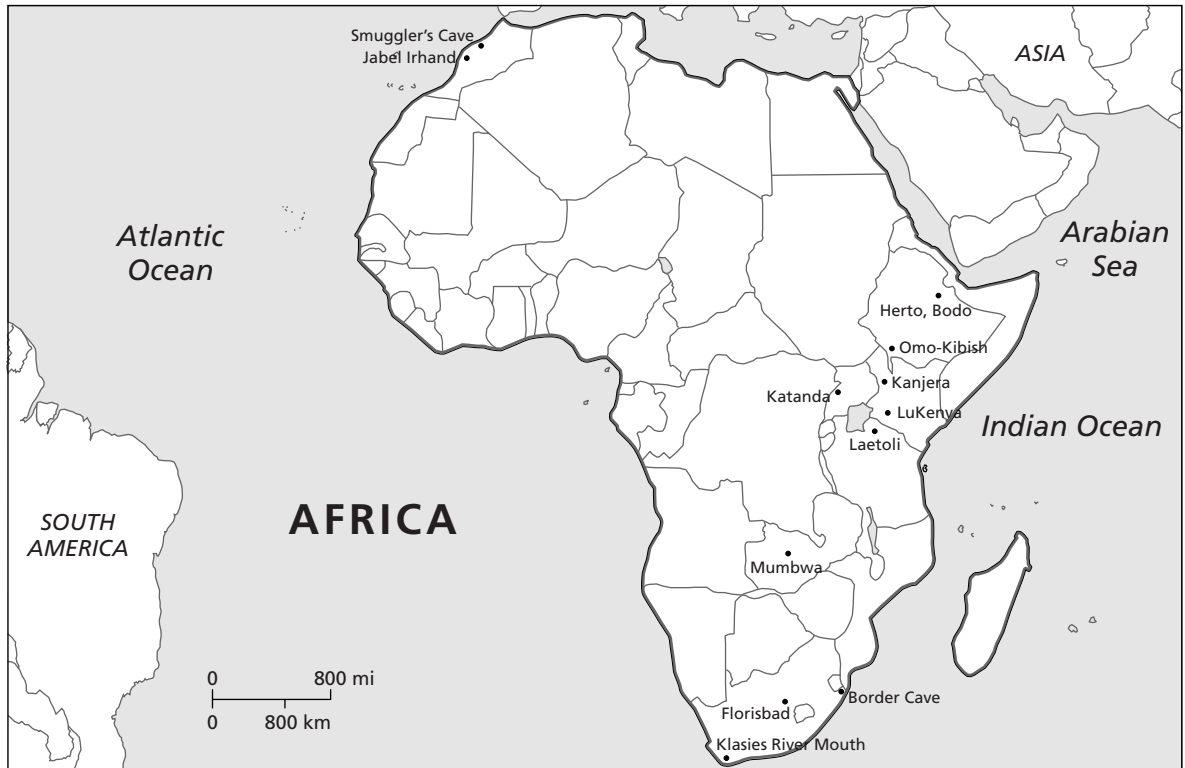


FIGURE 4.14 Early *Homo sapiens* sites in Africa. The dates of some sites are controversial. Most are thought to date between 160,000 and 60,000 years ago.

Allison Brooks and her group report that they have found sophisticated bone tools, including barbed points that may have been used to spear catfish in rivers in Zaire as early as 90,000 years ago (Figure 4.15).⁶³ Fishing in this way seems to have been a very late development in Europe, so one might consider this as some evidence in support of the idea that *Homo sapiens sapiens* evolved in Africa, and only in Africa. Perforated ostrich eggshell ornaments, bones, stone points, and examples of the use of ochre (a mineral that is often red or yellow in color)—perhaps as a pigment—have been found, but it is difficult to argue definitively on the basis of this evidence that there is a clear reflection of greater cognitive powers than other humans outside of Africa at this time possessed.

Thus, to some, the African evidence, in summary, is ambiguous. There are suggestions of a transition from archaic *Homo* to *Homo sapiens* at 160,000 years ago, but it is not certain that Africa is the *only* place this morphological change occurred, nor is there material evidence of some advantage that explains why Africans might have been able to drive into extinction all other hominins.

THE EVIDENCE FROM EAST ASIA AND AUSTRALIA

If the Total Replacement model is correct, at some point we should see a radical change in the human physical types who lived on this far periphery of early human adaptations. That

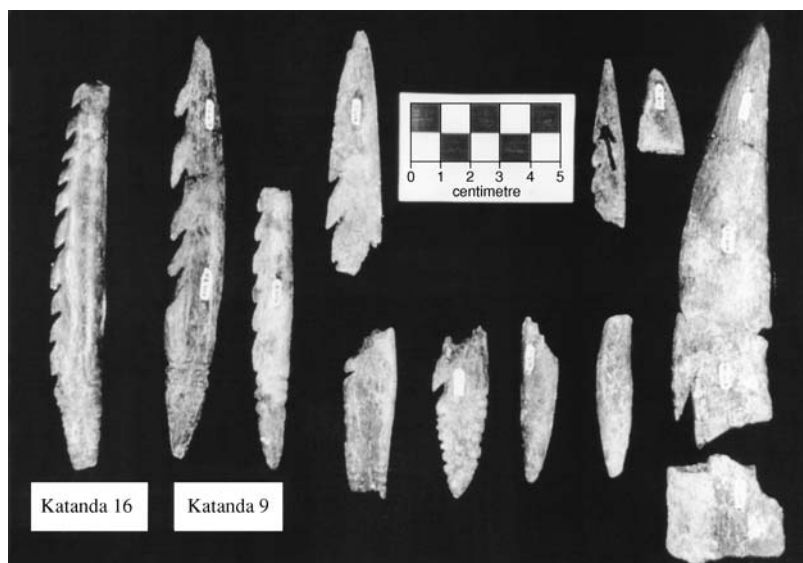


FIGURE 4.15 Bone harpoons from the site of Katanda, Zaire.

is, the people who almost certainly were in Indonesia and adjacent regions by about 900,000 years ago, for example, would have been abruptly replaced by *Homo sapiens sapiens* of the African type after about 100,000 years ago (and possibly much later). Moreover, there should be no evidence here of hybridization of Africans and Asians, nor any patterns of continuity in the physical evolution of indigenous Asian humans toward modern *Homo sapiens sapiens*. We might also expect some evidence of replacement in the tools and other aspects of the archaeological record.

Consider first the farthest periphery of the Late Pleistocene Old World—Australia. There is now persuasive evidence that people arrived there at least by 50,000 years ago, and possibly by 60,000 years ago.⁶⁴ If the “total replacement” occurred at about 200,000 years ago, then these early Australians might be expected to show little physical similarity to Chinese and other Asians of the hundreds of thousands of years before this time, such as those at Zhoukoudian and Java, because the Australians would have migrated to Australia as much as 140,000 years after the replacement of the world’s population began. If, as Klein suggests, however, the replacement occurred after 50,000 years ago, then these Australians may be a mix of early and later peoples, some of whom were closely related to Africans of this period.

Some anthropologists think that the east Asian fossil and archaeological record constitutes persuasive evidence for the rejection of the Total Replacement model. Pope, Wolpoff, Thorne,⁶⁵ and others see strong similarity between the early Australians and the Javanese, for example, and all of them as very distinct from Africans of the same age (i.e., c. 400,000–50,000 years ago). They focus on physical traits such as the “shovel” shape of the cross-sections of human incisors, which occurs in high frequency in Asian populations and much lower frequencies in Africans.⁶⁶ Frayer and his colleagues conclude that there is a very distinctive combination of facial and cranial features in Java, for example, and that this “unique combination of regional features . . . was stable for at least 700,000 years, while other characteristics continued evolving. The more recent Java remains have expanded brains that reached the modern range.”⁶⁷ These patterns of anatomical continuity would be expected on the basis of the Multiregional Evolution/Continuity hypothesis.

Advocates of the Multiregional Evolution/Continuity hypothesis also see strong evidence of continuity in the physical forms of humans in northeast Asia, as well as gradual regional evolution here of modern human brain capacities. Crania from Zhoukoudian, Dali, Jinniushan, and Yunxian and fragmentary finds from elsewhere form the basic evidence here.

Advocates of the Total Replacement model disagree with these interpretations.⁶⁸ Some have suggested that claims that early Asian humans show evolution toward “modern” *Homo sapiens sapiens* forms are based on a biased selection of only a few physical traits and inappropriate statistical manipulation of these data. They also stress the fragmentary and possibly biased record of fossils in Asia.

There is little evidence in the east Asian archaeological record of some obvious advantage in technology or other aspect of adaptation. From about 400,000 years ago onward, Asian stone tools show strong similarities, and some contrasts between Asian and African and European tools seem to go back far into prehistory. It is possible, of course, that invading Africans adopted the lithic technology of the groups they replaced, but this would seem unlikely.

In summary of the Asian evidence, scholars disagree entirely on the extent to which these data support the various hypotheses about human origins, and these debates turn on abstractions of statistical analyses of scarce and fragmentary human fossils. The stone tools of east Asia would seem to support the Multiregional Evolution/Continuity hypothesis in that east Asian forms seem to show similarity over hundreds of thousands of years as well as differences that distinguish them from those of other areas. But if replacement by Africans occurred in east Asia after 50,000 years ago, as Klein suggests, then the archaeological evidence becomes even more ambiguous. The few well dated and excavated sites of this period show some minor indications of greater use of “style” in the form of pierced shells and other artifacts. That these changes represent an African invasion, however, is far from clear.

THE EVIDENCE FROM WESTERN ASIA AND EUROPE

We know a great deal more about the prehistory of Europe and western Asia than of the rest of the world. One might optimistically think this fact would result in a much more uniform interpretation of this evidence, but in fact disagreements about the European and western Asian evidence are even more intense than those for Africa and east Asia.

About all scholars agree on is that (1) there were humans living in Europe and western Asia by 500,000 years ago but they were not *Homo sapiens sapiens*; (2) a distinctive form of human, the “Neandertals,” who were different from us in important anatomical ways, lived in Europe and western Asia between about 130,000 and 30,000 years ago; and (3) by 30,000–27,000 years ago all the Neandertals and other distinctive physical forms of humans, except ourselves, *Homo sapiens sapiens*, had disappeared.⁶⁹

To review this evidence requires discussion of a bewildering array of site names, fossil names, types of technologies, and so on. To focus all these data and to make them coherent, one can consider again the kinds of evidence stipulated earlier as to be expected on the basis of the Total Replacement model. That is, do we see various kinds of evidence in the European fossil and archaeological record that Africans invaded western Asia and Europe at some point after about 200,000 years ago and drove the indigenous people in these areas into extinction by virtue of some advantage in intelligence, technology, or other feature?

To set the stage for an examination of the evidence bearing on this question, we must go back to the beginning of human occupations in Europe and western Asia. As noted earlier, a few sites in the Middle East date, perhaps, to more than 500,000 years ago (e.g., ‘Ubeidiya, in Israel), and some fragmentary finds of human bones and archaeological sites

in Europe seem securely dated to before 500,000 years ago (see earlier). Other important hominin finds from the Middle East are discussed later in the context of the Neandertals.

To begin with the physical types of hominins that made these transitions, Chris Stringer (and his colleagues) and Erik Trinkaus have arranged most of the fossils between 500,000 and 30,000 into an order based on morphology.⁷⁰ Grade 1 hominins may be as old as 500,000 years, but dating these fossils has proved difficult in most cases. Some Grade 1 fossil specimens come from Europe. Trinkaus notes that some of these have been classified as *Homo erectus* and others seem to have Neandertal traits (see later), but as a group they seem to be consistent with a gradual change toward modern human forms (e.g., increased size of the cranial vault and decreasing mean dimensions of molars).

In Europe these Grade 1 hominins are followed by a group that seems to fall between the grades, in that they are quite archaic in some characteristics but also resemble slightly the Neandertals, who generally seem later in time than the Grade 1 group. A good example of these intermediate Grade 1–2 fossils is from Swanscombe, England, along the Thames River, not far from London. In 1935 workers in a cement plant uncovered a cranial bone from a gravel bank, and a year later another cranial fragment was found nearby that articulated perfectly with the first bone. Later, during excavations connected with preparations for the 1944 Allied invasion of France, another bone from the same skull was found just 25 m from the site of the first find. It is very possible, incidentally, that more hominin bones were included in the gravel used to make concrete for floating docks during the D-Day operation.

In the same gravel layers that produced these bones, excavators recovered the bones of extinct forms of elephants, deer, rhinoceroses, and pigs, which, together with subsequent chemical analysis and geological evidence, dated the Swanscombe fossils to between 400,000 and 250,000 years ago, when the abundance of horses, elephants, rhinoceroses, and other big-game species would have made England an ideal place for generalized hunting-and-gathering groups.⁷¹ Nor is there any problem explaining how these hominins would have gotten there, since Britain and Ireland were physically joined to Europe by a land bridge at various times during the Pleistocene.

