The Inhabitants of Ice Age Europe

NANCY MINUGH-PURVIS

Early European Origins

The first inhabitants of Europe were not native to the region. Some 5 to 6 million years ago, hominids (members of our biological family) evolved in Africa from an ancestral population of ape-like creatures that also gave rise to today's chimpanzees, our closest living relatives. These earliest African hominids—very different looking than ourselves—are given the scientific name *Australopithecus* to separate them from the genus *Homo* to which we, and other hominids more closely related to us, belong (see box on hominid taxonomy).

The differences between our-

Figure 1. An artist's reconstruction of the earliest Europeans. This painting by the Czech artist Zdeněk Burian shows how the inhabitants of the area of Heidelberg, Germany, might have appeared during Middle Pleistocene times. It was inspired by the famous Middle Pleistocene hominid fossil, the "Heidelberg jaw," discovered by workmen in the Mauer sandpit in 1907.

From Augusta and Burian 1960: Pl. 7

Scientific Nomenclature and Hominid Taxonomy

A system for classifying organisms is called a taxonomy. One such system for scientifically naming living and previously living organisms was devised by the Swedish naturalist Carolus Linnaeus in his historic 1758 publication, *Systema Naturae*. Under this system, which is still in use today, all organisms are referred to by a two-part name. The first part names the genus, a group of species with many common characteristics. The second name denotes the species to which an organism belongs. Living things are grouped together into a single species if they have the capacity to interbreed and produce fertile offspring. Obviously, this objective criterion cannot be applied to extinct organisms, making it necessary for paleontologists to use anatomical similarities in deciding which fossils should be grouped together as a species.

Since the time of Linnaeus, it has become common to add a third part to the scientific names of many organisms, in order to identify the subspecies to which they belong. Modern humans have the trinomial, or three-part name, *Homo sapiens sapiens*, indicating that we belong to the genus *Homo*, the species *sapiens*, and the subspecies *sapiens*. In Latin, this name means "wise, wise man." All living humans belong to this single subspecies.

In tracing the evolution of Ice Age Europeans, several different groups, or taxa, of the genus *Homo* need to be considered, including the following.

Early *Homo* (*Homo habilis*): The earliest form of *Homo* appeared in Africa approximately 2.5 million years ago. It possessed a brain not much larger than a chimpanzee's, and fairly large teeth. However, it made tools and is believed to have lived, full-time, on the ground. Some paleoanthropologists believe that the hominid brain began its evolution into the very large organ which it is today when early *Homo* became fully terrestrial. Without the need to climb trees, early *Homo* parents could carry helpless infants. This permitted the survival of babies born in a more premature state, allowing for greater brain growth to occur both before and after birth.

Homo erectus: *Homo erectus* evolved in Africa approximately 1.6 million years ago. It is notable for its fairly large brain size, and for smaller teeth and larger body size than its predecessors. Approximately 1 million years ago, some *Homo erectus* populations left Africa and began to colonize the Old World (Fig. 3). By 400,000 years ago, *Homo erectus* had evolved into the earliest members of our species, the first *Homo sapiens*.

Homo sapiens: Early *Homo sapiens* shared so many anatomical similarities with late *Homo erectus* that the exact time of the transition from one to the other is difficult to pin down. Anatomically, *Homo sapiens* may be distinguished from *Homo erectus* by its larger brain, smaller teeth, and less massive face. The first European

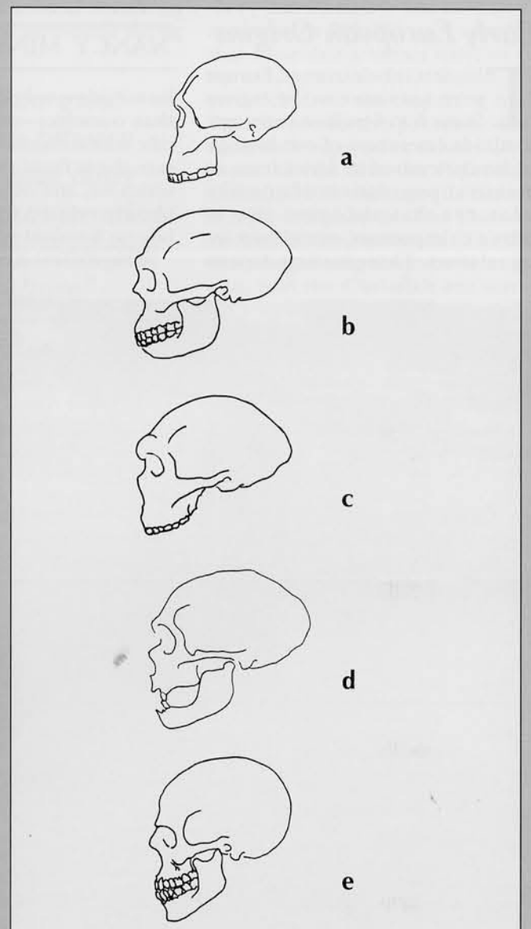

Figure 2a-e. (a) Early Homo, *(b)* Homo erectus, *(c) early* Homo sapiens, *(d)* Homo sapiens neanderthalensis, *and (e)* Homo sapiens sapiens.

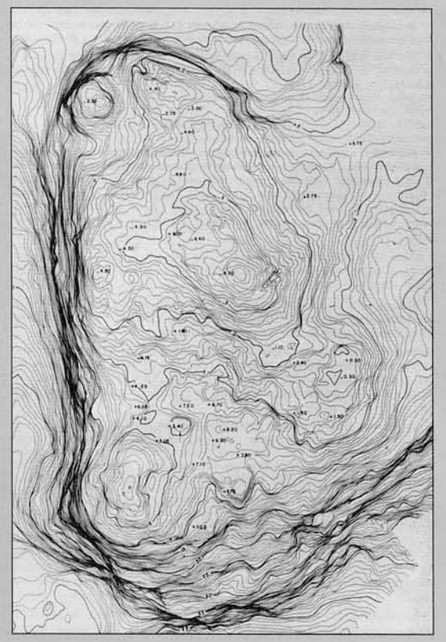

Figure 3a,b. (a) Ancient impression of a fleeting moment. In 1965 French prehistorian Henry de Lumley uncovered this 400,000-year-old print of a human foot at Terra Amata, a site in the city of Nice, on the French Riviera. It is the oldest human footprint known from Europe. (b) Contour drawing of the footprint.

Photos courtesy of Prof. Henry de Lumley

Homo sapiens lived from approximately 400,000 to 125,000 years ago.