The Swanscombe cranial remains are probably those of a woman of 20–25 years of age, with a cranial capacity of about 1,325 cm³—well within the range of modern humans.⁷² Hand-axes roughly similar to those of the Acheulian assemblages of France and Africa are among the most frequent tools in the level where the skull was found, but lower levels contain only flakes and choppers. Similar flakes and choppers have been found elsewhere in England and are commonly referred to as the Clactonian assemblage.⁷³ A wooden object that looks like the shaped end of a spear was found at Clacton and is one of the earliest wooden artifacts recovered anywhere, dating to 400,000–200,000 years ago. Stone projectile points are not found at Swanscombe, Zhoukoudian, or any other site prior to about 150,000 years ago, and thus the wooden spear fragment—if that is what it was used for—may be a clue to how these Middle Pleistocene peoples managed to kill animals. If animals were trapped in bogs, they could have been killed by multiple stab wounds with wooden spears—although it could not have been pleasant work.

The Swanscombe hominin is usually considered part of a biological group that includes a fossil from Steinheim, Germany. This cranium, dated to about 250,000 years ago, probably belonged to a young woman whose brain size and facial features place her between *Homo erectus* and ourselves. Unfortunately, no artifacts were found with the Steinheim

skull, so we cannot compare the site with the material from southern England. Nonetheless, the physical differences between this individual and *Homo erectus* at least raise the possibility that the transition from *Homo erectus* to *Homo sapiens* was well underway by 300,000 to 250,000 years ago and was taking place in more than one part of western Europe.

Excavations in a cave site in the French Pyrenees unearthed a skull (the Arago skull) and two mandibles (Figure 4.16) dated to about 200,000 years ago that seemed to fill the gap between *Homo erectus* and the European Neandertals.⁷⁴ The skull possesses some morphological characteristics of the east Asian *Homo erectus*, but lacks the incipient keel at the top of the skull usually found in these populations. The large size of the teeth and mandible and the structure of the chin seem to foreshadow the features of the “classic” (western European) Neandertal.

Late *Homo* remains have also been found at Bilzingsleben in eastern Germany, along with a somewhat atypical assemblage of very small tools with much larger implements, all quite different from the typical Acheulian assemblage. In fact, Svoboda has argued that the many small tools found at Arago, Vértesszöllös, and Bilzingsleben developed out of adapting to cold, open landscapes and thus could be expected to be different from the tools used in more forested environments.⁷⁵

In general, tool technology, diet, site locations, and average group size in Europe about 200,000 years ago do not seem much different from those of several hundred thousand years earlier, but clearly, population densities were increasing, and as people moved into more diverse niches there was an increasing variety in the stone tools associated with them.

Until recently these various early European *Homo sapiens* were viewed as representatives of the changes that eventuated in us, *Homo sapiens sapiens*, but recent evidence raises many questions about this interpretation. A key element in interpreting these archaic *Homo* fossils is the Neandertals.

THE MIDDLE TO UPPER PALEOLITHIC PERIOD (C. 300,000–40,000 B.P.)

I held it truth, with him who sings
To one clear harp in divers tones,
That men may rise on stepping-stones
Of their dead selves to higher things.

*Alfred, Lord Tennyson, from
In Memoriam*⁷⁶

There are multiple ways in which *Homo sapiens* diverged physically and behaviorally from pre-sapiens forms of *Homo* in the period between about 300,000–40,000 years ago.⁷⁷

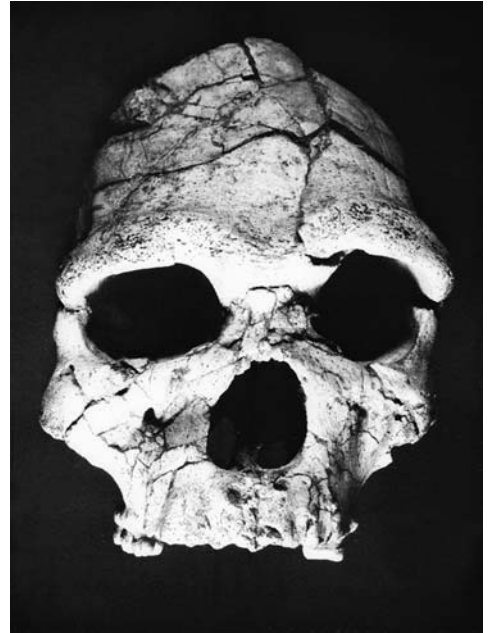


FIGURE 4.16 The Arago skull from France. This individual is now considered to be an early European Neandertal.

This is visible in many radical changes in human physical characteristics and material culture, including (1) an increase of average human brain size from about 1,100 to about 1,450 cm³ (although local variability was high, and the modern range of normal brain functioning is at least 1,000 to 2,000 cm³); (2) changes in physical form such that modern *Homo sapiens sapiens* have less robust skeletons, a more prominent chin, smaller or absent brow ridges, smaller teeth, a higher rounded skull, and other physical characteristics;⁷⁸ (3) increased human population numbers and densities—again with considerable local variation; (4) many technological innovations, including the atlatl (throwing stick), bone and wood tools of diverse types, and techniques for extracting a relatively great amount of cutting edge from a given amount of stone; (5) increased aesthetic expression in figurines, usually of bone or stone, beautiful wall paintings and rock carvings, burial techniques, and objects used for personal adornment; (6) a shift from generalized hunting patterns to concentrations in some areas on gregarious herd mammals like deer, reindeer, and horses; and (7) the appearance of artifact styles and trade in exotic items that bespeak the first manifestation of some sort of regional “ethnic” identity⁷⁹ that exceeds by a wide margin the local band society—in short, changes that may reflect the “total restructuring” of social relationships during the period from the Middle to Upper Paleolithic.⁸⁰

As noted earlier, the Total Replacement, African Origins, or Eve model contends that modern humans evolved first and only in Africa and only a few hundred thousand years ago or less, and then migrated to the rest of the world, displacing all other hominin forms, and with little or no genetic interchange with them. If this is true, then, as interesting as these many European and Asian fossils and sites of hundreds of thousands of years ago are, the people who left these remains had almost nothing to do with us in terms of our physical or cultural heritage.

This is a difficult premise for many anthropologists to accept because so much of what we think we know about human evolution has been based on sites such as Zhoukoudian in China, Toralba-Ambrona in Spain, and so on. If the African Origins model is correct, however, these sites were created by a form of human that has virtually nothing to do with us genetically, and probably little to do with us culturally.

Alternatively, the Multiregional Evolution, Continuity, or Candelabra models propose that sometime between about one and two million years ago a generic *Homo* ancestor of ours spread out across the warmer latitudes of Africa, the Middle East, Asia, and possibly the southernmost fringe of Europe; then, with the passage of the millennia, although these groups began to diverge somewhat as they adapted to local and different environments, across the whole range of *Homo* they were evolving toward *Homo sapiens* as a result of gene flow that connected all human groups to some extent and because they were all under similar evolutionary selective forces as generalized hunter-foragers, so that they all converged at about 30,000 years ago as one species, *Homo sapiens*—but with the physical differences that distinguish modern Europeans from, for example, modern Chinese.

For many archaeologists, one of the best test cases for resolving at least some aspects of the Total Replacement versus Multiregional Continuity ideas can be found in a relatively recent hominin group widely known to both archaeologists and the general public—the Neandertals. Our record of them is both abundant and long studied—Neandertals have provided one of the most numerous fossil bone assemblages for a hominin group, as well as more than 100 years of archaeological research on their sites.

The Neandertals

Nothing about the Neandertals seems simple. Evidence suggests they lived between about 130,000 and 30,000 years ago, but their precise period in history is difficult to define. Most of them seemed to have lived in Europe and western Asia, some as far east as central Asia and in much of the Middle East. The “Classic,” or western, Neandertals were different from us and from their contemporaries in Africa, east Asia, and Australia in various physical characteristics, but scholars disagree on the extent and significance of these differences. Some think the Neandertals could speak with about as much fluency as we do, others think the Neandertals did not have the mentality or vocal apparatus for normal human speech. Scholars disagree perhaps most heatedly about what “happened” to the Neandertals: That is, are we descendants of the Neandertals, or did they lose out in competition with our ancestors?

Because they belonged to the first pre-modern human identified, the Neandertals received much of the initial hostility to the concept of human evolution. From the beginning, anthropologists, clergy, and others held that the Neandertals were an aberrant stage in human development, not directly related to our own—presumably superior—ancestors. Some scholars, however, suspected that the Neandertals were the connecting link between *Homo erectus* and at least some populations of *Homo sapiens sapiens*. In 1957 a conference on the Neandertal produced evidence that Neandertal brain size on the average was larger than that of some modern human groups and that there were no grounds for concluding that their brains were structurally inferior or that they did not walk fully erect. In fact, it was suggested that “if he could be reincarnated and placed in a New York subway—provided that he were bathed, shaved, and dressed in modern clothing—it is doubtful he would attract any more attention than some of its other denizens.”⁸¹

Yet there are differences between ourselves and the Neandertals (Figure 4.17). The characteristics most frequently used to define them are (1) a receding or virtually absent chin; (2) large cheekbones and prominent brow ridges curving over the eye orbits and connecting across the bridge of the nose; (3) prognathism (protruding lower face); (4) a strong masticatory apparatus, including larger front teeth than are found in most modern human populations; (5) a short (average of perhaps 5 feet) but powerful stature, with thick and slightly curved long bones; and (6) a cranial capacity within the range of modern humans, though slightly larger on average for the classic “Western” type.

Erik Trinkaus has shown how the shapes and sizes of Neandertal teeth and heads vary in many obvious and also subtle ways from our own.⁸² He interprets the projecting mid-face of the Neandertals as a feature selected by natural selection in part “to facilitate the use of the anterior teeth as a vise.”⁸³ Neandertals would have had no problems with candied apples or corn on the cob, had they been available.

Based on their legs and lower bodies, Trinkaus suggested that the overall impression of Neandertal locomotor anatomy

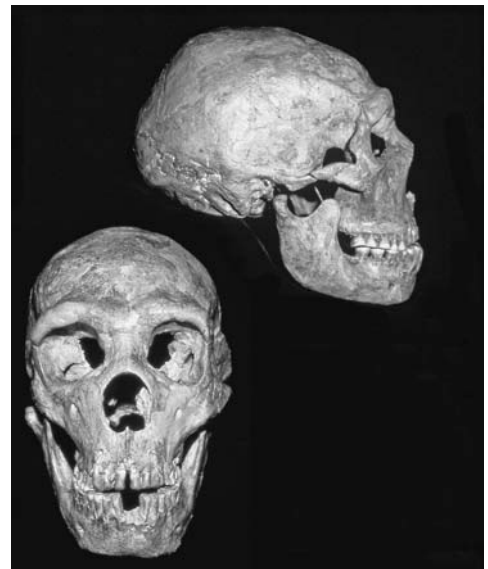


FIGURE 4.17 A Neandertal skull from Shanidar, Iraq.

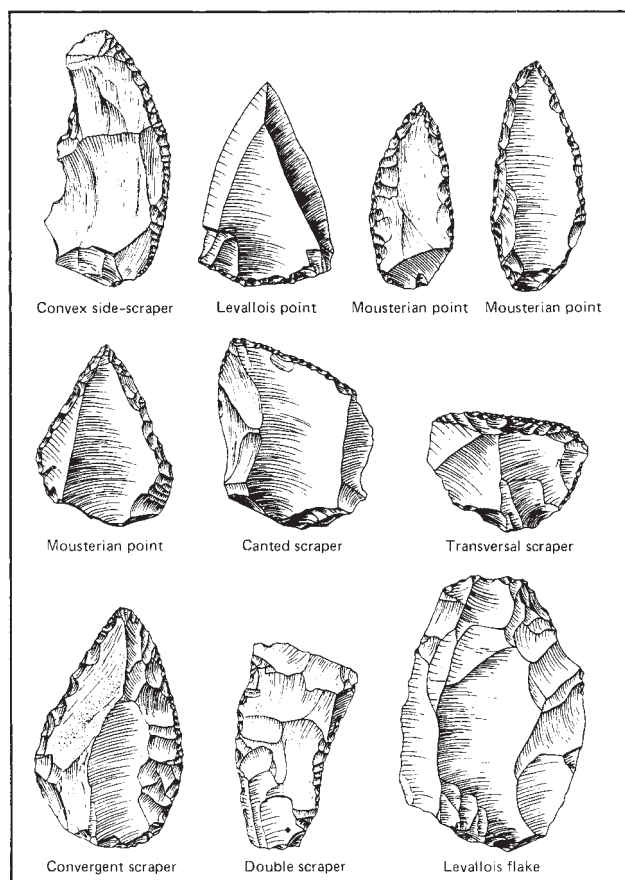


FIGURE 4.18 Some typical tool types of the Mousterian period. The Neandertals made effective stone tools for a variety of purposes.

is “one of great strength, as with the upper limb, but also one adapted for endurance for prolonged locomotion over irregular terrain.” Trinkaus concludes that the anatomy of their legs “suggests that they spent a significant portion of their waking hours moving across the landscape . . . far more than did early modern humans.”⁸⁴ The Neandertals would have been a bit short to be good offensive football linemen, but they would have made superstar wrestlers or baseball catchers, given their tremendous arm strength (though their ability to grip the ball might have been less than ours).