Homo sapiens neanderthalensis or Neanderthals (Fig. 4) lived in Europe and the Middle East between 125,000 and 35,000 years ago. They are considered archaic *Homo sapiens* by paleoanthropologists because of the large number of biological and behavioral traits which they shared in common with living *Homo sapiens*. At the same time, however, they were sufficiently different from ourselves to warrant placement in the separate subspecies *Homo sapiens neanderthalensis*. Neanderthals had large faces, powerful limbs, and extremely large brains which often exceeded the modern human average of 1450 millilitres.

Homo sapiens sapiens, or modern humans, appeared in Europe between 40,000 and 30,000 years ago, replacing the Neanderthals who had lived in that region for perhaps as long as 90,000 years. Although the earliest *Homo sapiens sapiens* were not completely modern in every aspect of their anatomy, their overwhelming biological and behavioral similarities to living humans warrants their inclusion in our own subspecies.

Figure 4. Staring out from under a massive browridge, this Neanderthal face from the Krapina rock shelter in Croatia was excavated at the turn of the century. The fossil-bearing deposits at Krapina yielded the remains of dozens of individuals, making it the richest of any known Neanderthal site. Although this specimen is fairly complete, most of the Krapina Neanderthals are broken bone fragments and teeth. Gouges and charring on some of these fossils have led several scientists to speculate that the Krapina people—many of them children—were the victims of an ancient cannibalistic massacre.

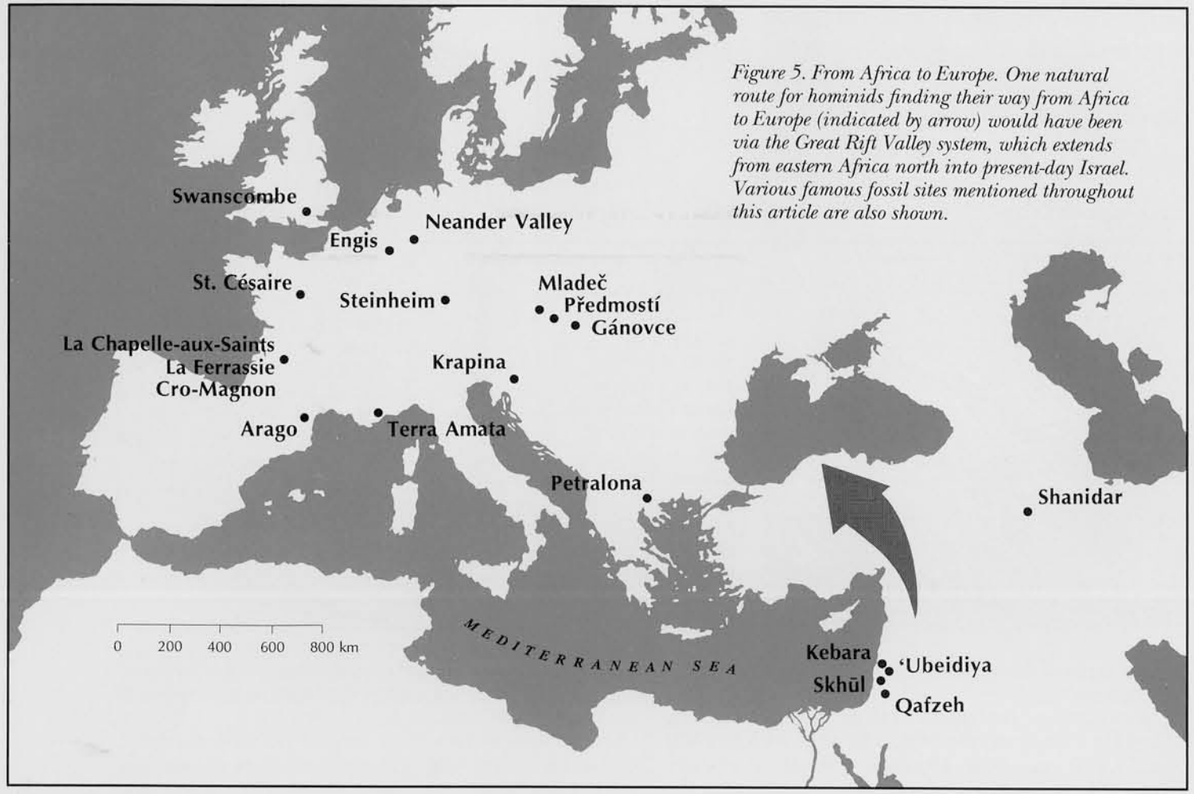

Figure 5. From Africa to Europe. One natural route for hominids finding their way from Africa to Europe (indicated by arrow) would have been via the Great Rift Valley system, which extends from eastern Africa north into present-day Israel. Various famous fossil sites mentioned throughout this article are also shown.

selves and the early australopithecines were major. Their brains were small, their teeth were large, and in many ways they looked more like living chimpanzees than humans. But in one very fundamental way, even these earliest members of *Australopithecus* were clearly hominids: they were fully bipedal creatures, who stood and walked erect, freeing their hands for full-time manipulative purposes such as the use of tools.

Between its appearance some 5 to 6 million years ago, and its eventual extinction as a group, the genus *Australopithecus* evolved into a number of species. One of these, which appeared between 4 and 2.5 million years ago, has been given the name of early *Homo*, or *Homo habilis*. Its descendent, *Homo erectus*, was probably the first hominid to reach Europe.

Homo erectus was different from its predecessor, early *Homo*, in a number of ways. Its brain was significantly larger, up to 1,250 millilitres in capacity. Its overall body size was also larger, within the modern human range, in contrast to the short earlier australopithecines and *Homo habilis*. The teeth of *Homo erectus* were smaller, suggesting a greater reliance on tools than on teeth for important activities. This is also seen in the tools associated with these hominids, which are more refined than those found with early *Homo*. Overall, *Homo erectus* had far more sophisticated means for dealing with its environment than did earlier hominids, and these skills must have figured prominently in its eventual colonization of much of the Old World.

Until approximately 1 million years ago, hominids evolved exclusively within the confines of the African continent. Then, *Homo erectus* began to push beyond its boundaries into other regions of the Old World. With this expansion of the hominid range, the first people arrived in Europe no later than 900,000 years ago. These immigrants of African ancestry probably came by way of the Middle East (Fig. 5).

The Middle East provides the logical route of passage from Africa into Europe for a variety of reasons. For one thing, the Straits of Gibraltar are very deep. Even during times in the earth's history when a far greater proportion of the earth's total water supply was tied up in massive continental ice sheets than today, ocean water levels have never dropped low enough to expose a land bridge connecting Gibraltar and north Africa. This would have made entry into Europe by foot from the west impossible.