The Neandertals were adept stone tool-makers. Most of their tools belong to the Mousterian stone tool industry (named after the site of Le Moustier in southern France), which includes several distinctive stylistic and functional elements (Figure 4.18). The scores of Mousterian sites in the Dordogne region of southwestern France include cave sites, rock shelters, and “open-air” locations, and one of the largest and most complex Mousterian sites here is a cave in the Combe Grenal Valley, near the Dordogne River. Francois Bordes uncovered 64 superimposed occupational levels in this cave, spanning the period from about 85,000–45,000 years ago, with few long periods of abandonment. The lowest levels contained tools resembling the Acheulian tools found at Swanscombe, but all later levels had the classic Mousterian tools usually associated with

Neandertals. More than 19,000 Mousterian implements were collected and analyzed from this cave, and the tools from different levels contrast sharply. Some levels contained many small flake-like pieces of stone, while others had concentrations of scores of “toothed” or “denticulated” tools. Moreover, analysis of the different levels revealed that certain types of tools tended to be spatially associated with a number of other types. That is, levels containing a relatively high number of points would usually contain relatively large numbers of scrapers and flakes—but few denticulates.

This diversity of tools may seem relatively unimportant, but it was the focus of a long debate that involved issues fundamental to the development of the discipline of archaeology and to contemporary views of human origins. The specific case of the Mousterian tools became part of a larger question: How are we to measure and interpret variability in ancient artifacts? For the Mousterian tools, François Bordes spent years in excavation and analysis to establish a typology that has been the framework for much of the work done on this period. Bordes classified all Mousterian tools into four categories, based on the relative

frequencies of certain types.⁸⁵ Bordes considered various explanations of the diversity of Neandertal tools, such as that this variability reflected different time periods, climates, or seasons of the year. On the basis of the archaeological evidence, however, he rejected these possibilities and eventually concluded that the four different clusters of tools are the remains of four distinct cultural traditions, or “tribes,” which developed certain kinds of tool manufacture and retained these distinctive expressions over the 100,000 years of the Mousterian period. Bordes’s vision of the Mousterian was one in which different tribes of Neandertals wandered much of the Old World for generation after generation, through tens of thousands of years, each group maintaining its unique styles of tool manufacture and meeting the others infrequently and usually with hostility.

This vision was questioned by Lewis and Sally Binford, who assumed that Mousterian tool variability was largely a reflection of the different tasks Neandertals had to perform to meet successfully the demands of their environment.⁸⁶ They tried to test their interpretation by a statistical analysis of Mousterian tools from three widely separated sites: the Jabrud Rock Shelter near Damascus, Syria; Mugharet es-Shubbabiq Cave in Israel; and an “open-air” station near Houpeville, France. Each site contained several different levels, representing different occupations; the total number for all three sites was 16. Lithics from each site were classified in terms of Bordes’s system and statistically analyzed for evidence that these groups of tools were used for different economic activities, rather than simply representing stylistic traditions. Factor analysis was the statistical method used to determine which of the tool types were usually found in proximity to one another in the various levels of the different sites. On this basis they defined several different “tool kits,” whose presumed functions included tool preparation, wood-working, butchering, and various other tasks.

But the exact nature of Neandertal tool-making variability has remained a matter of dispute. A recent model proposed by Harold Dibble, for example, suggests that most of the variability in types of scrapers is the result of how often Neandertals resharpened these tools (Figure 4.19).⁸⁷ Imagine that you need a sharp-edged flake for some task. You strike an appropriate flake off a core and use it, but the edge dulls. To continued using the same piece, you resharpen (strike small flakes off) the dull edge. You now have a single-edge sidescraper (in the Bordian typology). You can continue to resharpen that same edge several times, or you can choose to use and then resharpen the opposite lateral side of the flake. Once you resharpen that second edge, you have a double sidescraper (in the Bordian typology). Dibble’s model thus proposes that much of the variability we see in Mousterian scrapers is simply the result of how a stone artifact is resharpened, rather than linking those scraper shapes to activities or different groups of Neandertals.

NEANDERTAL CULTURE AND SOCIETY

As if the slurs cast on Neandertal intelligence and posture by early archaeologists were not enough, some anthropologists

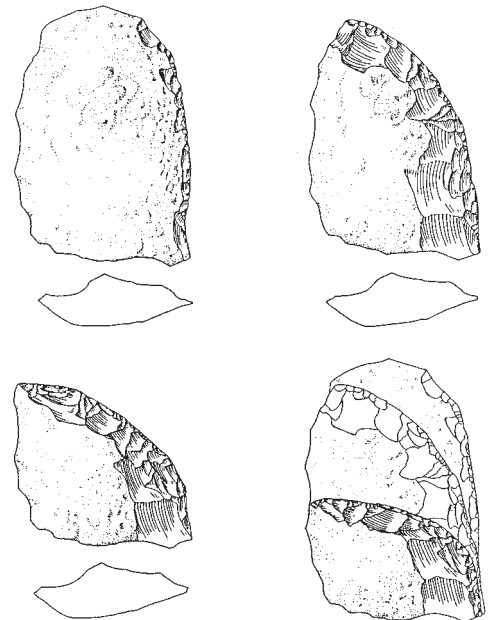


FIGURE 4.19 Dibble’s scraper reduction model shows how a single sidescraper is transformed into a transverse sidescraper simply through the process of resharpening the tool.

have questioned whether or not Neandertals were able to produce the range of sounds necessary for normal human speech. P. Lieberman and E. Crelin reconstructed the vocal apparatus of Neandertals using a computer simulation based on the measurement of a classic Neandertal, and using the vocal tracts of chimpanzees and human infants for comparison, they concluded that western European Neandertals would not have been able to make some vowels, such as *e*, and perhaps some labial and dental consonants, such as *b* and *d*.⁸⁸ Others doubt that the Neandertals could speak at all. Frayer and Wolpoff⁸⁹ challenge the old idea that the size and shape of the hyoid bone and other Neandertal anatomy are sufficiently different from that of modern humans to be used as evidence that the Neandertals had any less linguistic ability than we do. Lieberman⁹⁰ also has recently revised his earlier opinion about the speech of early hominins, contending that they likely did have language.

Archaeologists have long believed that, whatever their verbal fluency, the Neandertals were at least human enough to bury their dead. Excavations at La Chapelle-aux-Saints, in France, revealed a Neandertal corpse apparently laid out in a shallow trench, with a bison leg placed on his chest, and the trench filled in with bones, tools, and other debris—perhaps representing offerings of meat and implements. At La Ferrassie, France, a Neandertal “cemetery” was found, where a man, a woman, two children, and two infants seem to have been buried. A flat stone slab was on the man’s chest, the woman was in a flexed position, and, toward the back of the cave, the skull and skeleton of one of the children were buried in separate holes, about 1 m apart. At Teshik-Tash, in Siberia, a Neandertal child was buried in a grave with goat skulls whose horns seemingly had been jabbed into the ground. At Shanidar Cave in Iraq, the soil near a Neandertal’s body contained massive quantities of flower pollen. Ralph Solecki, the excavator, and Arlette Leroi-Gourhan, the palynologist, concluded that the skeleton had been buried with garlands of flowers.

But in these and other cases the evidence is at least somewhat equivocal. Even in the best of circumstances, archaeological excavation is a messy, ambiguous business of judging the significance of faint changes in the texture and color of sediments, and the Neandertal cave burials are notoriously difficult to excavate and interpret. Such caves have been homes not just to people but to hundreds of thousands of generations of cave bears, rodents, and other animals, and the natural processes of roof fall and sediment accumulation make for a confusing stratigraphic sequence. Thus, where one excavator may see a Neandertal carefully buried in a pit with a rock slab placed on his chest, another may observe evidence of a Neandertal who simply expired and was covered with rocks falling from the cave roof and by other debris. Thus some scholars see no evidence that any Neandertals were intentionally buried, while others believe that the Neandertals invested death with human-like emotion and ritual.⁹¹ Richard Klein, for example, suggests that the Neandertals did in fact bury their dead, but probably only as a matter of hygiene and without any or much ceremony.⁹² Lawrence Straus concludes⁹³ that Neandertal burial was a rare event, but he also makes the useful point that it is not at all clear than even *Homo sapiens sapiens* always buried their dead.

There is good evidence that Neandertals were not insensitive to the plight of the handicapped. Some Neandertals evidently suffered terribly from arthritis or had lost limbs and so could not have contributed much to the group’s food supply. Yet, they must have been supported by the rest of their society. Despite these touching displays of societal concern, there is also some evidence that Neandertals killed, butchered, and perhaps ate

one another. At Krapina in Yugoslavia, excavations revealed 20 Neandertals—men, women, and children—whose skulls and long bones had been smashed and split in suspicious ways. But Trinkaus and others question whether cannibalism was actually practiced.⁹⁴

All Neandertals were apparently hunters and gatherers, but they must have varied considerably throughout their range in the kinds of resources they exploited. The archaeological record is no doubt biased because most Neandertal sites found and excavated are those made evident by masses of animal bones associated with stone tools; the remains of plant foods and wooden tools, of course, do not preserve nearly so well and are not as easily found.

Neandertal population densities appear to have been low, and it is likely that most Neandertals lived with the same group of 25 or 50 people their whole lives, from time to time meeting other bands for mate exchanges. They were skilled hunters, locked into seasonal migrations with the animals they hunted, but in most habitats they probably foraged widely for eggs, birds, plants, and other small resources. They competed quite successfully with other predators for game, but must have occasionally lost out to the zoological carnival of horrors whose ranges they shared. Giant cave bears, saber-toothed cats, and wolves occasionally “selected out” an unfortunate Neandertal: “Some days you eat the bear, some days the bear eats you” was probably no empty cliché to them.

Trinkaus⁹⁵ examined 40 nearly complete Neandertal skeletons as well as bones from 166 other Neandertals, from both Europe and the Middle East, and compared their estimated age at death to the age at death for a variety of other groups, including ethnographically observed groups like the Yanomamö hunter-gatherers of South America and the !Kung Bushmen of southern Africa, as well as archaeologically retrieved skeletons from North America, Japan, Mexico, and elsewhere. Noting all the biases and other problems in estimating time of death and other factors, Trinkaus concluded that the Neandertals experienced relatively high “young adult mortality”⁹⁶—meaning that a higher percentage of Neandertals died during their young adult years than did in these other groups. Trinkaus suggests that these mortality patterns may be the result of various factors, including a relatively high level of adaptive stress. Almost all Neandertals would have been required to have a high degree of mobility, except infants in arms.

NEANDERTALS AND *HOMO SAPIENS SAPIENS*

William Golding, in his novel *The Inheritors*, imagined a world of the past in which peaceful, egalitarian, vegetarian Neandertals faced oblivion at the hands of villainous, meat-eating, beer-drinking *Homo sapiens sapiens*. This literary version of the Total Replacement model is studded with obvious symbolism intended to elevate this imaginary conflict into a statement about the human condition, but it is an interesting anthropological scenario as well, raising many questions. Throughout the ages, for example, humans have expressed a fine democratic and egalitarian spirit in few areas of life, but one of them—to some extent, at least—is in sexual congress: Wherever different “races” have coexisted, they have immediately and continually interbred. Did the Neandertals and other humans mate?

Such a question brings us back to the contrasting models of human origins. As these indicate, some scholars believe that no Neandertal genes are represented in contemporary human populations, while others think that some or even a lot of Neandertal genetic inheritance can be seen in contemporary European populations.



FIGURE 4.20 Overview of the Middle Paleolithic site of Qafzeh, Israel.

Who is right? We begin with the intriguing fact that the Neandertals entirely “disappeared” as a physical type sometime after about 30,000 years ago. No Neandertal bones have been found post-dating this time, and in some sites tool types widely believed to be associated with Neandertals are overlain with levels containing tools different in style. The Neandertals successfully lived over much of Europe and the Middle East for tens of thousands of years—why should they have vanished?

These and other ideas about the relationship of Neandertals to other early

Homo sapiens, and the relationship of both to ourselves, still cannot be tested systematically and conclusively against the archaeological record because there are so many gaps and biases in this record. But recent discoveries have at least given a sounder empirical basis for some of these debates about the Neandertals. A key site here is Qafzeh (Figure 4.20). Helene Valladas and her colleagues used thermoluminescence to date 20 burnt flint tools from Qafzeh, a cave near Nazareth, in Israel, in strata that contained the bones of a somewhat modern-looking *Homo sapiens*.⁹⁷ Other human remains have been found at Qafzeh, and electron spin resonance dating was done on some of these.⁹⁸ Various scholars have concluded on the basis of this analysis that a primitive form of modern humans lived here 92,000 years ago, and perhaps earlier—but at least 30,000 years before Neandertals inhabited this region. Valladas and her colleagues speculate that Neandertals came into the Middle East about 60,000 years ago, perhaps migrating into the Mediterranean areas as glaciers expanded during the Pleistocene. Thus, if modern humans evolved in Africa long before they reached Qafzeh, as the DNA evidence might suggest, then the Qafzeh region might have been a contact area between Neandertals and early modern humans—since the Neandertals lived all over Europe 125,000 years ago.