The earliest signs of human arrival in the prehistoric record of the Middle East come from 'Ubeidiya, Israel, an open air site on the west

bank of the Jordan River dated to approximately 1 million years ago. The highly fragmentary hominid fossils found at 'Ubeidiya almost certainly represent ancestors of the people who initially populated Europe. They have the extremely thick cranial bones found in *Homo erectus*, but the fossils are so poorly preserved that it is difficult to be completely certain of their identity. Nevertheless, their presence in Israel at this date indicates that by this time hominids had ventured out of Africa towards Asia Minor. Pushing northward through the Jordan River Valley, perhaps pursuing game or merely following their adventuresome curiosity, their descendents eventually traversed the land bridge which emerged at the Dardanelles during periods of lowered sea level, and reached Europe. A short 100,000 years later, they had not only arrived along the northern shores of the Mediterranean, but had already penetrated far into the rugged continental interior.

The time from 730,000 to 125,000 years ago is called the Middle Pleistocene epoch by geologists and paleontologists. Although hominids entered Europe well before Middle Pleistocene times, our earliest glimpses of them come not from their bones and teeth, but from vestiges of their behavior left behind at the earliest known European archaeological sites. Le Vallonet Cave on the French Riveria and the open-air site of Soleihac in the rugged interior of the French Massif Centrale

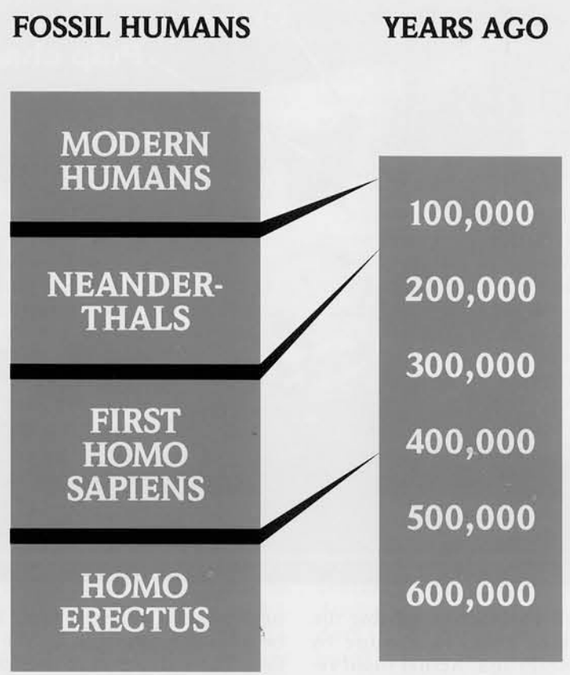

Figure 6. Chronology of European Ice Age fossils.

Figure 7. Middle Pleistocene faces. These specimens from Steinheim, Germany, and Arago, France, are unusually complete. While both demonstrate the large face and prominent browridge characteristic of these early Europeans, the Steinheim fossil (left) is believed to have belonged to a female individual and the Arago face to a male.

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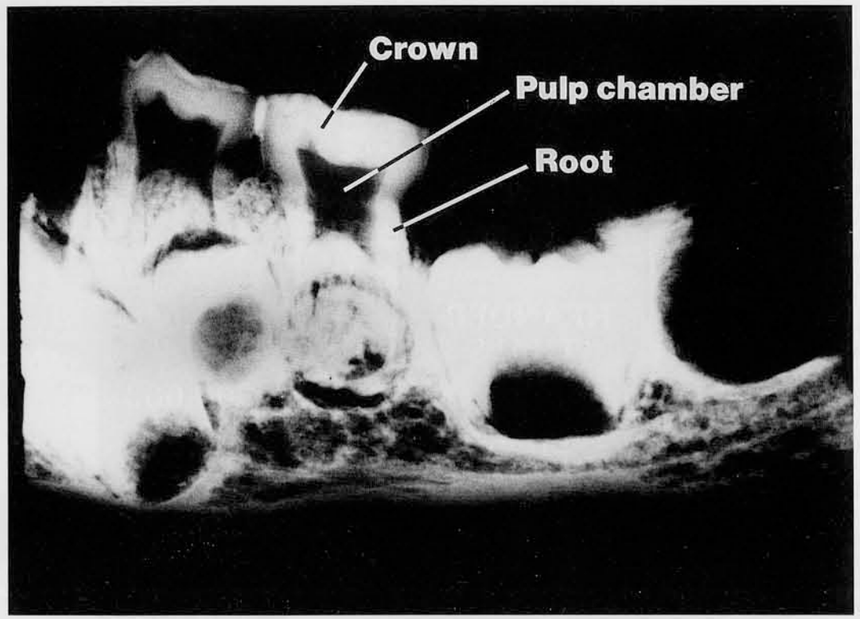


Figure 8. An x-ray of a Neanderthal child's lower jaw from Devil's Tower, Gibraltar. This specimen shows the enlarged dental pulp chambers and roots found in taurodontism, a common trait among Neanderthals.

X-ray courtesy of Dr. Mark Skinner

have yielded artifacts suggesting the presence of *Homo* in Europe by 900,000 years ago. Actual fossil remains of these earliest Europeans have only been recovered from later in the paleontological record, from sites dating well within the 730,000 to 125,000 year time range of the Middle Pleistocene itself (Fig. 1).

Early European Evolution

The fossil evidence for Middle Pleistocene Europeans is known from several sites in eastern, central, and western Europe, all located below the 51st parallel. However, as is often the case with hominid fossils, they are disappointingly sparse and extremely poorly dated, making their study a difficult undertaking.

Like all human ancestors living during Middle Pleistocene times, the earliest Europeans had extremely large faces with broad cheekbones. Their brains were larger than those of earlier species of *Homo*, and were inclosed in a massive skull. A large ridge of bone extended across the tops of their bony eye sockets, about where our eyebrows are today (Fig. 7). The back of the skull was particularly thick, probably because the neck muscles attached there had to be unusually strong to lift the heavy face. The widest part of the skull was low, just above the ears, so that it had the shape of a flattened pentagon when viewed from the rear. Although very few limb and trunk bones are known from these Middle Pleistocene Europeans, one portion of a pelvis from Arago, France, includes features reminiscent of those seen in its *Homo erectus* contemporaries from elsewhere in the Old World.

"Like all human ancestors living during Middle Pleistocene times, the earliest Europeans had extremely large faces with broad cheekbones."