The Qafzeh dates raise many questions. There is no molecular biological or genetic evidence that modern people originated in the Middle East, so it is presumed that any early modern *Homo sapiens sapiens* in this area would have descended from Africans. As Erik Trinkaus noted, if early modern humans reached the Middle East 92,000 years ago, they must have lived there in some relationship to the Neandertals for tens of thousands of years, since Neandertal remains in the Middle East dating to the period between 60,000 and 36,000 are well documented.⁹⁹

The human remains from Qafzeh must be understood in the context of evidence from nearby sites, especially the cave sites of Skhul (early modern *Homo sapiens sapiens*), Tabun (Neandertal), and Kebara (Neandertal). New dates from human remains at Skhul suggest

some of the individuals may have lived there as early as 100,000 years ago, and other finds at Skhul and Tabun indicate repeated human occupations between about 60,000 and 40,000 years ago.

So, who were these people in the Levant between 100,000 and 40,000 years ago, and what do they have to do with us?

Advocates of the Total Replacement model see these remains as belonging to two different species, one (*Homo sapiens sapiens*) superior to the other (the Neandertals) and in the process of replacing them, not mating with them. These scholars see “modern” elements in the crania of some of these hominins and very little overlap between these Levantine modern humans and the Neandertals in important elements of the post-cranial skeleton, such as the length of the pubis. But other scholars see these humans as belonging to the same general population and exhibiting anatomical variation that is “less, often considerably less, than normally found in a modern city.”¹⁰⁰

If the replacement of other humans by *Homo sapiens sapiens* occurred after 50,000 years ago, however, then the earliest “modern” *Homo sapiens* at Qafzeh could have been members of a population of archaic humans who were also replaced.

Given these ambiguities of interpretations of anatomy, what about the tools? Even the staunchest advocates of the original versions of the Total Replacement model have difficulty seeing an intrusive culture in the Levantine artifacts. There seems to be great continuity in the kinds of tools made, the species of game hunted, and other aspects of culture.¹⁰¹

In some ways the eastern Mediterranean can be considered part of “Africa” during periods of the Pleistocene,¹⁰² given its proximity and similarities of climate and ecology. We might expect, then, these kinds of ambiguities in interpretations of what happened in the eastern Mediterranean. But what about Europe?

The major differences between Neandertals and ourselves are in head and face shapes and sizes, but the Neandertal skeleton, especially the limbs and hip bones, is also different in size and morphology from that of modern humans. The torsional strength of Neandertal leg bones, for example, is about twice that of moderns.¹⁰³ Tools may have had a role in changing the selective pressures on the teeth, but how could tools or any other factor have altered the skeletal parts?

We know that Neandertals had a lengthy evolutionary history in Europe, and some scholars have suggested that Neandertals became biologically adapted to resist the cold conditions of glacial Europe. This involved natural selection for features that gave Neandertals a reproductive advantage—“classic” western European Neandertals evolved their distinctive features as part of adapting to cold climates and had so little genetic connection to people living elsewhere in the world that they became distinctive.¹⁰⁴ Eventually, however, they were absorbed or displaced by more modern-looking humans. Other scholars, however, maintain that the fossils from central European Neandertals all exhibit morphological changes in the direction of modern hominins.¹⁰⁵

If the Neandertals were entirely replaced by modern *Homo sapiens sapiens* moving out of Africa, it is possible that this extinction involved a *social* transformation, not just some slight difference in tool-making ability or other skill. Olga Soffer, for example, argues¹⁰⁶ for the appearance of modern human family structure and the division of labor by sex. She suggests that sites left by Neandertals are small and do not show the clusters of distinct artifacts that we would expect if people in various age and sex groups were doing different tasks in an integrated extended family. Perhaps most important, she sees no

evidence of symbolic abilities, as might have been expressed in figurines, cave painting, or other media. In contrast, Soffer suggests that modern *Homo sapiens sapiens* left sites that show substantial evidence of a society in which there was a clear division of labor by sex, that they expressed themselves symbolically to a much greater degree, and, in general, developed the sense of *kinship* that one finds as the basic organizing principle of all known hunter-forager groups.

Determining the presence of a division of labor by sex or of kinship, of course, is very difficult given the types of cultural materials—mainly stone tools and animal bones at most sites—we normally recover from the archaeological record. Much debate about the Mousterian (Middle Paleolithic) and Upper Paleolithic in Europe has thus centered on the types of stone tools characteristic of each tradition, as well as the addition of organic technology, such as points made out of bone or antler, and personal ornamentation and symbolism.

Unlike the sequence of tools at, for example, Qafzeh (in Israel) and Zhoukoudian (in China), the European archaeological record *does* appear to show a relatively sudden change: At many sites levels of “Mousterian” tools dating to the period when Neandertals were here are overlain with occupational debris containing substantially different stone tools and other remains that may or may not be the products of *Homo sapiens sapiens*.¹⁰⁷ But does this reflect replacement of one group by another?

Much of the debate on this topic has to do with debates about stone-tool technologies. The *Aurignacian* tool kit (Figure 4.21) has been found all over Europe and into the Middle East in sites dated to between about 40,000 to 30,000 years ago (some dates are outside this range).¹⁰⁸ To the specialist, these Aurignacian tools look completely different from the Mousterian tools traditionally associated with Neandertals across this same area, Europe and the Middle East. Mousterian tools are primarily made of flakes, whereas Aurignacian tools include a lot of blades, bladelets, burins, and other distinctive tools. Often the people who made Mousterian tools and those who made the Aurignacian ones used the same sources of flint and they often hunted about the same range of animals, but

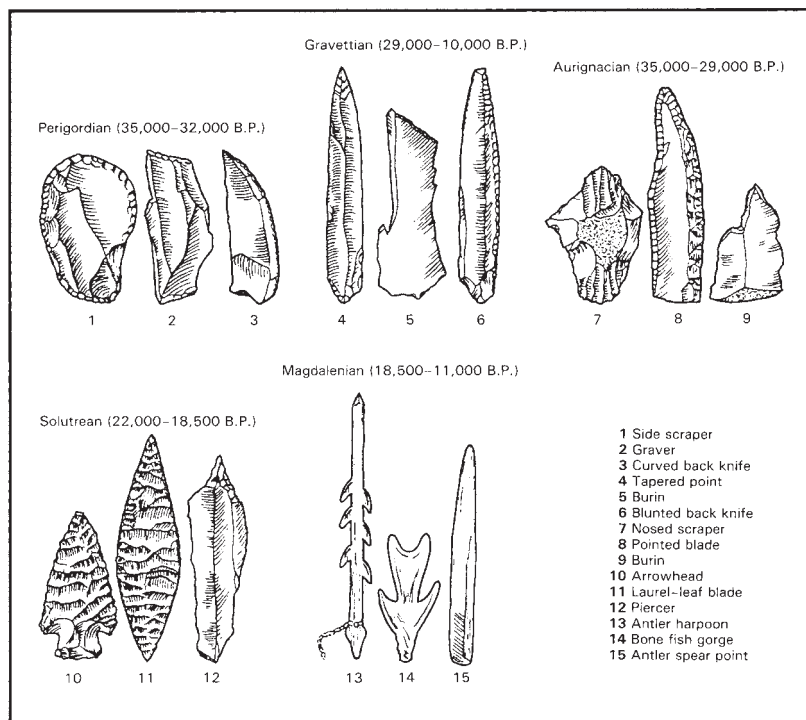


FIGURE 4.21 European tool kits, 35,000–11,000 years ago. The more diversified economies of the late Pleistocene are reflected in increasingly diverse tool kits compared to earlier periods (not drawn to scale).

these two stone-tool industries are made in very different ways and in radically different shapes. There is no evidence that the Mousterian tools were gradually developed into Aurignacian ones¹⁰⁹—in many sites Aurignacian assemblages lie directly on top of levels containing Mousterian tools. To some scholars, the lack of modern human fossils in western Europe at the time of the appearance of the Aurignacian leaves open the possibility that the earliest Aurignacian may be associated with Neandertals.

Recently, Straus's analysis of the results of intensely dating many Spanish Aurignacian sites with both radiocarbon and uranium-series dates, and comparing them with those from the Europe and the Middle East, revealed that “[f]ew if any other European Aurignacian assemblages have been reliably shown to be as old as the Spanish ones.”¹¹⁰ This pattern of dates may conflict with the idea that the Neandertals were driven into extinction by people who radiated out of Africa and abruptly replaced Neandertals by virtue of a superior technology—as might be represented by the Aurignacian tool kit. If that scenario were accurate, we would expect the Spanish Aurignacian sites to be the youngest, not the oldest, because presumably the modern *Homo sapiens sapiens* coming out of Africa arrived first in the Middle East, after which generations of their descendants and their descendants' descendants moved through eastern Europe, and only eventually into southwestern-most Europe, Spain. Alternatively, if people came out of Africa across the Straits of Gibraltar and arrived in Europe first in Spain, we would expect many Upper Paleolithic sites in southern Spain, and there are virtually none. As Straus notes, “[g]iven the present chronometric situation, it would be necessary for such a migration to have taken place virtually instantaneously to account for the Spanish dates. No possible migration patterns can be confidently reconstructed on the basis of the available chronometric dates for early Aurignacian sites.”¹¹¹

Another key site in these debates about the relationship of the Neandertals to ourselves is in France at Saint-Cesaire.¹¹² Human occupations here date to about 36,000 years ago—precisely the period when Neandertals were disappearing from the archaeological record. The problem is that, while the tools found at this site appear to be Upper Paleolithic in their stylistic and functional attributes, the human body found with them appears to be a Neandertal. As Trinkaus notes:

If the Chatelperronian industry was produced solely by Neandertals and all the Aurignacian assemblages were the products of early modern humans . . . then there must have been temporal overlap of these two human groups in western Europe. . . . Even if a direct biological-industrial association cannot be assumed, it is still evident that Neandertals were present in western Europe less than [35,000 years ago] and that early modern humans were present there by at least [30,000 years ago].¹¹³

The significance of this is that 5,000 years is a very short time for the physical changes observed between Neandertals and modern humans to have occurred. The oldest artifacts associated with modern humans in Europe belong to the Aurignacian period. The lowest levels in which Aurignacian-style tools were found at Abric Romaní, in Spain, yielded radiocarbon dates of about 37,000 years ago, but uranium series dates put this site at about 40,000 years ago, and it shows an “abrupt” replacement of earlier levels containing Mousterian remains.¹¹⁴

But other anthropologists suggest that the Neandertals were simply evolving into modern humans and that the association of Upper Paleolithic tools with the later forms of



FIGURE 4.22 The Largo Velho rock shelter in Portugal yielded a burial of a child that some researchers believe represents a “hybrid” between Neandertals and modern humans.

Neandertals is exactly what one would expect if this regional evolution process took place, even if there continued to be gene flow into Europe from outside. Fred Smith, for example, sees clear signs of reduction over time in the size of the brow-ridges of Neandertals at Krapina and Vindija in Yugoslavia, and at other central European sites.¹¹⁵ Trinkaus and Duarte¹¹⁶ have even suggested that the child buried at Largo Velho in Portugal (Figure 4.22) around 27,000 years ago is a hybrid between Neandertals and modern humans.

Some scholars have focused on stature and body proportions in debates about the relationship of Neandertals to us. The European Cro-Magnon after 30,000 years ago appears to have, on average, much longer limbs than did the Neandertals. Relatively long limbs are associated with adaptations to heat (as with the Dinka of East Africa today), whereas short limbs are associated with cold adaptation, such as in Eskimos and other north Asians. But it is difficult to make direct equations between stature and height, given that “culture,” in the form of clothes, fire, and so on, modify the direct effects of climate. Still, there are many puzzling bits of evidence. The tallest of the post-Neandertal Pleistocene Europeans seem to appear just before 20,000 years ago, in the coldest period of the Pleistocene, when we might have expected natural selection to favor a shorter, stockier body type; and then later, in warmer periods, stature seems to have declined—again, the opposite of what we might expect.¹¹⁷ Stature is so

directly related to diet and other factors, however, that we should not expect to see a clear correlation between it and temperature in every case—except in the long term, and even then the relationship is likely to be modified by migrations, differences in technology and economy, and other factors.

Models of Modern Human Origins: Summary The most recent academic debates about models of modern human origins reveal profoundly different conclusions, with scholars disputing everything from the size and shape of particular characteristics of specific fossil skulls to the nature of basic evolutionary processes. Some see the Neandertals as an archaic form of human who made no significant contribution to ourselves,¹¹⁸ some believe that modern Europeans represent an admixture of African and Neandertal genes,¹¹⁹ and some see evidence in the Neandertal fossil record of an evolution toward modern humans and believe that the Neandertals became the modern humans of Europe through regional evolution and genic exchange with other populations outside Europe.¹²⁰

It may be that these disputes are never resolved to everyone's satisfaction on the basis of evidence. For many, however, the recent genetic studies of Neandertal samples from Europe¹²¹ are the final "nail in the coffin" for Neandertals as ancestors to modern humans. The mtDNA differences between Neandertals and modern humans shown in these studies would simply seem to be too numerous for Neandertals to be anything other than extremely distant "cousins" who suffered the fate of many animal species throughout time—extinction.

One thing is absolutely certain. No one in the past 25,000 years has experienced the wonder of encountering a hominin in the landscape who is not us—*Homo sapiens sapiens*.

Life, Art, and Ritual in the Upper Paleolithic

Writing about art is like dancing about architecture.—Anonymous

In 1868, near the Spanish port of Santander, so the story goes, a hunter's dog fell into a crevice in some boulders, and in rescuing the animal the hunter moved some rocks, revealing the opening of a cave. The owner of the land on which the cave (known as Altamira) was located, a Spanish nobleman and amateur archaeologist, eventually began to excavate the cave floor. He found some stone artifacts, but, according to the story, was unaware of the paintings in the cave until his 12-year-old daughter visited the site and glanced at the ceiling. In the glow of her lantern she saw beautiful visions of animals. The central painting is of a group of about 25 animals, mainly bison, with a few horses, deer, wolves, and boars (Figure 4.23). Roughly life-size, these paintings were done in rich browns, yellows, reds, and blacks, and the natural configuration of the cave ceiling had been used to emphasize the shape of the animals. The rounded haunch of a bison, for example, was painted over a natural bulge in the stone ceiling, creating a three-dimensional effect.¹²²

Scholarly reception to the Altamira discoveries was almost uniformly negative. Some respected prehistorians even hinted that Don Marcelino, their discoverer, had hired an art student to fake these paintings, while another scholar dismissed them as simply the expression "of a mediocre student of the modern school." So abused by critics was the Don that eventually he padlocked the cave, and he died in 1888 without having seen his discoveries accepted as true Paleolithic expressions. Years later, when many more paintings and other art works had been discovered, Altamira's antiquity was finally acknowledged, and most of these paintings are now given dates between about 17,000 and 12,000 years ago. Analysis shows that the colors were produced by mixing natural mineral pigments, such as ocher and manganese dioxide, with a binder (blood, urine, vegetable juice, or something similar), and that they were either brushed on with an implement made of animal hair or applied by making a kind of crayon from the pigments and lubricant. Some painting may also have been done by using a pipe to blow the powdered pigments on a surface prepared with animal fat. Many of these paintings were executed in the dark



FIGURE 4.23 A bison painted on the ceiling at Altamira, Spain.

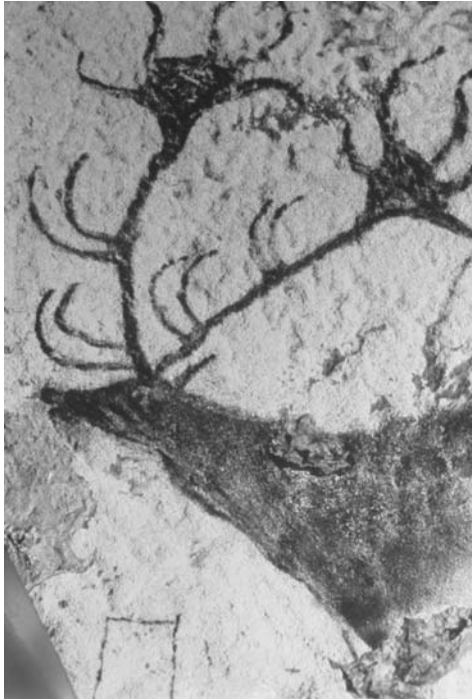


FIGURE 4.24 A painted reindeer from Lascaux, France.

recesses of caves, by light provided by lamps made of stone bowls filled with animal fat, with a wick made of lichens, grass, or juniper.¹²³

During World War II, paintings on a scale comparable to those of Altamira were discovered at Lascaux Cave, in France. Researchers estimate that the Lascaux paintings date to about 17,000 years ago, but were done on many different occasions and perhaps over a much longer span. Many varieties of animals are depicted here, including some one hopes were imaginary. The animals are often painted as if they are in motion, and the general effect is very impressive (Figure 4.24). One of the many curious things about these and other Upper Paleolithic cave paintings is that while the animals are depicted in very real, very representational terms, the figures of humans are either simple stick drawings or else weird half-humans, half-animals.

The most stunning recent discovery has been the cave chambers at Chauvet in the Ardèche Valley of southern France, found by three spelunkers in 1994.¹²⁴ The wealth of images include both animals commonly shown in cave art—horses, bison, mammoth, and aurochs (an extinct form of wild cattle)—as well as those that are less frequently depicted in the other cave art sites—musk ox, leopard, cave bear, cave lion, rhinoceros, and an owl (Figure 4.25). Incredibly, Chauvet Cave is also the oldest of the cave art sites, dating to about 32,400 years ago—it is some 15,000 years older than the cave art at Lascaux and Altamira.



FIGURE 4.25 An engraved horse from Chauvet Cave, France.

We must accept at the onset that we can never really know the thoughts of these long-dead Paleolithic artists. The same might be said of Vincent Van Gogh or any other artist, of course, given that aesthetic expressions can never be fully, rationally comprehended, even by the artist. But neither Van Gogh's work nor Paleolithic art can be expected to be random with regard to theme, technique, or style. Art can be expected to tell us something about the artist. And in any case, there is something profoundly unsatisfying about analyses of ancient peoples based only on stone

tools, hut foundations, and other techno-environmental residues. Most people, including archaeologists, wish to know the “minds” of ancient peoples, and in few ways do these seem so accessible as in their art.

People apply the term Paleolithic art to a great range of materials, including cave paintings, rock carvings, sculpted and carved animal bones, ivory statuettes, and baked clay objects. As Margaret Conkey noted,¹²⁵ one should probably not imagine that all these expressions were fundamentally aesthetic in nature, in the sense that we think of aesthetics as removed from economic function. An early interpretation of the great cave paintings was that they were expressions of sympathetic magic, done to ensure success in hunting and other activities. By picturing animals with spears stuck in them or caught in traps, Upper Paleolithic people may have thought they increased their chances of killing and trapping these animals. Many of the paintings are in small, hidden passages where working conditions were very cramped, suggesting that these pictures were not created for the pleasure of the general viewing public. Then again, many paintings are superimposed on one, two, or even more older ones, indicating perhaps that these efforts were ritual in nature, not simply artistic. In fact, the most common themes of these Upper Paleolithic artists were food and sex, with food receiving most of the attention.

These interpretations of Paleolithic art were challenged by Andre Leroi-Gourhan, who plotted the relative frequencies of lions, mammoths, bison, reindeer, and other animals in caves with many such representations; he concluded that these paintings were invested with cosmological significance—reflecting in various ways the patterns in which Paleolithic peoples ordered their world.¹²⁶

The disemboweled bulls, prancing deer, and other hunting scenes, plus the popularity of the penis and vulva motifs, suggest to some that these earliest of Spanish and French impressionists were men. But Elizabeth Fisher has argued that students of cave art have concealed the high frequency of female sex organs represented and thus the implication that many of the artists were probably women.¹²⁷ Line markings that some archaeologists have considered calendrical devices, Fisher thinks may be records of menstrual periods.

In recent years various alternative explanations of Paleolithic art have been suggested (Figure 4.26). Lewis-Williams and Dowson have argued that much of Paleolithic art was the product of people in “entopic,” or altered, states of consciousness—either through drugs or meditation.¹²⁸ They note that ethnographic studies of contemporary hunter-gatherers show wide use of hallucinogens, trances, and such altered states to produce paintings and carvings. They also argue that it seems a feature of human neuroanatomy that images perceived in altered states of consciousness include both “real” representational forms and fantastic nonrepresentational forms and that people tend to project these images on walls and ceilings in their minds. Thus, “Tracing projected


















		SAN	COSO	PALAEOLITHIC
STAGE 1 ENTOPTICS	I			
	II			
	III			
STAGE 2 CONTRUAL	IV			
	STAGE 3 ENTOPTICS AND ICONICS	V		
VI				

FIGURE 4.26 Entopic forms are images seen during trances and other states of altered consciousness. They are a widespread phenomenon among modern human groups and have been suggested as an explanation for some of the engraved and painted Upper Paleolithic images.

mental images with a finger in the sand or on the soft wall of a cave to experience them more fully would have ‘fixed’ them and would have been an initial step in the history of art. They were merely touching them and marking *what was already there*.¹²⁹

The study of Paleolithic visual imagery and art is a demonstration of a point made well by Hodder, that archaeology is not necessarily a neutral discipline in which analyses are scientific and culture-free.¹³⁰ Paleolithic art has often been a “Rorschach test,” in the sense that modern-day observers have tried to read into it the mind and spirit of primitive humans, but they perhaps have learned more about their own psyches than about the primitives’. In any case, as Conkey notes, “‘paleolithic art’ [is] an extremely diverse and abundant repertoire of material culture that cannot be accounted for by any inclusive umbrella except perhaps as ‘cultural.’”¹³¹

HUMAN COLONIZATION OF THE WORLD: CIRCA 30,000–10,000 YEARS AGO

One main factor in the upward trend of animal life has been the power of wandering.

Alfred North Whitehead

Unless the earth is truly different from every other known celestial body, any humans left on this lovely green-blue world in a few billion years will be converted to their component atoms—along with the pyramids of Egypt, the Great Wall of China, and all other human artifacts and natural features—and vaporized in a supernova such that they will spend eternity as elements of a timeless universe.

Given our human history, however, we can anticipate that our descendants will have long since colonized other worlds when that fateful day comes. However tenuous our links to these distant successors may become, some portion of “us” may reverberate through

space and time until the universe once again collapses on itself.

Thus, “in our beginning is our end,” perhaps. For our ancestors have always wandered, always colonized. Generation after generation, they left Africa, probed Europe and Asia, settled the Americas, Australia, the farthest ends of the planet (Figure 4.27). Many of the readers of this book can expect to see human colonies on the moon and perhaps beyond in their lifetimes. Exponential functions are impressive aspects of our universe. In time a single mutated virus turns into uncountable billions and

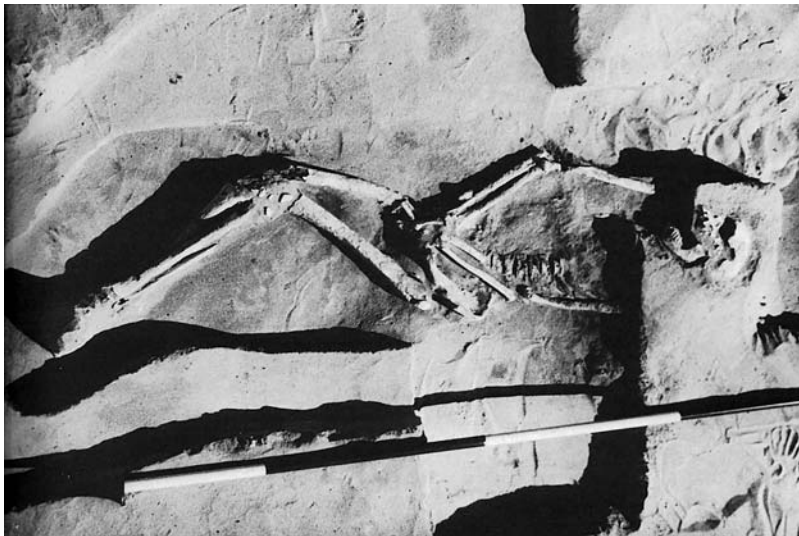


FIGURE 4.27 An early burial at Lake Mungo, Australia.

disperses throughout a system. We may not like the analogy, but we may “infect” the universe in the same way.

All this may seem far from the sturdy human hunter-foragers of the past hundred thousand years, but we are linked to them by the long-term growth functions of which we are all a part.

In various chapters of this book the focus is a major question about a particular human development: Why did culture evolve, how did *Homo sapiens sapiens* emerge as the only remaining hominins? If we ask “why” they colonized the world, we are left with the “because it’s there” kind of answer Sir Edmund Hillary gave when asked why he climbed Mt. Everest. Simple demographic models suggest that any population will colonize appropriate environments through growth and migration, and our own ancestors’ travels seem adequately “explained” by such formulations. But it is also hard to deny a human “instinct” for travel, an inherent desire to see what’s beyond the next hill or valley. Also, as we have noted previously, maintaining genetic variability through genic exchange confers great advantages in terms of long-term survival.

If there is in fact an instinctive human urge to travel, it would be “adaptive” in an evolutionary sense, for long-term evolutionary success comes with dispersal and variation. Our ancestors accomplished both: They penetrated almost all of the world before the end of the Pleistocene, and although they remained a single species, they developed great variety in their physical forms and cultural adaptations.