However, there are also some differences between the European Middle Pleistocene people and the fossils known from other areas of the Old World at this time. For example, the back portion of a skull found at Swanscombe, England, in the gravels of the Thames River, has a curious oval depression on the outside of the back of the braincase. The significance of this feature is unknown, but we find it in the braincases of later ancient Europeans, the Neanderthals, as well. Likewise, the flattened, backward projection of the rear of the skull, known as an occipital bun or chignon because of its resemblance to a roll of hair worn at the back of a woman's head, is found in an early fossil skull from Biache-Saint-Vaast, a site in northern France. This too foreshadows the Neanderthals and other subsequent European populations.

These early Europeans of the Middle Pleistocene had huge faces, with jaws that projected so far forward that even though their teeth were larger than ours, they did not fill the entire horizontal part of the jaw. Instead, there was a gap between the back teeth and the vertical part of the jaw. In two specimens from Arago, France, and another from the site of Petralona, Greece, this forward projection is further accentuated by the swollen appearance of the middle part of the face, from the nose to the cheekbones. Both of these traits, too, are typical of the later Neanderthals of Europe.

Even the teeth show unusual differences from contemporary *Homo erectus* elsewhere in the Old World, further evidence that unique local evolutionary changes were occurring within European populations. In several lower jaws known from this time, the cheek teeth, or molars, are swollen internally and have stubby roots. This condition, known as taurodontism, is particularly exaggerated in later Europeans (Fig. 8). Moreover, the back teeth, or molars and premolars, were shrinking in the hominids of Europe—a trend found throughout the Old World over this time period. But in European fossils, the front teeth were enlarging at the same time. This trend too became even more pronounced among the later Europeans known as Neanderthals.

Finally, there may have been a marked difference in the appearance of males and females, far more than is true of people today. It appears that during Middle Pleistocene times, male and female Europeans were quite different in overall body size and muscularity, a tendency which characterized Europeans until only 10,000 to 20,000 years ago.

Paleoanthropologists are currently divided as to whether these Middle Pleistocene Europeans should be classified as late *Homo erectus*, or their descendant, early *Homo sapiens*. For example, one skull from Bilzingsleben, Germany, appears very similar to a well-known *Homo erectus* specimen from east Africa. Other fossils, however, are more like *Homo sapiens* in possessing thinner bones in the braincase and other more modern traits. Whatever their scientific name, these fossils provide numerous clues pointing to the evolution within Europe of a very unusual archaic group of ancient people, the Neanderthals.

The Neanderthals

By Upper Pleistocene times, which began 125,000 years ago, hominid fossils become increasingly more common in the European paleontological record. Many more sites are known, and they contain more and better preserved fossils. In addition, the fragile remains of children, nearly unknown from the European Middle Pleistocene, are rather common in the Upper Pleistocene (Fig. 9). This increase in hominid fossils could reflect a greater hominid population density in certain areas of Europe during this time. Or, it could have resulted from a new and very human behavioral pattern: intentional burial of the dead. But the people represented by these fossils did not look human in the modern sense; they were archaic members of our species, given the scientific name *Homo sapiens neanderthalensis* (see box, Neanderthal or Neandertal?).

Neanderthals were strikingly different in appearance than ourselves. Their long, narrow faces were dominated by a strong browridge and a large nose set in a swollen midfacial area which projected out over a receding chin. Short in stature, barrel-chested, and extraordinarily well-muscled (Fig. 10), these stocky people successfully inhabited most areas of the European continent below the 52nd parallel for nearly 100,000 years.

Although scientists have been studying the many peculiar aspects of Neanderthal anatomy for over a century (the first recognized Neanderthal was discovered near Dusseldorf in the Neander Valley, Germany, in 1856), this endeavor continues in earnest today. This is for two reasons. First, we want to learn as much as possible about these people who successfully adapted to the hardships of life during the

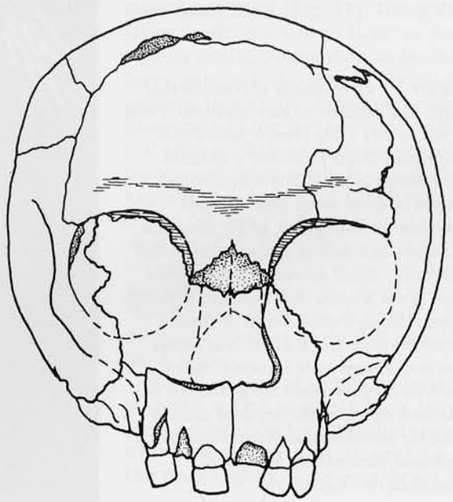


Figure 9. The Engis child, the first Neanderthal specimen discovered. Late in 1829, Dr. Paul Schmerling, a Dutch physician turned paleontologist, conducted systematic excavations of ancient animal remains at the Engis Caves, some 8 miles southwest of Liège, Belgium. His efforts were rewarded with discoveries of many Ice Age fossils, including the first hominid fossil remains ever discovered: several beautifully preserved parts of a 4-5 year old Neanderthal child (reconstructed in the drawing) and the faceless cranium of a more modern adult. While scientific attention focused on the adult, the pieces of the Engis Neanderthal child were boxed, shelved, and forgotten for nearly 100 years, leaving Schmerling forever unaware that he had discovered an archaic variety of Homo.

Drawing by Melissa Bell-Sabatino

European ice ages. Second, by comparing Neanderthal to modern human biology, we may eventually understand a bizarre and still unexplained event which occurred in Europe between 35,000 and 30,000 years ago: the highly successfully Neanderthals disappeared.

Neanderthal Biology

In trying to understand what made the Neanderthals so successful, paleoanthropologists study their adaptations, the biological and behavioral patterns that enable an organism's survival in its particular environment. Over the years, several investigators have suggested that the distinctive features of Neanderthals are specializations that evolved to enable them to better cope with the windy, dry, freezing environmental conditions which dominated Europe for much of their existence. Biological evidence for this comes from nearly all areas of the Neanderthal skeleton, including the skull, trunk, and extremities.

One researcher, the late Carleton S. Coon, suggested that the peculiar Neanderthal face, with its voluminous nasal aperture and large, puffed-out cheek regions, was a specialized anatomical complex for warming frigid air to prevent it from chilling the brain and lungs (Coon 1962). The extensive mucous membranes lining the wide nose would, additionally, have moistened the arid, dusty air of glacial times.

The limb skeletons of Neanderthals also suggest that they were cold-adapted people. Just as with arctic populations today, such as the Inuit of North America, the lower segment of Neanderthal arms and legs was shorter than the upper segment. This design conserves body heat by reducing the potential amount of exposed surface area available for heat dissipation through the skin. The Neanderthal's stocky build would also have conserved body heat.