On the one hand, the superficial variations our ancestors acquired as they colonized the world are the most trivial in all of human evolution; on the other hand, these differences of skin color, facial features, and other characteristics, and the cultural differences that accompanied them, are of the greatest socioeconomic and political importance in today’s world—for human variations are inextricably linked to the idea of “race.” Despite the rejection of this concept by many scholars, the concept of “race” is likely to remain with us until gene flow is sufficient that obvious differences in physical appearance all but disappear. Most anthropologists do not like the concept of “race” because, aside from the negative social problems associated with it, the characteristics used by most people to define race appear to be superficial, to be crude typologies imposed on a multidimensional underlying variability, and to be poorly correlated in some ways with underlying genetic relationships of various groups.¹³² “Black” skin tones, for example, are shared by Australian Aborigines and west Africans—two groups of people whose degree of genetic relatedness may be much less than that between west Africans and Scandinavians. Physical features such as skin tones, degree of hair follicle “curl,” nose shape and eyelid shape, and so on, tend to fall on geographic clines—that is, they exhibit variation over space and through time that is continuous, not discrete. And often variations within groups (*polymorphism*) is greater than that between groups (*polytypy*).¹³³

For good or ill, however, the migrations and radiations of our ancestors over the past 30,000 years have produced or continued group differences that remain an important part of today’s cultural world.¹³⁴

The World at 30,000 Years Ago

Soon after 30,000 years ago the world was inhabited by only one human species, *Homo sapiens sapiens*—ourselves—and our ancestors had penetrated almost every environment of the Old World, and perhaps the New World as well (see chapter 5). Across this great

expanse people had developed a great diversity of tools, in stone, bone, and other materials, much of which has probably long since disappeared from the archaeological record. The evidence of fish hooks and barbed spear-points suggests that many people had finally added fish to their diet—a seemingly obvious choice, but one that does not appear to have been made by many people until after 20,000 years ago. In many environments fish can greatly supplement other foods and thereby support much greater human populations with considerable reliability. Other technological advances, such as the atlatl, or throwing stick, probably also greatly extended the hunting prowess of many groups, and exploitation of plant foods was probably also rapidly improving in efficiency.

Late Pleistocene Climates and Geography

If we were ever fortunate enough to find people of about 30,000 years ago well-preserved in some glacier, we would probably see few differences between them and us. Over much of the world human teeth have become smaller during the past 30,000 years and some subtle changes in other aspects of our form and physiology have occurred, but not much else about us physically is different from the people of 30,000 years ago. Human brain size was slightly larger for some of the people at that time, but it is unlikely that they were of a fundamentally different mentality.

By 30,000 years ago people were living in almost every part of the Old World, and in Australia; their arrival in the Americas was certainly before 15,000 years ago, but the evidence for earlier occupations (see chapter 5) is controversial.

Oscillating sea levels had some role in this dispersal, since in some periods land bridges allowed people to walk from Southeast Asia to many areas that are now Indonesian islands, such as Java, Sumatra, and Borneo. Rising sea levels may also have forced people into migrations, even though the rates at which these levels rose were likely slow enough that no single individual had a personal sense of them. Thiel argues that people on islands in danger of being submerged by rising waters made the colonizing trips to Australia 50,000 or more years ago.¹³⁵ Elsewhere, people had to abandon many other low-lying areas, such as the shores of the eastern Mediterranean and the broad plains that now lie under the English Channel.

These climatic alterations and ensuing changes in geography and ecology can be thought of as giant engines, acting to mix and move human populations, offering adaptational challenges that elicited human ingenuity in various forms. But people were never simple passive victims of climatic and ecological happenstance: Humans not only developed the technology to make a living in the vast span of the world but also evolved the social systems that were an indispensable part of this adaptation.

Late Pleistocene Europeans

Between about 30,000 and 19,000 years ago, European climates began a long cooling trend, with some periods of extreme cold, but for most of the period the summers were cool and the winters relatively mild. The rich European grasslands and mixed forest habitats supported great numbers of herbivores, including reindeer, deer, bison, wild ox, ibex, woolly rhinoceros, and mammoths. France seems to have been densely occupied during this period, particularly near the confluence of the Dordogne and Vezere rivers

(Figure 4.28). This lovely part of the world is a well-watered, heavily forested limestone formation, honeycombed with caves and rock shelters, which offered excellent places to live. Mammoths, horses, and many other animals were hunted by these Upper Paleolithic peoples, but the reindeer was the staff of life: At many sites 99 percent of all the animal bones found belonged to reindeer; reindeer hides provided clothing and coverings for shelters; reindeer antlers were the hammers used to produce the long elegant blades for which these people are justly famous; and reindeer bone was the raw material for fish gorges, needles, awls, and other important tools.

Reindeer travel long distances each year as they follow the grazing lands from one climatic zone to another. Thus, through the reindeer herds Upper Paleolithic peoples of southern France could exploit land they had never seen; the reindeer would browse their way to the far north each year and then return to southern France for the winter, at which time they could be harvested.

Average human group size may have been relatively large during the Upper Paleolithic in Europe, the Middle East, and other areas because of the requirements of hunting large gregarious mammals such as reindeer, bison, horses, and wild cattle. With some of these species, an efficient hunting technique is the drive, where many people work together to stampede a herd over a cliff or into a bog. Such mass slaughter also requires many people to process the carcasses, and a large group would also have been advantageous in these circumstances as a means of defending particularly favorable places along the animals' migration routes.

The overall population also increased in some parts of Europe—and probably much of Eurasia—during the last millennia of the Pleistocene. Several factors were probably important in this population growth. The stone-tool technology of this period, with its indirect percussion and pressure techniques, was vastly more efficient than previous industries. Spear throwers, or atlatls, were also in common use—a very significant innovation considering the heavy reliance on big game, since an atlatl can increase the range of a short spear from about 60 m, if thrown by hand, to about 150 m (Figure 4.29). Eventually, the bow and arrow also added significantly to hunting effectiveness. Some of the earliest evidence of bows and arrows comes from the Stellmoor site, near Hamburg, Germany, where about a hundred wooden arrows dating to approximately 10,000 years ago were recovered. But the bow-arrow combination was probably invented independently and



FIGURE 4.28 The Les Eyzies region of southern France is known for its concentration of Upper Paleolithic cave and rock shelter sites, including many famous cave art sites.

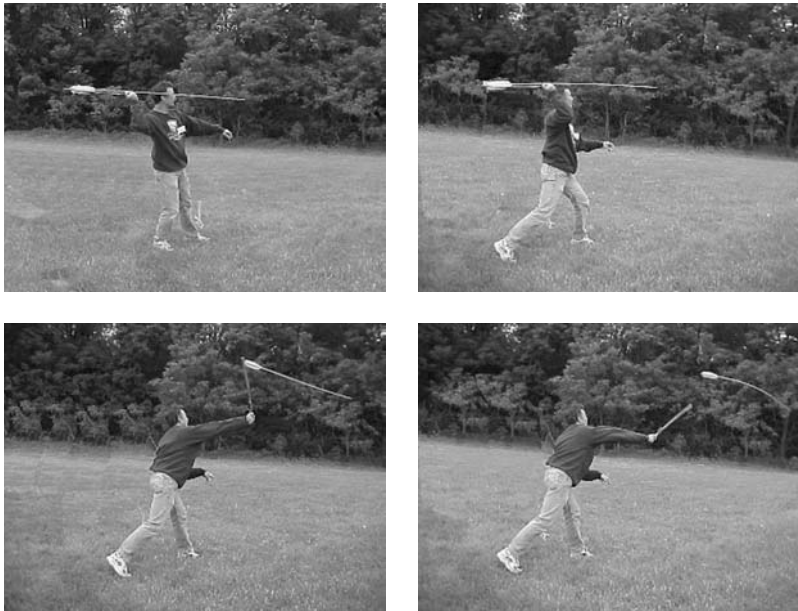


FIGURE 4.29 The atlatl, or spearthrower, was an important new technology in the Upper Paleolithic. Here, John Whittaker of Grinnell College demonstrates how an atlatl is used.

perhaps long before 10,000 years ago, if small stone tools called microliths were used as arrowheads.

Life in the Upper Paleolithic was somewhat more severe than one might imagine. From a sample of 76 Upper Paleolithic skeletons drawn from sites in Europe and Asia, Vallois found that less than half of these individuals had reached the age of 21, that only 12 percent were over 40, and that not a single female had reached the age of 30.¹³⁶ In fact, the distribution of ages and sexes represented by these skeletons was not significantly different from what one might expect from a comparable sample of Neandertals.¹³⁷ But even worse, many skeletons evidenced rickets, malnutrition,

and other diseases and deformities. Not content with nature's provisions for population control, Upper Paleolithic peoples seem also to have occasionally slaughtered each other. At the site of Sandalja II (12,000 B.P.), near Pula, Yugoslavia, for example, the skeletal remains of 29 people were found in a smashed and splintered condition. Elsewhere, there is unmistakable evidence of wounds from arrows and spears.

By about 14,000 years ago, the people of western Europe had developed fish traps to harvest the countless salmon that migrated up the rivers there each year. This relatively late exploitation of fish in Europe has a parallel in prehistoric southeastern North America, where Native Americans lived for thousands of years subsisting primarily on deer, mussels, and a variety of plant foods, almost totally ignoring the myriad fish in nearby lakes and streams. If salmon were present in great numbers in European rivers during the Mousterian and early Upper Paleolithic, their exploitation may have been blocked by the terms of human adaptation to reindeer and other animals. Reindeer and other game would have been a more dependable resource for humans, in the sense that at least some of these animals would have been available year-round, while the salmon would have been sharply seasonal. Salmon runs, in fact, might have conflicted with the scheduling of reindeer hunting, and as a consequence these peoples may have been far from the river, exploiting different resources, at the time the salmon were most available. Perhaps even more important, the successful exploitation of salmon would have required technological readaptation on a major scale. Catching salmon one by one would not have been especially productive: Their real utility probably came only after nets, fish weirs, drying racks, smoking racks, and other largely nonportable technology came into common use.

The slow growth of worldwide human population density through most of the Pleistocene would seem to suggest that Upper Paleolithic populations were not in any sense “driven” by population pressures to exploit new resources, such as reindeer and salmon. Rather, it seems the reverse: As people began to devise ways to exploit rich salmon streams, reindeer herds, and other resources, larger groups could be supported. And just a slight increase in fertility or the number of offspring who lived on the average to reproductive age would in the long run produce vastly greater population densities.

And it was not just in France and the ecologically richer parts of Europe that populations were growing in the late Pleistocene. Olga Soffer has documented, for example, the ingenuity of generations of peoples as they adapted to the harsh winters of the central Russian Plain.¹³⁸ One of the most amply documented Upper Paleolithic cultures in eastern Europe is the Kostenki-Bershevo culture centered in the Don River Valley, about 470 km southeast of Moscow. About 25,000–11,000 years ago, the Kostenki-Bershevo area was an open grassland environment, with no rock shelters, caves, or other natural habitations, and with very little wood available for fires. People here left a variety of archaeological sites, including base camps, where pithouses were constructed by digging a pit a meter or so deep, ringing the excavation with mammoth bones or tusks, and then draping hides over these supports (Figure 4.30). The savage winters of Pleistocene Russia must have required constantly burning fires, and the great quantities of bone ash found at these sites indicate that these fires were often fed with mammoth bones in lieu of very scarce wood. Some excavated pithouses were relatively large, with many hearths, suggesting that several families may have passed the winter together. The people of Kostenki subsisted primarily through big-game hunting, mainly of herd animals such as horses, with an occasional mammoth, wild cow, or reindeer. Numerous wolf and fox bones at these sites probably reflect the hunting of these animals for their fur for clothing. Like their Upper Paleolithic counterparts elsewhere, the Kostenki people manufactured a variety of decorative items, including “Venus” figurines (representations of women, usually with exaggerated secondary sexual characteristics) (Figure 4.31).

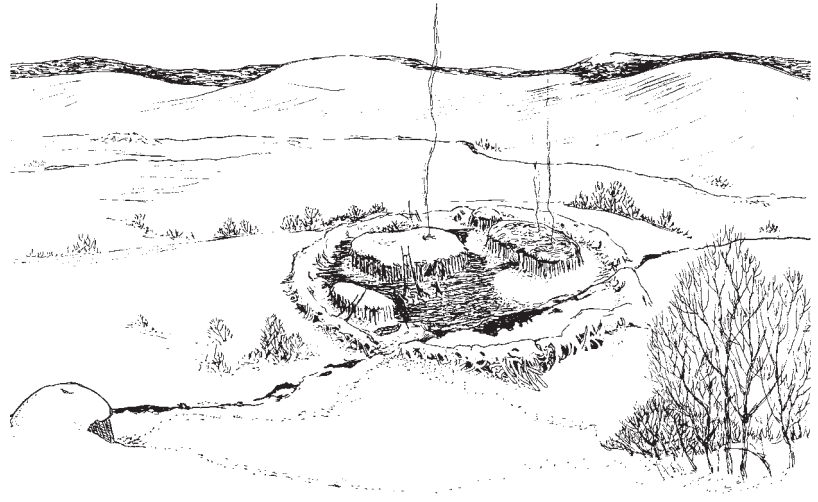


FIGURE 4.30 The reconstruction of a 27,000-year-old settlement at Dolni Vestonice illustrates how people used shelters to colonize the frigid plains of eastern Europe.

Late Pleistocene Asians

Until recently, few Upper Paleolithic sites were known in East Asia. Excavations at Zhoukoudian revealed levels dating to about 10,000 years ago containing approximately

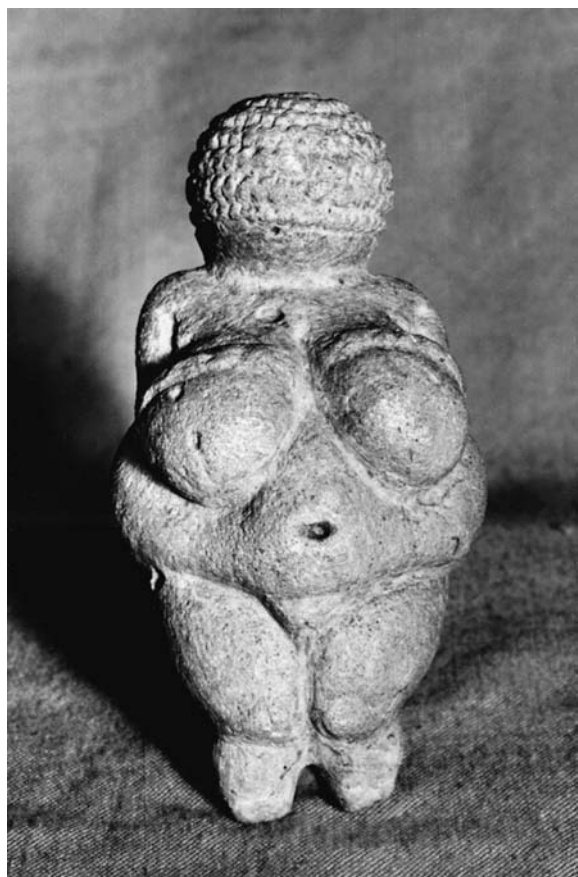


FIGURE 4.31 Cast of Venus figurine from Willendorf, Austria. These figurines are widespread across much of Europe during the Gravettian Upper Paleolithic period, suggesting a shared belief system.

seven individuals—all of whom had been killed, but apparently not eaten. One individual had clearly died from an arrow or small spear wound to the skull, and another had been beaten about the head with a large stone. Elsewhere, two skulls have been retrieved from Wadjak, in central Java, but dating these has proved difficult.

Hundreds of late Pleistocene sites have been found in Japan. Dating these sites is difficult, but the classic European Upper Paleolithic blade and burin industries are well represented in Japan, particularly in the northern areas across from Siberia.

The earliest known stone tools from Southeast Asia may be those of the Sonviiian assemblage from northern Vietnam, dating to about 23,000 B.P.,¹³⁹ but the Hoabinhian lithics of about 12,000 years ago are the earliest *widespread* Upper Paleolithic lithic industry in this area.

One of the most intriguing problems in Asian prehistory is the initial colonization of Australia. One has to imagine that people who were living in a world in which the Neandertals still had 15,000 years of domination of Europe somehow managed to float or sail. The geology seems to admit no other possibilities, because even with the most extreme estimates of the extent to which Pleistocene glaciers lowered worldwide sea levels, people could not have got to Australia except over some very deep water. Nor is swimming a realistic possibility. Probably thousands of coastal fisherfolk were washed out to sea and drowned in many millennia of typhoons and floods, before some fortunate castaways finally made it to Australia.

In any case, between 60,000 and 45,000 years ago, the ancestors of the Australian Aborigines somehow managed to cross about 65 km of open ocean to reach Australia. And while it is possible that an occasional boat of fisherfolk was shipwrecked on the New Guinea–Australia coast, computer simulations that take into account normal fertility rates and the genetic diversity of modern populations suggest that more than just a boatload or two of colonists founded that area’s present aboriginal population.¹⁴⁰ Two distinct groups of ancient people have been found there,¹⁴¹ which some scholars believe indicate colonization by two different groups, one a more gracile type, by 50,000 years ago, the other a more robust people, before 20,000 years ago. Like their contemporaries in America, the late Pleistocene Australians lived at a time when many large and small animal species were becoming extinct, and their possible role in this extinction pattern remains a matter of controversy.

The Australian Aborigines offer a wonderful subject for meditations on the nature of humanity. Consider: These people lived in what may have been nearly complete isolation

for more than 40,000 years in an ecologically diverse continent, and when first encountered by Europeans in the seventeenth century, their technology hardly approached the sophistication of the Neandertals: just simple stone tools and rudimentary wooden implements. Yet they evolved a kinship system and cosmology that most non-Aborigines can only apprehend dimly after many years of study.

SUMMARY AND CONCLUSIONS

We began this chapter with humans of about 1.5 million years ago spread out along the warm margins of Africa and Asia, making a reasonable living with little more than crude stone tools, intellectual abilities far poorer than our own, and probably only the rudiments of human social organization. We end this chapter, in effect, with ourselves, in the form of our late Pleistocene relatives of just 30,000 years ago. As to what happened in this period of a million and a half years, we have a lot of data, but not enough to describe with certainty some of the most important evolutionary patterns and dynamics. Every year anthropologists meet in conferences around the world to discuss their research, and this year, like last year and every previous year, they will debate the origins of modern humans. Like this chapter, these debates will end with no real resolution. Some anthropologists are convinced that one or another of these models of human origins is accurate, but no one really knows. Even with a tenfold increase in finds of relevant human fossils, these debates would likely continue for years to come. If Richard Klein is correct,¹⁴² for example, the origins of modern humans may have arisen directly from a single mutation, perhaps in a single individual, that allowed one group of East Africans to conceptualize time, space, and human possibilities in a way superior to that of all other humans. Such a mutation could have occurred and left no trace in fragmentary crania. If Frayer, Wolpoff, Thorne, Smith, and Pope—all advocates of multiregional continuity in human evolution—are correct, they apparently will need much additional data to convince their colleagues.

Yet, as noted earlier, it is not necessarily pointless to review evidence and arguments in unresolved debates. In these conflicting ideas about the nature and history of our origins we can see how “science” operates and we can get a sense of the significance of these intellectual problems. Currently, hardly a day passes without the announcement of some new breakthrough in identifying the genetic basis for some aspect of the human condition, from our personalities to our susceptibility to disease. To the extent that we are expressions of our genes, our history and fate, then, are in the selective forces of the past hundreds of thousands of years. These forces and these genetic patterns are, of course, the basic data in these debates about modern human origins.

Given the pace of genetic research, it is not impossible that we will eventually be able to re-create a Neandertal, but until we do and then give him or her the SATs, we will not be able to resolve arguments conclusively about just who these people were, what they were capable of, and how they relate to us.

In searching for causes of the increasing brain size and other changes that took place between 400,000 and 30,000 years ago, we might note that rates of evolutionary change frequently seem to be higher along the margins of a species’ range. This may have been the case with *Homo*, as bands of these hominins probed far into England, northern Europe,

and perhaps northern Eurasia, and began to specialize in various forms of hunting, scavenging, and gathering. The Swanscombe and Steinheim individuals, with their nearly modern brain size, may be reflections of these developments along the northern periphery. Gene flow in most hunting-and-gathering societies is sufficiently high that these changes in brain size and facial architecture would probably have been quickly disseminated over a wide area.

But the “margins” of a cultural animal like early humans can be culturally and technologically—not just geographically—defined. As noted later, brain sizes may have increased most rapidly in Africa, not on the world’s cold periphery. Brain tissue has a relatively high “cost”: It consumes great amounts of energy and oxygen. Also, giving birth to large-brained offspring requires a pelvic bone structure that reduces maternal mobility. Since *Homo erectus* was obviously an efficient hunter, forager, and tool-maker, perhaps the increased brain size was related to increasing emotional capacities rather than to improvements in the problem-solving abilities that were important in hunting or tool-making. Great advantages would accrue to a Pleistocene hunting-and-gathering group that could organize itself as part of a social network involving many different bands and hundreds of individuals, and perhaps the increasing brain size had to do with the selective advantage of being able to generalize emotions to scores of “kinsmen.”

In any case, the great variability of cranial capacity among “normal” people today, and the fact that human brain size seems generally to have increased quite uniformly up to about 100,000 years ago, should warn against simplistic explanations of this phenomenon.

To explain the relatively slow rate of technological change between 2 million and 100,000 years ago, we must reflect on the fact that our ancestors of this period were many fewer than the large populations of humans that characterized the world even 10,000 years ago. Although technological innovation is not a simple product of the number of minds available to create new ideas, a strong relationship exists between population numbers and innovation in the simple hunting-gathering economies of the early and middle Pleistocene. Even as late as 500,000 years ago, there were probably only a million people in the entire world. Also, people of this era tended to live much shorter lives. Few survived past 30 years of age, and—although few adolescents of any age have believed it—people learn a great deal and retain considerable creativity past 30.

Finally, if we look beyond the bones and stones and the practical analytical questions about our past, we might muse on the implications of the evidence presented here. It is worth noting that the facts and models about the dynamics of our ancestry recounted here and in chapter 3 all but killed a beautiful world- and life-view. The idea of “Nature, red in tooth and claw,” as the means by which we emerged from our reptilian past has appalled people since the dark truth of our origins was first made evident by Darwin. It is thus appropriate to end this chapter with a beautifully somber expression of this mortally wounded world and life-view, by Alfred, Lord Tennyson, a contemporary of Darwin, and a man profoundly anguished by Darwin’s ideas.

Are God and Nature then at strife,
That Nature lends such evil dreams?
So careful of the type she seems,
So careless of the single life;

That I, considering everywhere
 Her secret meaning in her deeds,
 And finding that of fifty seeds
 She often brings but one to bear,
 I falter where I firmly trod,
 And falling with my weight of cares
 Upon the great world's altar-stairs
 That slope thro' darkness up to God,
 I stretch lame hands of faith, and grope,
 And gather dust and chaff, and call
 To what I feel is Lord of all,
 And faintly trust the larger hope.
 "So careful of the type?" but no.
 From scarpéd cliff and quarried stone
 She cries, "A thousand types are gone:
 I care for nothing: all shall go . . ."
 . . .
 Man, her last work, who seem'd so fair,
 Such splendid purpose in his eyes,
 Who roll'd the psalm to wintry skies,
 Who built him fanes of fruitless prayer,
 Who trusted God was love indeed
 And love Creation's final law—
 Tho' Nature, red in tooth and claw
 With ravine, shriek'd against his creed—
 Who loved, who sufferd countless ills,
 Who battled for the True, the Just,
 Be blown about the desert dust,
 Or seal'd within the iron hills?
 No more? A monster then, a dream,
 A discord. Dragons of the prime,
 That tare each other in their slime,
 Were mellow music match'd with him.

From In Memoriam, 1850

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NOTES

1. Last Poems, 1922, no. 12.
2. Gould, *Wonderful Life*.
3. Although it will be interesting to follow developments in the recent discovery in Indonesia of *Homo floresiensis* (see Brown et al., "A New Small-Bodied Hominin from the Late Pleistocene of Flores, Indonesia"). These hominins, dubbed by some of their discoverers and in the popular press as "hobbits," date to about 18,000 years ago, and thus, at least in this isolated island context, are contemporary with modern forms of humans. *Homo floresiensis* stood only about 3 feet tall and had a brain size in the range of Australopiths, about 380 cc; it was obviously a quite different animal than us.
4. Klein, *The Human Career*, pp. 283–295.
5. *Ibid.*, p. 409.
6. Other names of early hominins include *Homo antecessor* (Spain), *Homo heidelbergensis* (Africa and Europe), *Homo louisleakeyi* (Africa), and *Homo rhodesiensis* (Africa). See Klein, *The Human Career*; McBrearty and Brooks, "The Revolution That Wasn't: A New Interpretation of the Origin of Modern Human Behavior."
7. Reviewed in Klein, *The Human Career*, pp. 333–338.
8. Isaac, "The Archaeology of Human Origins," p. 60.
9. Isaac, "Sorting Out the Muddle in the Middle – An Anthropologist's Post-Conference Appraisal," p. 504.
10. Shipman, "Early Hominid Lifestyle."
11. Impressive numbers of hand-axes at sites could also be the result of taphonomic processes; see, for example, Schick, "Geological Analysis of an Acheulean Site at Kalambo Falls, Zambia."
12. Binford, *Bones, Ancient Men and Modern Myth*, p. 294; *idem.*, "Human Ancestors."
13. Several claims have been made for the early use of fire, perhaps as early as 1.4 million years ago in Africa, but closer analyses of these finds suggest instead that taphonomic processes are responsible. Natural brush fires, for example, leave a scatter of charcoal across both sites and the surrounding region. See, for example, James, "Hominid Use of Fire."
14. Roberts, "Body Weight, Race and Climate."
15. Binford, "Human Ancestors: Changing Views of Their Behavior."
16. Gabunia et al., "Earliest Pleistocene Hominid Cranial Remains from Dmanisi, Republic of Georgia: Taxonomy, Geological Setting, and Age."
17. Zhu et al., "New Evidence on the Earliest Human Presence at High Northern Latitudes in Northeast Asia."
18. de Vos, Sondaar, and Swisher, "Dating Hominid Sites in Indonesia."