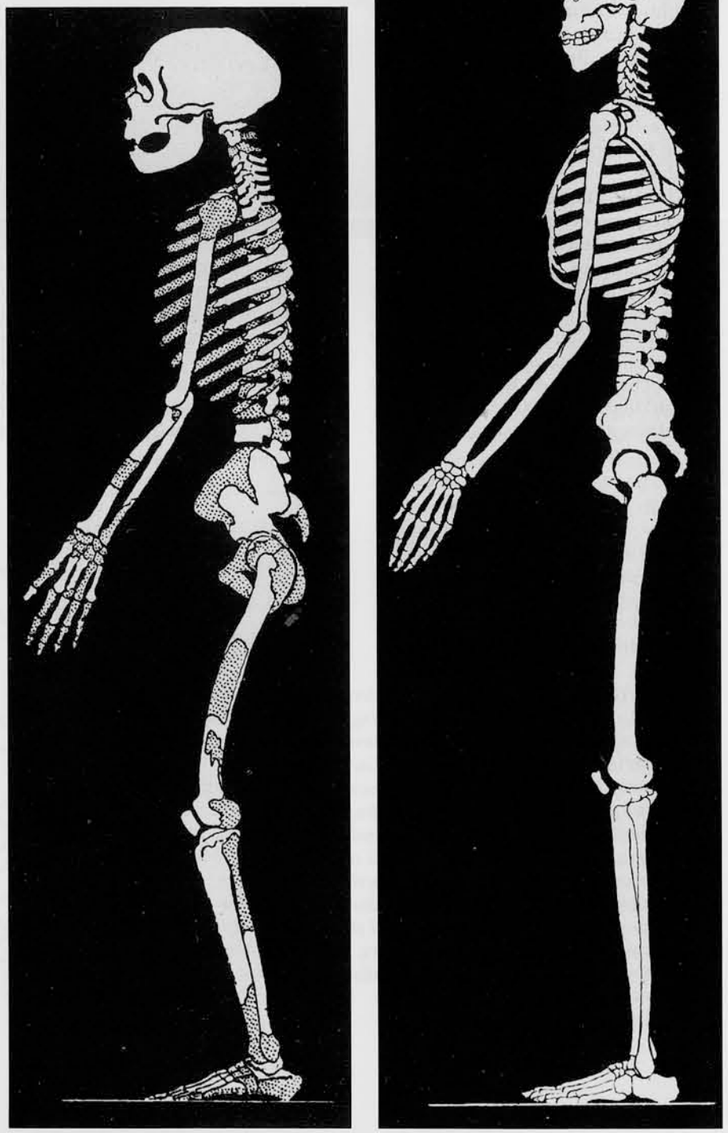
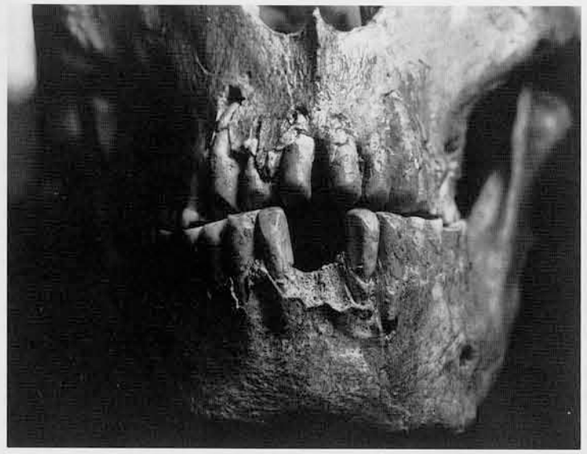


Figure 10. Comparison of Neanderthal (left) and modern human skeletons. From 1911 to 1913, the French pathologist Marcellin Boule published a detailed description of an elderly Neanderthal found in what many prehistorians consider a ritual grave, at the site of La Chapelle-aux-Saints, France. Using that specimen, Boule generated a reconstruction of the Neanderthal skeleton, depicted here. Although some details of Boule's reconstruction (such as the bent knees) are now known to be incorrect, many, such as the prominent bony processes in the neck region of the vertebral column and the barrel-chested thorax, accurately represent these extinct hominids.
From Boule 1923: Figs. 155, 156



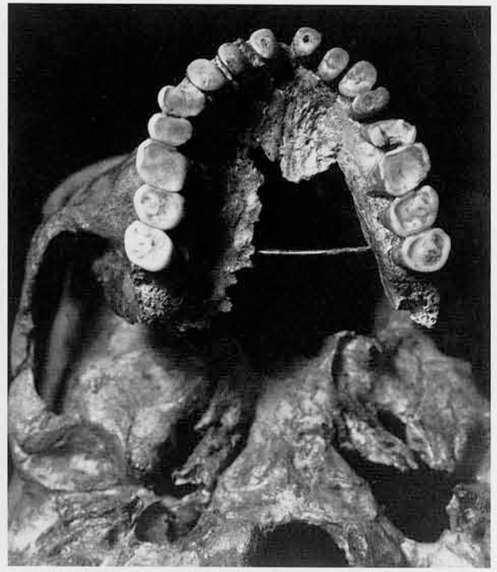


Figure 11a,b. Excessive tooth wear was common among Neanderthals. The extreme rounded wear seen on so many Neanderthal front teeth may be a result of using them to assist the hands in gripping and pulling objects. This individual, from Shanidar, Iraq, utilized his teeth so extensively that the dental crowns are completely worn away, leaving only the exposed, worn tops of the tooth roots for chewing.
Photos courtesy of Dr. Erik Trinkaus

Yet another feature which can perhaps be explained as a cold climate adaptation is the most intriguing of all aspects of Neanderthal biology: their large brains (estimated by measuring the internal volume of fossilized braincases), which equaled or slightly exceeded the average modern human brain in size. However, just because Neanderthal brains were somewhat larger than our own does not mean that they were more intelligent. Average brain size among modern human populations and individuals varies widely within a range of approximately 1,100 to 2,000 millilitres and cannot be taken as an indicator of relative intelligence. For metabolic reasons, however, modern human populations living in colder regions tend to have larger cranial capacities, on average, than those in tropical environments. This correlation again points to the possibility that Neanderthals possessed a strong biological adaptation to the cold climate of Ice Age Europe.

The cold adaptation hypothesis also supports the idea that Neanderthals evolved strictly within the confines of Europe, a notion suggested by the paucity of their remains outside of this fairly circumscribed geographical area. One unanswered question then is, if the Neanderthals were indeed well adapted to cold climates, why did they never penetrate into Siberia or Scandinavia as the early *Homo sapiens sapiens* did? Was it because their populations remained fairly small, so that there was no need to push into new territory? Or does it suggest that they did not have the technology to survive the even greater extremes of cold in these regions?

Many paleoanthropologists have begun to suspect that the distinctive Neanderthal morphology might be the result of a very different process, related to a less sophisticated technology rather than cold adaptation. We know Neanderthals used their front teeth for utilitarian purposes, such as holding objects while working with them, far more than do modern humans. This is obvious from the extreme, rounded wear and fine microchipping seen on their front teeth (Fig. 11). Using the front teeth as a vise to hold or pull objects would transmit considerable force through the face. This could explain, in part, the extreme forward projection of the Neanderthal midfacial region, with its flattened cheekbones and large nose. It could also explain the impressive development of the Neanderthal temporalis muscle (Fig. 12). Even the strong bony browridges over their eyes may have provided buttresses for distributing biomechanical stress, generated by using the teeth as tools, through the facial bones.

Another part of the Neanderthal skeleton which suggests their teeth were being used for strenuous work over and above food processing is the neck region of the vertebral col-

umn. Here, the bony prominences project far backwards, indicating that they were once connected by very strong muscles and ligaments, capable of supporting the head and neck against strong pulling.

Some clues as to why Neanderthals might have needed to use their teeth as tools have been offered by Erik Trinkaus, a paleoanthropologist at the University of New Mexico. His reconstructions, based on the enlarged muscle attachment areas as well as joint surfaces on their fossilized upper limb bones, indicate that their arms were considerably stronger than those of most modern humans. Trinkaus suggests that Neanderthals were able to grip objects in their hands more powerfully but less precisely than modern humans, and therefore also used their teeth. However, his interpretation has not gone unquestioned, because we know that the earliest *Homo sapiens sapiens* in the Middle East were making and using the same tools as the Neanderthals there, despite their less muscular and more modern upper limb anatomy.

Components of both the cold adaptive hypothesis and the facial stress hypothesis might, of course, account for Neanderthal morphology. However, some aspects of Neanderthal adaptation do not fit into either of these models.

Ralph Holloway, a paleoneurologist at Columbia University, has studied Neanderthal brain endocasts (see Fig. 13) and found no evidence that their brain was in any way more primitive than our own. Instead, he finds that the majority of adult Neanderthal specimens exhibit the modern human pattern of left cerebral dominance, indicating that they, like most of us, were righthanded.

Holloway's studies of the endocranial casts of *Homo sapiens neanderthalensis* do show one puzzling difference, however. They possessed a larger amount of tissue in the rear, or occipital area, of their brains, that area of the cerebral cortex in charge of vision, than do modern humans. Research on the remains of Neanderthal children has shown that the majority of Neanderthal brain growth was completed very early in life just as in modern humans. The only exception was in the growth in the occipital region, which occurred quite late in the growth period—during adolescence. This pattern was not unique to Neanderthals; it is seen in the remains of early *Homo sapiens sapiens* from Europe as well (Trinkaus and Le May 1982; Minugh-Purvis 1988). Since that time, however, modern humans have lost this pattern, but the evidence for the great similarity between brain growth in Neanderthals and early *Homo sapiens sapiens*, as well as ourselves, suggests that striking similarities must have existed between Neanderthal and our own cognitive and behavioral systems.

> *"old Neanderthals suffered from many of the same ailments affecting elderly persons today."*

Before Neanderthals, very few examples of older adults are known from the prehistoric record. But many of the Neanderthal fossils which have been discovered belonged to oldsters, well past their biological prime at the time of their deaths. These old Neanderthals suffered from many of the same ailments affecting elderly persons today. There is conspicuous evidence of arthritis in the joints of their limbs and back, and many are missing most of, if not all, their teeth. Yet these individuals survived, disabled, for some time prior to their deaths. Oldsters without teeth must have been eating prepared foods which could be easily ingested without chewing, and those affected with severe arthritis were probably assisted or even cared for by other

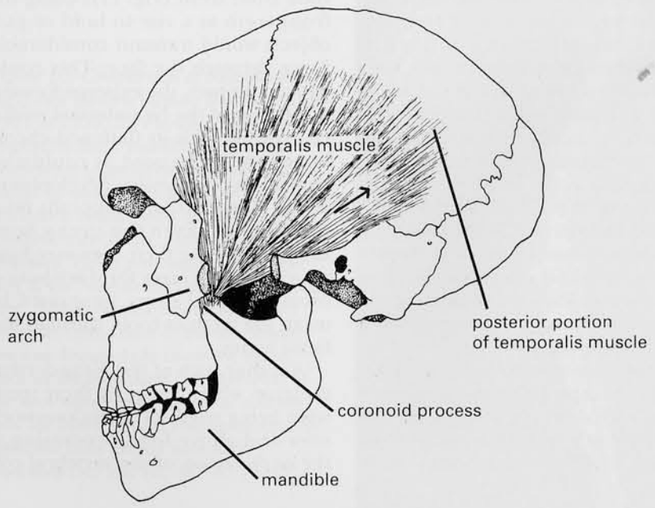


Figure 12. Using the teeth as tools. The horizontal orientation of the back or posterior part of the temporalis muscle resists forces transmitted through the front teeth. This muscle was undoubtedly very well developed in Neanderthals, as seen from the very enlarged, hook-shaped form of the coronoid process of their lower jaw. Part of the zygomatic arch has been removed in this drawing in order to expose the insertion of the temporalis muscle into the mandible.
Drawing by Melissa Bell-Sabatino

Figure 13. Naturally occurring endocranial cast from Gánovce, Czechoslovakia. Endocranial casts are positive replicas of the brain case, cast from molds of the internal surface of a skull cavity, and can be used to study, indirectly, the brains of extinct species. They are usually produced in the lab with modern casting materials. This naturally occurring endocranial cast from a Neanderthal was discovered in 1926. Such specimens are extremely rare.
From Jelínek 1975: Fig. 127

members of their social group, a behavior we tend to regard as uniquely human among primates. Even more striking is the evidence that such care did not end at death. Several Neanderthals, some elderly, others in their prime, and still others young children or infants, have been found in what appear to have been deliberate, perhaps even ceremonial, burials.

Another difficult question concerns whether Neanderthals possessed language. This fundamental human characteristic is linked to many other types of symbolic behavior. Thus, it is extremely important to determine whether this was part of the Neanderthal behavioral repertoire if we wish to assess or perhaps use it as a gauge of their humanness. The biological evidence for the evolution of language comes from two distinct areas: the brain and the speech apparatus. Holloway's studies of Neanderthal brain endocasts give every indication that their neural circuitry for language capacity was well evolved. However, it is just as difficult to document and analyze the anatomy of the vocal apparatus as it is to study the anatomy of the brain from the fossil record.