19. Bar-Yosef and Goren-Inbar, "The Lithic Assemblage of 'Ubeidiya: A Lower Paleolithic Site in the Jordan Valley"; Tchernov, "Age of 'Ubeidiya Formation (Jordan Valley, Israel) and the Earliest Hominids in the Levant."
20. Klein, "Anatomy, Behavior, and Modern Human Origins."
21. Klein, *ibid.*, p. 178.
22. These are the *Homo antecessor* remains. See Bermúdez de Castro et al., "A Hominid from the Lower Pleistocene of Atapuerca, Spain: Possible Ancestor to Neandertals and Modern Humans."
23. Sevink et al., "A Note on the Approximately 730,000-Year-Old Mammal Fauna and Associated Human Activity Sites Near Isernia, Central Italy"; but see Villa, "Early Italy and the Colonization of Western Europe," who raises questions about the very early date, as well as taphonomic issues in site formation.
24. Wu Rukang and Jia Lampo, "China in the Period of *Homo habilis* and *Homo erectus*."
25. *Ibid.*
26. Boaz et al., "Large Mammalian Carnivores as a Taphonomic Factor in the Bone Accumulation at Zhououdian."
27. Arens, *The Man-Eating Myth*.
28. Garn and Block, "The Limited Nutritional Value of Cannibalism."
29. Shapiro, *Peking Man*.
30. Freeman, "Acheulian Sites and Stratigraphy in Iberia and the Maghreb," p. 664.
31. *Ibid.*
32. Evidence for wooden throwing spears has been found elsewhere in Europe, at the site of Schöningen in Germany at 400,000 years ago (see Thieme, "Lower Palaeolithic Hunting Spears from Germany"), and possibly in England at the site of Clacton-on-Sea (see Warren, "Palaeolithic Wooden Spear from Clacton").
33. See Binford, "Human Ancestors," for a scavenging interpretation; but for contrasting view, see Shipman and Rose, "Evidence of Butchery and Hominid Activities at Torralba and Ambrona."
34. Vértes, "The Lower Palaeolithic Site of Vértesszöllös, Hungary."
35. There are some controversial examples of possible figurines from, for example, Berkehat Ram in Israel (see Pelcin, "A Geological Explanation for the Berkehat Ram Figurine"; D'Errico and Nowell, "A New Look at the Berekhat Ram Figurine: Implications for the Origins of Symbolism"), and Tan Tan in Morocco (see Bednarik, "A Figurine from the African Acheulian").
36. Bender, "Comment on G. Krantz (CA 21:773–79)."
37. White, "Beyond Art: Toward an Understanding of the Origins of Material Representation in Europe," p. 560.
38. Klein, "Anatomy, Behavior, and Modern Human Origins."
39. *Through the Looking-Glass*.
40. Frayer et al, p. 16.
41. *Ibid.*, p. 17.
42. *Ibid.*, pp. 17–18.
43. Leakey, *Olduvai Gorge*.
44. Weidenreich, *Apes, Giants, and Man*.
45. See also Coon, *The Origins of Races*.
46. Ferraro et al., *Anthropology*, p. 129, presents a simplified description of this issue.
47. Aiello, "The Fossil Evidence for Modern Human Origins in Africa: A Revised View."
48. Melnick and Hoelzer, "What Is mtDNA Good for in the Study of Primate Evolution?" p. 9.
49. Frayer et al., "Theories of Modern Human Origins: The Paleontological Test."
50. *Ibid.*, p. 39.
51. See Krings et al., "Neanderthal DNA Sequences and the Origin of Modern Humans"; Krings et al., "A View of Neanderthal Genetic Diversity"; Ovchinnikov et al., "Molecular Analysis of Neanderthal DNA from the Northern Caucasus"; and Caramelli et al., "Evidence for a Genetic Discontinuity Between Neandertals and 24,000-Year-Old Anatomically Modern Europeans."
52. See, for example, Bräuer, "Africa's Place in the Evolution of *Homo sapiens*."
53. The following points of evidence are adapted from Frayer et al., "Theories of Modern Human Origins: The Paleontological Test," pp. 19–20.
54. *Ibid.*
55. Olszewski, "Issues in the Development of the Early Upper Paleolithic, and a 'Transitional' Industry from the Zagros Region."
56. White et al., "Pleistocene *Homo sapiens* from Middle Awash, Ethiopia."
57. McBrearty and Brooks, "The Revolution That Wasn't: A New Interpretation of the Origin of Modern Human Behavior."
58. Singer and Wymer, *The Middle Stone Age at Klasies River Mouth in South Africa*.
59. McBrearty and Brooks, "The Revolution That Wasn't: A New Interpretation of the Origin of Modern Human Behavior."
60. Frayer et al., "Theories of Modern Human Origins: The Paleontological Test," pp. 19–20.

61. McBrearty and Brooks, "The Revolution That Wasn't: A New Interpretation of the Origin of Modern Human Behavior."
62. Klein and Edgar, *The Dawn of Human Culture*, pp. 23–26.
63. Brooks et al., "Dating and Context of Three Middle Stone Age Sites with Bone Points in the Upper Semliki Valley, Zaire."
64. Jones, "From Kakadu to Kutikina: The Southern Continent at 18,000 Years Ago"; Frankel, *Remains to Be Seen*.
65. Pope, "The Antiquity and Palaeoenvironment of the Asian Hominidae"; Wolpoff et al., "Modern *Homo sapiens* Origins: A General Theory of Hominid Evolution Involving the Fossil Evidence from East Asia"; Thorne, "The Arrival of Man in Australia."
66. See table 2 in Frayer et al., "Theories of Modern Human Origins: The Paleontological Test," for their argument that proponents of the Eve hypothesis have systematically misinterpreted the data from Africa with regard to shovelling.
67. Frayer et al., "Theories of Modern Human Origins: The Paleontological Test," p. 22.
68. The one continuity exception that proponents of Total Replacement might allow is the recent discovery of *Homo floresiensis* on Flores Island, Indonesia (see endnote 3). *Homo floresiensis* is thought to be a descendant of the Asian *Homo erectus*.
69. With the possible exception of *Homo floresiensis*, dated to as late as 18,000 years ago.
70. Stringer et al., "The Significance of the Fossil Hominid from Petralona, Greece"; Trinkaus, "Evolutionary Continuity Among Archaic *Homo sapiens*."
71. Conway et al., *Excavations at Barnfield Pit, Swanscombe, 1968–72*; Wymer, "Excavations at Barnfield Pit, 1955–60."
72. *Ibid.*, p. 22.
73. Roe, *The Lower and Middle Paleolithic Periods in Britain*.
74. de Lumley, "Ante-Neanderthals of Western Europe."
75. Svoboda, "Lithic Industries of the Arago, Vértesszöllös, and Bilzingsleben Hominids: Comparison and Evolutionary Interpretation."
76. Tennyson was alluding to Goethe here.
77. White, "Rethinking the Middle/Upper Paleolithic Transition"; others have referred to this as a "revolution" (see Bar-Yosef, "The Upper Paleolithic Revolution").
78. Lieberman, "Testing Hypotheses About Recent Human Evolution from Skulls."
79. Wobst, "Stylistic Behavior and Information Exchange."
80. White, "Rethinking the Middle/Upper Paleolithic Transition."
81. Straus and Cave, "Pathology and the Posture of Neanderthal Man."
82. Trinkaus, "The Neandertals and Modern Human Origins."
83. *Ibid.*, p. 203.
84. *Ibid.*, p. 205.
85. Bordes, *Typologie du Paleolithique Ancien et Moyen*.
86. Binford and Binford, "A Preliminary Analysis of Functional Variability in the Mousterian of Levallois Facies."
87. Dibble, "Middle Paleolithic Scraper Reduction: Background, Clarification, and Review of the Evidence to Date."
88. Lieberman and Crelin, "On the Speech of Neanderthals."
89. Frayer and Wolpoff, "Comment on 'Glottogenesis and Modern *Homo sapiens*.'" p. 58.
90. Lieberman, "On the Nature and Evolution of the Neural Bases of Human Language," p. 58.
91. For a review of the evidence and dissenting comments on this topic, see Gargett, "Grave Shortcomings: The Evidence for Neandertal Burial"; Chase and Dibble, "Middle Paleolithic Symbolism"; Brace, "Review of *Shanidar: The First Flower People*, by R. Solecki," p. 86.
92. Klein, "Anatomy, Behavior, and Modern Human Origins."
93. Straus, *Iberia Before the Iberians: The Stone Age Prehistory of Cantabrian Spain*.
94. Russell, "Bone Breakage in the Krapina Hominid Collection"; "Mortuary Practices at the Krapina Neandertal Site"; and Trinkaus, "Cannibalism and Burial at Krapina."
95. Trinkaus, "Neandertal Mortality Patterns."
96. *Ibid.*, p. 121.
97. Valladas et al., "Thermoluminescence Dating of Mousterian 'Proto-Cro-Magnon' Remains."
98. Schwarcz, "Chronology of Modern Humans in the Levant."
99. Trinkaus, quoted in B. Bower, "An Earlier Dawn for Modern Humans?" p. 138.
100. Frayer et al., "Theories of Modern Human Origins: The Paleontological Test," p. 37; see also Arensburg and Belfer-Cohen, "Sapiens and Neandertals: Rethinking the Levantine Middle Paleolithic Hominids."
101. Shea, "Spear Points from the Middle Paleolithic of the Levant"; summarized in Frayer et al., "Theories of Modern Human Origins: The Paleontological Test," p. 20.

102. Klein, "Anatomy, Behavior, and Modern Human Origins."
103. Lovejoy and Trinkaus, "Strength of Robusticity of the Neanderthal Tibia."
104. Ruff, "Climatic Adaptation and Hominid Evolution: The Thermoregulatory Imperative"; Steegmann et al., "Neanderthal Cold Adaptation: Physiological and Energetic Factors."
105. Smith, "Upper Pleistocene Hominid Evolution in South-Central Europe: A Review of the Evidence and Analysis of Trends"; Wolpoff et al., "Modern Human Ancestry at the Peripheries: A Test of the Replacement Theory."
106. Soffer, "Ancestral Lifeways in Eurasia – the Middle and Upper Paleolithic Records."
107. Reviewed in Straus, "Upper Paleolithic Origins and Radiocarbon Calibration: More New Evidence from Spain."
108. *Ibid.*, p. 197.
109. Olszewski, "The Early Upper Palaeolithic in the Zagros Mountains."
110. *Ibid.*, p. 196.
111. *Ibid.*; but see Bocquet-Appel and Demars, "Neanderthal Contraction and Modern Human Colonization of Europe" for an alternate model using radiocarbon dates to show the "advancing wave" of Aurignacian-using modern humans.
112. Leveque and Vandermeersch, "Les Decouvertes de Restes Humains."
113. Trinkaus, "The Neandertals and Modern Human Origins," p. 198.
114. Bischoff et al., "Dating of the Basal Aurignacian Sandwich at Abric Romani (Catalunya, Spain) by Radiocarbon and Uranium-Series."
115. Smith, "Upper Pleistocene Hominid Evolution in South-Central Europe: A Review of the Evidence and Analysis of Trends."
116. Trinkaus and Duarte, "The Hybrid Child from Portugal."
117. Frayer et al., "Theories of Modern Human Origins: The Paleontological Test," p. 32.
118. Relethford, "Absence of Regional Affinities of Neanderthal DNA with Living Humans Does Not Reject Multiregional Evolution."
119. Trinkaus and Duarte, "The Hybrid Child from Portugal."
120. Wolpoff et al., "Multiregional Evolution: A World-Wide Source for Modern Human Populations."
121. See endnote 51.
122. Prideaux et al., *Cro-Magnon Man*, pp. 93–94.
123. De Beaune, "Paleolithic Lamps and Their Specialization: A Hypothesis."
124. Clottes, "France's Magical Ice Age Art: Chauvet Cave."
125. Conkey, "New Approaches in the Search for Meaning? A Review of Research in 'Paleolithic Art.'"
126. Leroi-Gourhan, "The Evolution of Paleolithic Art."
127. Fisher, *Woman's Creation*.
128. Lewis-Williams and Dowson, "The Signs of All Times: Entopic Phenomena in Upper Paleolithic Art."
129. *Ibid.*, p. 215 (emphasis theirs).
130. Hodder, *Reading the Past*; also see Straus, *Iberia Before the Iberians: The Stone Age Prehistory of Cantabrian Spain*.
131. Conkey, "New Approaches in the Search for Meaning? A Review of Research in 'Paleolithic Art,'" p. 422.
132. Marks, *Human Biodiversity: Genes, Race, and History*.
133. *Ibid.*; Brace et al., "Clines and Clusters Versus 'Race': A Test in Ancient Egypt and the Case of a Death on the Nile."
134. Current news stories (for example, the *Philadelphia Inquirer* of April 17, 2005) report on the start of the five-year Genographic Project that will analyze the DNA of 100,000 people worldwide in an effort to trace, in detail, the migrations of humans after modern humans left Africa. The North American center is at the University of Pennsylvania, under the direction of Dr. Theodore Schurr of the Department of Anthropology.
135. Thiel, "Early Settlement of the Philippines, Eastern Indonesia, and Australia-New Guinea: A New Hypothesis."
136. Vallois, "The Social Life of Early Man: The Evidence of the Skeletons."
137. *Ibid.*
138. Soffer, *The Upper Paleolithic of the Central Russian Plain*.
139. Bellwood, *The Prehistory of the Indo-Malaysian Archipelago*.
140. White and O'Connell, "Australian Prehistory: New Aspects of Antiquity."
141. Thorne, "The Arrival of Man in Australia."
142. Klein, "Anatomy, Behavior, and Modern Human Origins."