The vocal tract consists of a complex of structures including the teeth, palate, tongue, and larynx or voice box. Unfortunately, most of the anatomy of these areas is soft tissue and cartilage, which like the brain, do not fossilize. To study the Neanderthal capacity for speech, we must again rely heavily on indirect evidence: the areas of vocal tract soft tissue attachment to bones, such as the skull base, and a small, horseshoe-shaped bone, the hyoid, which rests just underneath the lower jaw high in the throat (see Fig. 9 in Chase's "Language in the Ice Ages"). These areas are so delicate and preserved so rarely that, for example, only a single hyoid bone is known from the entire hominid fossil record.

The single known hyoid bone was discovered in 1983 with the remains of a Neanderthal skeleton from the Israeli site of Kebara. Because the hyoid of the Kebara Neanderthal is unambiguously modern in form, it suggests that European Neanderthals may have had hyoids of similar shape and, by extension, the capacity for articulate speech. Meager though it is, the evidence from both the brain and the vocal tract shows that Neanderthals most certainly possessed a fairly sophisticated form of verbal communication that we would consider language.

The First Modern Humans Appear in Europe

Suddenly, between about 35,000 and 30,000 years ago, Neanderthals vanished from Europe. Their disappearance may have been linked to a new type of hominid which, according to some evidence, had been evolving in the Middle East and sub-Saharan Africa throughout the Upper Pleistocene. These were the earliest members of our own subspecies, *Homo sapiens sapiens*. They appeared in Europe curiously late, around the time that the skeletal morphology seen in the European fossil hominid record began to change from the Neanderthal to the modern human pattern.

A few sites are known which date to the time of this transition from Neanderthals to modern humans. One, at Mladeč, Moravia (Czech Republic), has yielded the remains of several partial skeletons. The Mladeč bones are not fully anatomically modern, but rather have a number of modern human traits mixed with archaic features reminiscent of Neanderthals, such as a thick, large browridge and protruding occipital area. In the Balkans, at the site of

Figure 14. An early Homo sapiens sapiens *from the mass grave at Předmostí, Czechoslovakia. Although not as strongly built as a Neanderthal, this individual clearly possesses many archaic features, such as a bulging area at the back of the skull and fairly strong browridges.*

From J. Matiegka, *Homo Předmostensis* (Prague: Nákladem Ceské Akademie Věd a Umění, 1934), Pl. 2, no. III

Krapina, Croatia, the faceless braincase of a child was unearthed at the turn of the century. It, too, presents a mixture of Neanderthal and modern features. Later-in-time central European sites, such as the spectacular cemetery of the Předmostí mammoth hunters in Moravia, demonstrate that Neanderthal characteristics like the occipital bun continued in European populations for thousands of years after the last known Neanderthals disappeared (Fig. 14).

In western Europe, the fossil record at the time of the transition is equally sparse. A very late Neanderthal, who died approximately 32,500 years ago, is known from the site of St. Césaire, France. Although the skull of this individual shows some modern features, including a high forehead and even a chin, the stout, strongly curved bones of the skeleton's limbs are unmistakably those of a Neanderthal. The next good fossil hominid remains from western Europe belong to the earliest known modern humans from this region: the people buried at the famous site of Cro-Magnon, France, about 30,000 years ago. No fossils are known from the time gap separating St. Césaire and Cro-Magnon in western European fossil deposits, and without a continuous record, it is impossible to know whether some genetic mixing, as was probably occurring in eastern Europe, occurred in the west as well, or whether the Neanderthals of France, Belgium, and Iberia met a more sudden demise due to disease or other factors connected with the arrival of modern humans to their region. One paleodemographer, Ezra Zubrow, has calculated that it would only take 30 generations, or 1,000 years, for Neanderthal populations to have completely disappeared if the incoming modern humans had even a slight adaptive advantage over them (Zubrow 1989).

Is it correct to think that when Neanderthals disappeared they became totally extinct, with no surviving children—totally replaced by the newly arrived *Homo sapiens sapiens*? Or is it perhaps more accurate to ascribe the Neanderthal disappearance to interbreeding with these more modern immigrants until their genes became so completely absorbed that they were no longer recognizable as having come from a Neanderthal stock? This remains one of the major debates of modern paleoanthropology, a debate which will probably continue for some time, given the minimal amount of direct evidence available from the fossil record.

Where modern humans came from, and the nature of their adaptations which permitted them to so quickly replace the Neanderthals, is also under debate. Unlike Neanderthals, the limb segment proportions of these early *Homo sapiens sapiens* do not exhibit a cold climate adaptation despite the fact that they inhabited Europe during the coldest interval of the entire Upper Pleistocene. Nor do they exhibit the distinctive, specialized facial features that slowly evolved during the Mid-

Neanderthal or Neandertal?

Neanderthal, as the term is spelled here, is also commonly spelled without the "h." This is because *Tal*, the German word for valley, was formerly spelled *Thal*. When changes in German orthography at the turn of the century resulted in the respelling of this word as *Tal*, the 'h' was removed from "Neandertal" by some experts, while the old spelling "Neanderthal" was continued by others. Both spellings of the familiar name are considered equally acceptable by the scientific community, and the use of the "h" in this article simply reflects the preference of the guest editor (who pulled rank on the author). Nevertheless, because the scientific name predates the spelling change, the conventions of taxonomic nomenclature dictate that the "h" must be retained in the scientific name *Homo sapiens neanderthalensis*.

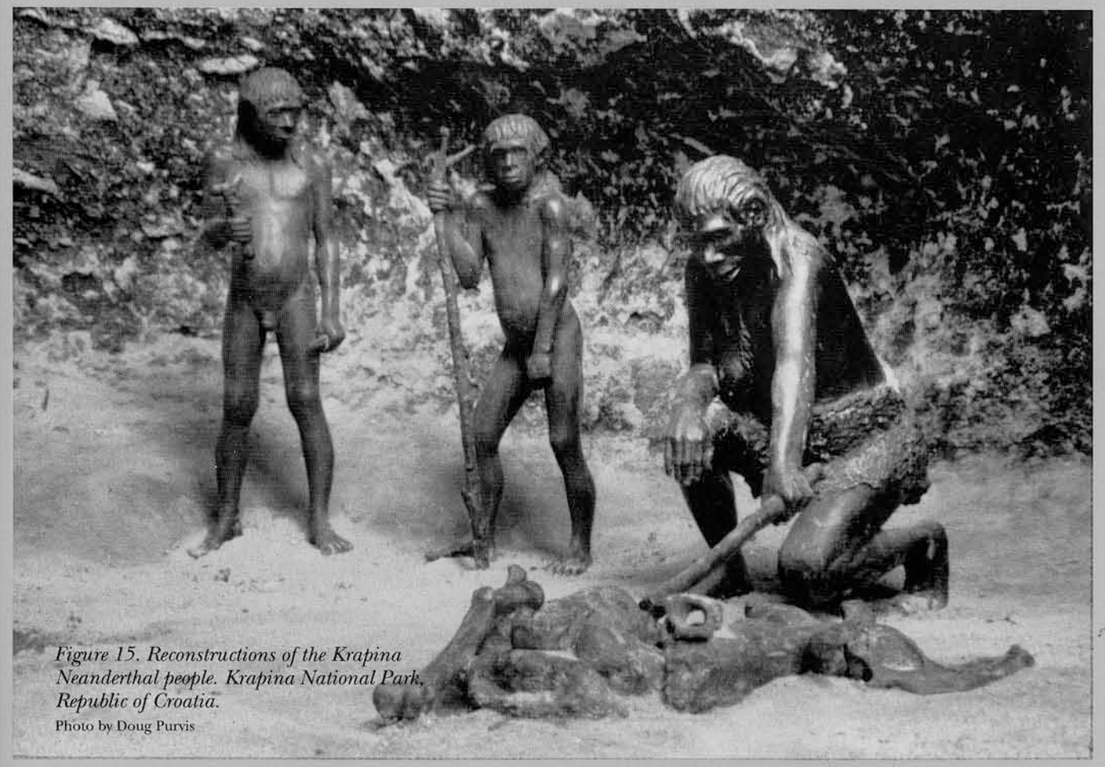


Figure 15. Reconstructions of the Krapina Neanderthal people. Krapina National Park, Republic of Croatia.

Photo by Doug Purvis

MtDNA: The Genetic Data for Human Evolution

The mitochondrion, the organelle responsible for the production of energy within the cell, contains its own genetic material, known as mitochondrial DNA or mtDNA. Unlike the DNA found in the nucleus of the cell, which is inherited from both parents, mtDNA is inherited only from the mother. Thus, it provides a genetic record of an individual's maternal ancestry.

Due to a high mutation rate and other factors, mtDNA evolves very quickly: five to ten times faster than the DNA of the cell nucleus. This makes it highly suitable for the examination of recent evolutionary events. By estimating the average mutation rate of mtDNA in the laboratory, and comparing the differences found in the mtDNA of living human populations, research first conducted by the late Allan Wilson at UCLA, Berkeley, and his colleagues, and more recently by Mark Stoneking at Pennsylvania State University, suggested that all living humans evolved from an African ancestry—from an African "Eve," approximately 200,000 years ago. This controversial finding, if correct, would have provided the first non-fossil evidence that modern humans were already living before Neanderthal times. However, the statistical methods used to calculate this divergence time have been strongly questioned, leaving the mtDNA findings to date highly improbable. Future research will doubtless clarify this interesting new line of inquiry into human evolution.

dle and early Upper Pleistocene of Europe, culminating in Neanderthal craniofacial morphology.

Several lines of evidence have recently led to a renewal of the view, originally suggested in the late 1930s, that the European Neanderthals were replaced by modern immigrants from warmer latitudes, such as Africa or the Middle East. New dates for the sites of Skhūl and Qafzeh in Israel have suggested that this may be the case. There, early modern human remains actually predate local Neanderthals. This is supported by fossil remains from southern Africa which, if correctly interpreted, suggest the presence of modern humans in that region over 100,000 years ago. However, genetic research which has utilized comparisons of mitochondrial DNA (see box on genetic data) in living human populations to suggest that all modern humans originated in Africa around 200,000 years ago has recently been challenged.

If modern humans did indeed evolve in Africa over 100,000 years ago, then the Neanderthals must be considered unique to Europe and vicinity: a regional specialization which disappeared as the ubiquitous *Homo sapiens sapiens* steadily moved into their range. In contrast to the views of 19th century prehistorians and our own views of only fifteen years ago, we now recognize that, for much of the past 1 million years, the entire time period since the arrival of hominids in Europe, the region was an evolutionary backwater. More and more evidence now points to a pattern of hominid evolution in Europe which, isolated by climatic extremes, digressed from the course of events elsewhere and resulted in the emergence of the Neanderthals. But the question of whether these archaic *Homo sapiens*, who survived the rigors of Upper Pleistocene Europe for at least 70,000 years, became totally extinct with the arrival of *Homo sapiens sapiens* or whether today's Europeans represent, in part, their living descendents must, for the present, remain unanswered.

Bibliography

Augusta, Josef, and Zdeněk Burian
1960. *Prehistoric Man.* London: Paul Hamlyn.

Boule, Marcellin
1923. *Les Hommes Fossiles.* Paris: Masson and Co.

Bräuer, Gunter, and Fred H. Smith, eds.
1992. *Continuity or Replacement: Controversies in Homo sapiens Evolution.* Rotterdam: A.A. Balkema.

Coon, Carleton S.
1962. *The Origin of Races.* New York: Knopf.

Jelínek, J.
1975. *The Pictorial Encyclopedia of the Evolution of Man.* London: Hamlyn.

Mellars, Paul, and Christopher Stringer, eds.
1989. *The Human Revolution: Behavioral and Biological Perspectives of the Origins of Modern Humans.* Princeton: Princeton University Press.

Minugh-Purvis, Nancy
1988. *Patterns of Craniofacial Growth and Development in Upper Pleistocene Hominids.* Ph.D. dissertation, Dept. of Anthropology, Univ. of Pennsylvania. Ann Arbor: University Microfilms.

Thorne, Alan G., and Milford H. Wolpoff
1992. "The Multiregional Evolution of Humans." *Scientific American* 266:76-83.

Trinkaus, Erik, and Marjorie Le May
1982. "Occipital Bunning Among Later Pleistocene Hominids." *American Journal of Physical Anthropology* 57:27-35.

Wilson, Allan C., and Rebecca L. Cann
1992. "The Recent African Genesis of Humans." *Scientific American* 266:68-73.

Zubrow, Ezra
1989. "The Demographic Modelling of Neanderthal Extinction." In *The Human Revolution*, ed. Christopher B. Stringer and Paul Mellars, pp. 212-31. Princeton: Princeton University Press.